Building a ‘toolkit’ for change: Evaluation of horse owner behaviour and knowledge transfer in response to an educational campaign



Katie Louise Lightfoot

School of Veterinary Medicine and Science

Thesis submitted to the University of Nottingham for the degree of

Doctor of Philosophy

May 2020

Abstract

Colic is the umbrella term used to describe clinical signs of pain in the horse. A common source of concern for horse owners, colic has been shown to be the most common reason for emergency veterinary attendance in the United Kingdom (UK). However, despite having primary responsibility for maintaining the health and welfare of their animals, research has shown that horse owner knowledge of colic is limited. In response to these findings the 'REACT Now to Beat Colic' campaign was launched in September 2016. Interventions of this type are widely used within human medicine to raise awareness of select issues and elicit a positive change in behaviour. Yet, despite the importance of behaviour change on improved health outcomes, the success or failure of an intervention is rarely investigated. This thesis aimed to evaluate horse owner behaviour and the transfer of knowledge in response to the 'REACT' campaign.

Using a mixed-methodology, a process evaluation of several key elements of the 'REACT' campaign was conducted. The first section of this thesis investigated current levels of campaign awareness and engagement. During the first 12 months, over 20,000 educational 'REACT' packs had been distributed, with thousands of owners engaging with online content. However, the findings of an online survey suggested that, one-year post launch, campaign awareness was relatively low, with The British Horse Society (BHS) membership facilitating the highest level of recognition. Owners reported varied

levels of resource engagement, with very few participants feeling that the campaign had impacted upon their knowledge and approach to colic. This result was further supported by the fact that a large proportion of horse owners were still unsure of correct health value ranges, with levels of knowledge similar to that reported previously.

Consequently, the second section of this thesis aimed to investigate existing behaviours that could be potential barriers to campaign engagement. A combination of theoretical frameworks were used to identify horse owner attitudes and practices associated with planning for a potential colic emergency. The results indicated that horse owners generally fell into one of two categories: no intention to adopt or already implementing emergency recommendations. Beliefs surrounding the completion of emergency preparation, such as perceived personal relevance and benefit, were shown to be significantly linked to horse owners' intention to adopt emergency advice. Lower levels of intention were found to be associated with alleged social pressure. Social influence was also a significant factor in the spread of inaccurate beliefs, with findings of an online survey highlighting the continuous presence of misconceptions about colic within the equestrian community. However, the findings of these studies also demonstrated that horse owners consider individual factors, such as the horse-human relationship, essential during emergency decision making.

Therefore, the final section of this thesis further explored *'contextual'* factors associated with colic that may affect owner engagement with the

‘REACT’ campaign. A prospective study of horses diagnosed with colic found that the decision to pursue surgery or intensive medical treatment was frequently based on the severity of clinical signs. However, non-clinical factors, such as financial constraints, horse age and owner concerns regarding equine welfare, were also considered significant in the decision-making process. This concept was further investigated through a qualitative study of stakeholder experiences in which four over-arching themes were identified: ‘head’, ‘heart’, ‘practicalities’ and ‘impact’. Owners understood that they were responsible for their horse’s welfare (‘head’) however, the horse-human relationship (‘heart’) often led to conflict during decision-making. ‘Practicalities’, such as the availability of transport and adverse weather conditions, presented owners with additional, unforeseen challenges when considering referral. It was apparent that an owner’s interpretation of their horses wants / needs (‘heart’) had a major bearing on their decision to refer for colic, with the experience often leaving owners with feelings of guilt and a change in help seeking behaviour (‘impact’).

This research highlights the importance of regular campaign evaluation to ensure the desired outcome is being elicited within the target population. The results show that owners evaluated new information against their own prior experience or knowledge, with many reluctant to adopt new approaches or ideas because of persistent false beliefs or the fear of social criticism. Additionally, though prior preparation can help to facilitate rapid judgements, the strength of emotional attachment

can often cause owners to become conflicted. Therefore, it is paramount that both campaigners and veterinary professionals acknowledge the implications of the human-animal bond on informed decision-making.

Publications

LIGHTFOOT, K. L., BURFORD, J. H., ENGLAND, G. C. W., BOWEN, M. & FREEMAN, S. L. 2018. Investigation into the telephone triage of colic cases within UK veterinary practice. Equine Veterinary Journal, 50, 7-8.

LIGHTFOOT, K. L., HANNELLY, E., TYLER, A. R., ENGLAND, G. C. W., BURFORD, J. H., BOWEN, M. & FREEMAN, S. L. 2018. Impact of an educational campaign on owner knowledge and approach to equine colic. Equine Veterinary Journal, 50, 7-7.

LIGHTFOOT, K. L., ENGLAND, G. C. W., BURFORD, J. H., BOWEN, M. & FREEMAN, S. L. 2019. Use of human behaviour models to investigate horse-owner intention to adopt emergency recommendations. Equine Veterinary Journal, 51, 22-22.

Funding and Ethical Approval

This PhD research was co-funded by the University of Nottingham's School of Veterinary Medicine and Science and the equine charity World Horse Welfare.

Studies were reviewed and approved by the University of Nottingham's School of Veterinary Medicine and Science Ethics Committee.

Data collection was conducted in accordance with General Data Protection Regulations (2018) and the British Educational Research Association's Revised Ethical Guidelines for Educational Research (2018).

Acknowledgements

Firstly, I would like to thank World Horse Welfare and the University of Nottingham's School of Veterinary Medicine and Science for funding this PhD research and providing me with so many fantastic opportunities. To everyone I have had the pleasure of working with over the past three years, both external and internal, thank you for your continued support, kindness, and enthusiasm.

To my supervisors, Professor Sarah Freeman, Professor Gary England, Professor Mark Bowen and Dr John Burford, thank you for your endless patience, support, and encouragement during this endeavour. A special thank you must go to Professor Sarah Freeman who surpassed all of her supervisory responsibilities from day one. You have given me the confidence and skills to achieve goals I never thought possible. I cannot wait to start my career in academia and promise to release my inner 'D' more often!

Thank you to each and every horse owner and veterinary professional who gave up their time to participate in this research. This thesis would not have been possible without your enthusiasm, honesty, and dedication. A huge, huge thank you must go to James Wilson, Richard Birnie and Harriet Clough. I owe the completion of this research project to your continued friendship, support, and wacky sense of humour.

Finally, I would like to dedicate this thesis to my fiancé Nick Burrell and parents Steve and Tanya Lightfoot. Thank you for always being there and supporting me every step of the way.

Table of Contents

ABSTRACT..... I

PUBLICATIONS..... V

FUNDING AND ETHICAL APPROVAL..... VI

ACKNOWLEDGEMENTS..... VII

TABLE OF CONTENTS..... VIII

LIST OF FIGURES..... XIX

LIST OF TABLES..... XXIV

CHAPTER 1: INTRODUCTION..... 2

1.1 THESIS OVERVIEW..... 2

1.2 THESIS STRUCTURE..... 4

1.2.1 Literature review..... 4

1.2.2 Thesis methodology..... 4

1.2.3 Research section one..... 5

1.2.4 Research section two..... 5

1.2.5 Research section three..... 6

1.2.6 Final discussion..... 6

1.2.7 Image acknowledgement..... 6

CHAPTER 2: LITERATURE REVIEW..... 7

2.1 EQUINE COLIC: THE NATURE OF THE PROBLEM..... 8

2.1.1 Overview..... 8

2.1.2 Incidence of colic..... 9

2.1.3 Risk factors for the development of colic..... 9

2.1.4 Recurrence of colic..... 12

2.1.5 Primary assessment..... 13

2.1.6 Pathophysiology of common gastrointestinal diseases..... 15

2.1.6.1 Simple, non-strangulating obstructions..... 15

2.1.6.2 Strangulating obstructions..... 17

2.1.7 Decision for referral and surgical intervention 20
2.1.7.1 Observations on physical exam 20
2.1.7.2 Results of diagnostic tests 28
2.1.7.3 Use of predictive models 29
2.1.8 Prognosticating colic 30
2.1.8.1 Determining risk of mortality 30
2.1.8.2 Current rates of survival 32
2.1.9 Maximising chances of survival 38
2.2 CHANGING HUMAN BEHAVIOUR: WHAT, WHY AND HOW? 40
2.2.1 A brief history of behaviour change 40
2.2.2 Theories of behaviour 43
2.2.3 Interventions for change 51
2.2.4 Targeting regulatory processes 55
2.2.5 Use of campaigns 58
2.2.6 The 'REACT Now to Beat Colic' campaign 62
2.3 THESIS AIMS AND OBJECTIVES 67
CHAPTER 3: THESIS METHODOLOGY 68
3.1 PHILOSOPHICAL UNDERPINNINGS 69
3.1.1 Ontology and Epistemology 69
3.1.2 Theoretical perspective of thesis 72
3.2 EVALUATING INTERVENTION SUCCESS 74
3.2.1 Methods of evaluation 74
3.2.2 Evaluating the 'REACT Now to Beat Colic' campaign 77
3.3 MIXED-METHODS RESEARCH 79
3.3.1 Qualitative and quantitative methods 79
3.3.2 Combining research paradigms 80

3.4 RELIABILITY AND VALIDITY 83
3.4.1 Thematic analysis 85
3.4.2 Triangulation 86
3.4.3 Reflexivity 88
RESEARCH SECTION ONE 89
CHAPTER 4: SURVEY-BASED INVESTIGATION OF HORSE OWNER AWARENESS OF AND ENGAGEMENT WITH AN EVIDENCE-BASED CAMPAIGN…… 90
4.1 INTRODUCTION 90
4.2 AIM AND OBJECTIVES 94
4.3 MATERIALS AND METHODS 95
4.3.1 Sample population 95
4.3.2 Survey development 95
4.3.3 Pilot survey 96
4.3.4 Survey dissemination 101
4.3.5 Data management 101
4.3.6 Data analysis 102
4.3.6.1 Descriptive 102
4.3.6.2 Recognising the 'normal' horse 102
4.3.6.3 Statistical testing 103
4.4 RESULTS 104
4.4.1 Survey engagement 104
4.4.2 Participant demographics 106
4.4.3 Recognising the 'normal' horse 107
4.4.4 Recognition of equine colic 112
4.4.5 Approach to equine colic 114
4.4.6 Resource engagement 116

4.4.7 Potential impact of resources 118
4.5 DISCUSSION 120
4.5.1 Overview of findings 120
4.5.2 Study limitations 120
4.5.3 Key findings 122
4.5.4 Recommendations for future work 129
4.6 CONCLUSION 131
RESEARCH SECTION TWO 132
CHAPTER 5: USE OF HUMAN BEHAVIOUR CHANGE MODELS TO INVESTIGATE HORSE OWNER INTENTION TO ADOPT EMERGENCY RECOMMENDATIONS 133
5.1 INTRODUCTION 133
5.2 AIM AND OBJECTIVES 137
5.3 MATERIALS AND METHODS 138
5.3.1 Sample population 138
5.3.2 Survey development 139
5.3.3 Pilot survey 141
5.3.4 Survey dissemination 148
5.3.5 Data management 148
5.3.6 Data analysis 149
5.3.6.1 Descriptive analysis 149
5.3.6.2 Statistical analysis 149
5.4 RESULTS 152
5.4.1 Survey engagement 152
5.4.2 Participant demographics 152
5.4.3 Colic experience and knowledge 155
5.4.4 Planning for a colic emergency 158

5.4.4.1 Implementation of 'REACT' recommendations 158
5.4.4.2 Beliefs associated with emergency planning 161
5.4.4.3 Influencing factors 167
5.4.5 Statistical analysis 169
5.4.5.1 Theory of Planned Behaviour (TPB) question reliability 169
5.4.5.2 Univariable Regression 170
5.4.5.3 Multivariable Regression 170
5.5 DISCUSSION 173
5.5.1 Overview of findings 173
5.5.2 Study limitations 174
5.5.3 Key findings 176
5.5.3.1 Horse owner experience, knowledge, and concern 176
5.5.3.2 The horse-human relationship 182
5.5.3.3 The role of others 183
5.5.4 Recommendations for future work 185
5.6 CONCLUSIONS 186
CHAPTER 6: *CHALLENGING THE NORM*: IMPACT OF EVIDENCE-BASED KNOWLEDGE ON HORSE OWNER DECISION-MAKING 187
6.1 INTRODUCTION 187
6.2 STUDY AIMS AND OBJECTIVES 189
6.3 METHODS 190
6.3.1 Sample population 190
6.3.1.1 Participant recruitment and selection 190
6.3.2 Data collection 190
6.3.2.1 Survey development 190
6.3.2.2 Survey pilot 191

6.3.2.3 Survey dissemination 204
6.3.3 Data analysis 205
6.3.3.1 Descriptive analysis 205
6.3.3.2 Statistical analysis 206
6.4 RESULTS 207
6.4.1 Survey engagement 207
6.4.2 Participant demographics 207
6.4.3 Colic education 209
6.4.4 Current horse ownership 212
6.4.4.1 Current horse details 212
6.4.4.2 Horse-human relationship 215
6.4.4.3 Decision to refer for colic treatment - descriptive 217
6.4.4.4 Decision to refer for colic treatment – statistical evaluation 218
6.4.5 Impact of evidence-based information 220
6.4.5.1 Knowledge and approach to monitoring health 220
6.4.5.2 Knowledge and approach to colic 222
6.4.5.3 Decision to refer for colic treatment 227
6.4.5.4 Surgical intervention 229
6.5 DISCUSSION 234
6.5.1 Overview of findings 234
6.5.2 Study limitations 235
6.5.3 Key findings 237
6.5.3.1 Emotional attachment as a barrier to knowledge transfer 237
6.5.3.2 Existing knowledge and beliefs 242
6.5.3.3 Social ‘norms’ as a barrier to knowledge transfer 244
6.5.4 Recommendations for future study 247

6.6 CONCLUSIONS 248

RESEARCH SECTION THREE 250

CHAPTER 7: IN-DEPTH CASE ANALYSIS OF CRITICAL DECISIONS MADE BY HORSE OWNERS AND VETERINARY PROFESSIONALS: FINDINGS FROM A PROSPECTIVE CLINICAL STUDY 251

7.1 INTRODUCTION 251

7.2 STUDY AIMS AND OBJECTIVES 252

7.3 METHODS 253

7.3.1 Study design 253

7.3.1.1 Participant recruitment 253

7.3.1.2 Case selection 253

7.3.2 Data collection 254

7.3.2.1 Development of data collection forms 254

7.3.2.2 Pilot 261

7.3.2.3 Form dissemination 261

7.3.2.4 Form submission 262

7.3.3 Data analysis 263

7.4 RESULTS 264

7.4.1 Study engagement 264

7.4.1.1 Primary vs referral colic cases 264

7.4.1.2 Practice participation 264

7.4.2 Horse demographics 265

7.4.2.1 Signalment 265

7.4.2.2 Previous medical history 265

7.4.2.3 Recent management changes 266

7.4.2.4 Previous history of colic 266

7.4.2.5 Current colic episode 266

7.4.3 Clinical presentation 267
7.4.3.1 Time first examined vs time of admission 267
7.4.3.2 Drug administration prior to admission 267
7.4.3.3 Demeanour and behaviour severity on admission 269
7.4.3.4 Assessment of body condition 270
7.4.3.5 Clinical parameters 270
7.4.3.6 Abdominal examination 271
7.4.3.7 Drug administration and response to analgesia 272
7.4.4 Diagnostic evaluation 274
7.4.4.1 Rectal palpation 274
7.4.4.2 Nasogastric intubation 274
7.4.4.3 Abdomino-paracentesis 274
7.4.4.4 Abdominal ultrasound 275
7.4.4.5 Haematology and biochemistry 275
7.4.5 Diagnosis and treatment 276
7.4.6 Case outcome 279
7.4.6.1 Overview 279
7.4.6.2 Demographic features of horses undergoing euthanasia 279
7.4.6.3 Clinical features of horses undergoing euthanasia 279
7.5 DISCUSSION 285
7.5.1 Study overview 285
7.5.2 Limitations 286
7.5.3 Key findings 289
7.5.3.1 Owner recognition and response 289
7.5.3.2 Factors affecting decision-making 290
7.5.4 Recommendations for future study 294

7.6 CONCLUSIONS 295

CHAPTER 8: A QUALITATIVE INVESTIGATION OF STAKEHOLDER EXPERIENCES AND DECISION-MAKING DURING CRITICAL CASES OF EQUINE COLIC 296

8.1 INTRODUCTION 296

8.2 STUDY AIMS AND OBJECTIVES 297

8.3 METHODS 298

8.3.1 Study design 298

8.3.1.1 Theoretical framework 298

8.3.1.2 Research team and reflexivity 298

8.3.1.3 Participant selection 299

8.3.1.4 Participant recruitment 299

8.3.1.5 Setting of data collection 303

8.3.1.6 Data collection 304

8.3.2 Data analysis 311

8.3.2.1 Transcription 311

8.3.2.2 Coding and theme generation 311

8.4 RESULTS 313

8.4.1 Demographics 313

8.4.1.1 Horse owner 313

8.4.1.2 Veterinary practitioner demographics 313

8.4.2 Thematic analysis 315

8.4.2.1 'Head' 317

8.4.2.2 'Heart' 326

8.4.2.3 'Practicalities' 337

8.4.2.4 'Impact' 346

8.5 DISCUSSION 352

8.5.1 Study overview 352
8.5.2 Limitations 352
8.5.3 Key findings 354
8.5.3.1 Head vs heart 354
8.5.3.2 Practicalities 358
8.5.3.3 Impact 362
8.5.4 Recommendations for future work 366
8.6 CONCLUSIONS 368
CHAPTER 9: FINAL DISCUSSION 369
9.7 OVERVIEW 370
9.8 OVERALL STUDY DESIGN AND LIMITATIONS 372
9.9 KEY THESIS FINDINGS 375
9.9.1 Campaigns as a tool for change 375
9.9.2 Existing knowledge: beneficial or destructive? 380
9.9.3 The power of social norms 387
9.9.4 Context is key: the role of the horse-human relationship 395
9.10 RECOMMENDATIONS FOR FUTURE WORK 400
9.10.1 'REACT Now to Beat Colic': What next? 400
9.10.2 How can equine welfare be improved? 401
CHAPTER 10: OVERARCHING CONCLUSION 404
REFERENCES… 406
APPENDIX I: IMAGE ATTRIBUTION 461
APPENDIX II: PUBLISHED THEORIES OF BEHAVIOUR 462
APPENDIX III: PERSONAL REFLEXIVITY STATEMENT 468
APPENDIX IV: AMENDMENTS FOLLOWING PILOTING OF A SURVEY EXPLORING HORSE OWNER KNOWLEDGE AND APPROACH TO COLIC (CHAPTER FOUR) 470

APPENDIX V: FORMATION OF NEW CATEGORIES FOR STATISTICAL ANALYSIS (CHAPTER FOUR) 474

APPENDIX VI: SUPPLEMENTARY RESULTS (CHAPTER FOUR) 475

APPENDIX VII: AMENDMENTS PERFORMED FOLLOWING PILOTING OF A SURVEY INVESTIGATING HORSE OWNER INTENTION TO ADOPT EMERGENCY RECOMMENDATIONS (CHAPTER FIVE) 476

APPENDIX VIII: FORMATION OF NEW CATEGORIES FOR STATISTICAL ANALYSIS (CHAPTER FIVE) 478

APPENDIX IX: SUPPLEMENTARY RESULTS (CHAPTER FIVE) 482

APPENDIX X: RESULTS OF STATISTICAL ANALYSIS (CHAPTER FIVE) 483

APPENDIX XI: AMENDMENTS PERFORMED FOLLOWING PILOTING OF A SURVEY INVESTIGATING MISCONCEPTIONS ABOUT COLIC (CHAPTER SIX) 487

APPENDIX XII: SUPPLEMENTARY RESULTS (CHAPTER SIX) 490

APPENDIX XIII: UK EQUINE VETERINARY PRACTICES INVITED TO PARTICIPATE IN A 12 MONTH PROSPECTIVE STUDY INVESTIGATING CRITICAL DECISION-MAKING IN HORSES DIAGNOSED WITH COLIC (CHAPTER SEVEN) 494

APPENDIX XIV: PROSPECTIVE DATA COLLECTION FORMS AND RESOURCES (CHAPTER SEVEN) 495

APPENDIX XV: SUPPLEMENTARY RESULTS (CHAPTER SEVEN) 511

APPENDIX XVI: INTERVIEW INFORMATION AND CONSENT SURVEYS (CHAPTER EIGHT) 520

APPENDIX XVII: VETERINARY SURGEON RECRUITMENT SURVEY (CHAPTER EIGHT) 531

APPENDIX XVIII: CORRECTIONS PERFORMED ON INTERVIEW SCHEDULES (CHAPTER EIGHT) 536

APPENDIX XIX: INTERVIEW RECRUITMENT FLOWCHARTS (CHAPTER EIGHT) .. 537

List of figures

Figure 1-1: Overview of thesis structure and content 3

Figure 2-1: Range of factors associated with an increased risk of colic development. (Based on the findings of a systematic review performed by Curtis et al., 2019) 10

Figure 2-2: Key elements and observations performed during an initial physical examination of a colic patient. Based on guidelines described by Southwood (2012) and Desrochers and White (2017) 14

Figure 2-3: The location and various causes of simple, non-strangulating obstructions in the horse (Image reproduced from Van Weyenberg et al., 2006) 16

Figure 2-4: Clinical findings that can be used to identify 'critical' cases of colic and the need for urgent referral or surgical intervention. Based on signs described by White (2017). 21

Figure 2-5: Survival of 1003* horses diagnosed with gastrointestinal related colic in a study by Curtis et al., 2015 (* 13 horses have been removed from the original study population of 1016 due to having non-gastrointestinal causes of colic). 34

Figure 2-6: The average short and long term survival of horses undergoing surgical intervention for colic based on current evidence (Abutarbush et al., 2005, Christophersen et al., 2014, Christophersen et al., 2011, Immonen et al., 2017, Johnson and Keller, 2005, Mair and Smith, 2005a, Mair and Smith, 2005c, Morton and Blikslager, 2002, Naylor et al., 2014, Stewart et al., 2014, Sutton et al., 2009, van den Boom and van der Velden, 2001, van der Linden et al., 2003, Voigt et al., 2009, Wormstrand et al., 2014) 36

Figure 2-7: Graphs created using Google Ngram viewer indicating the popularity / use of the terms A) behaviour and B) behaviour change in books using the English language between 1800 and 2008. 42

Figure 2-8: The 'social ecology model of behaviour change' which describes the importance of both individual (A) and environmental (B) influences on a person's intention to change their behaviour. Reproduced from Panter-Brick et al. (2006). 44

Figure 2-9: The A) Expectancy-Value Model and B) Theory of Reasoned Action as described by Ajzen and Fishbein. Both models describe how behaviour is dependent on personal motivation, which in turn depends on various social and intra-personal factors. Reproduced from (Ajzen and Fishbein, 1979, Fishbein and Ajzen, 1977) 47

Figure 2-10: The Theory of Planned Behaviour as described by Ajzen (1991b). 48

Figure 2-11: The COM-B model as describe by Michie et al. (2011). 49

Figure 2-12: The six steps of Intervention Mapping. Reproduced from Bartholomew Eldredge et al. (2016) 53

Figure 2-13: The Behaviour Change Wheel. Reproduced from Michie et al. (2011) 54

Figure 2-14: The use of visual cues strategically placed within our environment is just one example of 'nudge theory' being used to encourage desirable behaviour. 56

Figure 2-15: The four main aims of the Nottingham Equine Colic Project 63

Figure 2-16: The 'REACT' clock depicts the five most common signs of equine colic 65

Figure 3-1: The various ontological positions as described by Moon and Blackman (2014) 70

Figure 3-2: The various epistemological positions as described by Moon and Blackman (2014) 71

Figure 3-3: The relationship between ontological and epistemological positions and a researcher's subsequent theoretical perspective. Reproduced from (Moon and Blackman, 2014) 73

Figure 3-4: Diagram illustrating the process evaluation described within this thesis 78

Figure 3-5: The two main typologies of mixed-methods study design, and a combination of both methods, as described by Johnson and Onwuegbuzie (2004) 82

Figure 3-6: Diagram illustrating the use of both mixed-model and mixed-method study designs within this thesis 84

Figure 3-7: The six-steps of Thematic Analysis, as described by Braun and Clarke (2006) 87

Figure 4-1: Dissemination of the 'REACT Now to Beat Colic' campaign during the first year of launch. Based on information provided by The British Horse Society (2017). 92

Figure 4-2: Flow diagram illustrating participant completion of an online survey exploring horse owner knowledge and approach of colic. 105

Figure 4-3: The lowest (A) and highest (B) heart rate values given by participants in an online survey investigating UK horse owner knowledge and approach to colic. The correct heart rate range, values falling within 28 and 44 beats per minute, is highlighted. 108

Figure 4-4: The lowest (C) and highest (D) heart rate values given by participants in an online survey investigating UK horse owner knowledge and approach to colic. The correct respiratory rate range, values falling within 8 and 16 breaths per minute, is highlighted. 109

Figure 4-5: Participant confidence measuring and interpreting three equine health values; rectal temperature, heart and respiratory rate; in an online survey exploring UK horse owners' knowledge and approach to colic. 111

Figure 4-6: Stacked bar chart displaying participant awareness and use of REACT campaign materials taken from an online survey investigating UK horse owner awareness of an educational colic campaign..... 117

Figure 5-1: The five stages of the Trans-Theoretical Model (TTM) of behaviour change and corresponding states of individual readiness (adapted from Prochaska and DiClemente,1982). 135

Figure 5-2: Flow-diagram illustrating respondent progress during online completion and preliminary data analysis of a survey investigating horse owner intention to adopt emergency recommendations. 153

Figure 5-3: Map-chart displaying the range of UK locations represented by survey participants (n=698) completing an online survey investigating horse owner intention to adopt emergency recommendations. 154

Figure 5-4: Stacked bar chart displaying the nature of participants most recently witnessed (n = 126) or personally managed (n = 510) colic episode in an online survey investigating horse owner intention to adopt emergency recommendations. 157

Figure 5-5: Stacked bar chart displaying participants' intention to implement measures designed to either prevent colic or aid in the recognition of early symptoms in an online survey investigating horse owner intention to adopt emergency recommendations..... 159

Figure 5-6: Stacked bar chart displaying participants' intention to implement measures designed to aid their personal preparation for a potential colic emergency, in an online survey investigating horse owner intention to adopt emergency recommendations..... 160

Figure 5-7: Stacked bar chart displaying participants' intention to implement measures designed to minimise delays in veterinary treatment by involving

others in an online survey investigating horse owner intention to adopt emergency recommendations. 162

Figure 5-8: Participant agreement with statements reflecting control beliefs associated with colic and the use of emergency plans, in an online survey investigating horse owner intention to adopt emergency recommendations. 163

Figure 5-9: Participant agreement with statements reflecting behavioural beliefs associated with emergency plans, in an online survey investigating horse owner intention to adopt emergency recommendations. 165

Figure 5-10: Participant agreement with statements reflecting normative beliefs associated with the influence of others on their intention to implement an emergency colic plan, in an online survey investigating horse owner intention to adopt emergency recommendations. 166

Figure 5-11: Bar chart displaying the median importance score (0 = not at all important, 10 = very important) of owner, horse health and horse management factors in the decision to pursue referral treatment for colic, as indicated by survey participants (n = 701) in an online survey investigating horse owner intention to adopt emergency recommendations. 168

Figure 6-1: Flow-diagram illustrating respondent progress during online completion and preliminary data analysis of a survey investigating the impact of evidence on owner decision-making. 208

Figure 6-2: Stacked bar chart illustrating participants responses to statements associated with the horse-human relationship 214

Figure 6-3: Stacked bar chart displaying participant intention to start weekly monitoring of their horse's heart rate after reading scientific evidence 221

Figure 6-4: Stacked bar-charts illustrating participant intention to seek urgent veterinary help at the first sign of colic after reading scientifc evidence of A) subtle signs of colic and B) time until irreversible intestinal damage 224

Figure 6-5: Stacked bar-chart illustrating participant intention to leave a horse with colic in a safe place and not walk it after reading scientific evidence ... 226

Figure 6-6: Stacked bar-chart illustrating participants' intention to consider referral treatment after reading evidence 228

Figure 6-7: Stacked bar-chart illustrating participants intention to pursue surgical intervention after reading evidence on A) the average cost of colic surgery and B) the prognosis of horses over the age of 16 undergoing surgery 230

Figure 6-8: Stacked bar-chart illustrating participants intention to pursue surgical intervention after reading evidence on A) the long-term survival of horses undergoing colic surgery and B) return to work following surgery.... 233

Figure 7-1: The bespoke practice 'Research pack' and associated resources sent to participating veterinary practices 262

Figure 7-2: Bar chart displaying the submission of colic cases during a 12 month prospective study 264

Figure 7-3: Flow-chart comparing the demeanour of horses following the admistration of analgesia and their presentation upon arrival at the referral hosiptal 273

Figure 7-4: The short-term survival of 60 horses referred for colic treatment 280

Figure 7-5: Box and whisker plot illustrating the average age of horses that were either euthanased or survived 281

Figure 7-6: Box and whisker plot illustrating the average heart rate of horses that were either euthanased or survived 281

Figure 7-7: Box and whisker plot illustrating the average respiratory rate of horses that were either euthanased or survived..... 282

Figure 7-8: Box and whisker plot illustrating the combined behavioural severity score of horses that were either euthanased or survived 282

Figure 8-1: Flow-diagram illustrating the recruitment of UK horse owners to participate in a telephone interview exploring their experience of critical colic 302

Figure 8-2: The final interview schedule used to investigate horse owner experiences of decision-making during a critical case of colic..... 305

Figure 8-3: The final interview schedule used to investigate veterinary practitioner experiences of decision-making during a critical case of colic .. 308

Figure 8-4: Thematic diagram illustrating the interation of overarching themes, themes and sub-themes as identified during thematic analysis..... 316

Figure 8-5: Thematic diagram illustrating the over-arching theme 'head' and three associative themes. 317

Figure 8-6: Thematic diagram of the over-arching theme 'heart' and three associative themes 326

Figure 8-7: Thematic diagram illustrating the over-arching theme ‘practicalities’ and associative themes 337

Figure 8-8: Thematic diagram illustrating the over-arching theme ‘impact;’ and associate themes..... 346

Figure 9-1: Conceptual model illustrating how campaign resources can be tailored to audience 'readiness' to change 386

Figure 9-2: Conceptual model illustrating how equine welfare is impacted by social practices elicited by the equestrian industry as a whole..... 392

Figure 9-3: How idea adoption may vary between horse owners and key strategies that can be used to engage them. Based on Rogers (1995) 'Diffusion of Innovations' model..... 394

List of tables

Table 2-1: Grades of intestinal mucosal injury used to determine the need for resection in strangulated small intestines (Freeman et al., 2014)..... 19

T**able 2-2:** White’s (1990) early five point behavioural-scoring system used for assessing colic severity in horses. 23

Table 2-3: Physiological parameters routinely assessed in the colic patient, their normal value ranges and associated indications of disease severity as described by Desrochers and White (2017) 26

Table 2-4: Elements of a physical examination that can help to ascertain hydration status in the horse (Corley, 2002)..... 28

Table 4-1: Questions included in the final design of a survey exploring horse owner knowledge and approach to colic 97

Table 4-2: The top ten most recognised signs of colic as reported by participants of an online survey exploring UK horse owners’ knowledge and approach to colic. 113

Table 5-1: Question types and topics included within the final version of a survey investigating horse owner intention to adopt emergency recommendations. 142

Table 5-2: Results of multivariable logistic regression with outcome variables (no intention vs. already implementing) associated with uptake of recommendations designed to: aid recognition and prevention of colic, involve others in emergency planning and personal preparation for an emergency. 172

Table 6-1: Scientific evidence and expert opinion presented to owners in Section 4 of a survey investigating the impact of evidence on owner decsion-making. 192

Table 6-2: Question types and topics included within the final version of a survey investigating the impact of evidence on owner decision-making. 194

Table 6-3: Results of multivariable analysis with outcome variables relating to owner intention to pursue referral treatment if their horse was to develop a critical case of colic 219

Table 7-1: Existing scientific literature consulted in the development of a bespoke colic assessment form 256

Table 7-2: Details of veterinary presecribed drugs adminstered to horses prior to hospital admission 268

Table 7-3: Colic behavioural severiy scores for 56 horses referred for colic treatment 269

Table 7-4: Details of abdominal examination performed on horses referred for colic treatment 271

Table 7-5: Details of veterinary presecribed drugs administered during the initial clinical exam 272

Table 7-6: Details of laboratory tests performed on horses referred for colic treatment 275

Table 7-7: Details of colic diagnoses for 51 horses referred for colic treatment 277

Table 7-8: Factors associated with the euthanasia of horses diagnosed with colic 283

Table 8-3: Details of participating horse owners most recent colic experience, including horse age, breed and insurance status 314

“Tell me and I forget.

Teach me and I may remember.

Involve me and I learn”

– Benjamin Franklin

Chapter 1: Introduction

1.1 Thesis overview

'Colic' is a collective term which refers to clinical signs of abdominal pain within the horse (Southwood, 2012c). This condition is the most common type of emergency seen by first opinion practices, but a definitive and rapid diagnosis still remains a challenge, with the majority of critical cases being euthanased after primary veterinary assessment (Bowden *et al*., 2017). Early recognition by owners coupled with prompt veterinary assessment can assist in the identification of critical cases sooner, increasing the chances of a positive outcome (Curtis *et al*., 2015, Jennings *et al*., 2014, Proudman *et al*., 2002a). However, recent studies have highlighted potential barriers that could hinder this process, such as how owners recognise and manage horses with colic (Bowden *et al*., 2020, Scantlebury *et al*., 2014).

Campaigns aim to encourage a change in behaviour and often target diseases or illnesses which have a low level of public awareness (Stone *et al*., 2011). The 'REACT Now to Beat Colic' owner campaign was launched in September 2016 to encourage a proactive approach to colic and maximise chances of survival, following evidence which suggested owner knowledge of colic is currently limited. Successful campaigns must have regular reflection on progress and the flexibility to adapt to the needs of stakeholders (Stone *et al*., 2011; Power and Wardle, 2015; Smith *et al*., 2016). Therefore, this thesis aimed to evaluate horse owner behaviour in response to the 'REACT' campaign

and to highlight areas for further development. These aims were achieved using a mixed methods approach, with a particular focus on current campaign awareness, owner intention to adopt emergency recommendations and potential barriers to behaviour change. Figure 1-1 provides a visual overview of this thesis's structure, with a more detailed explanation provided in the following section.

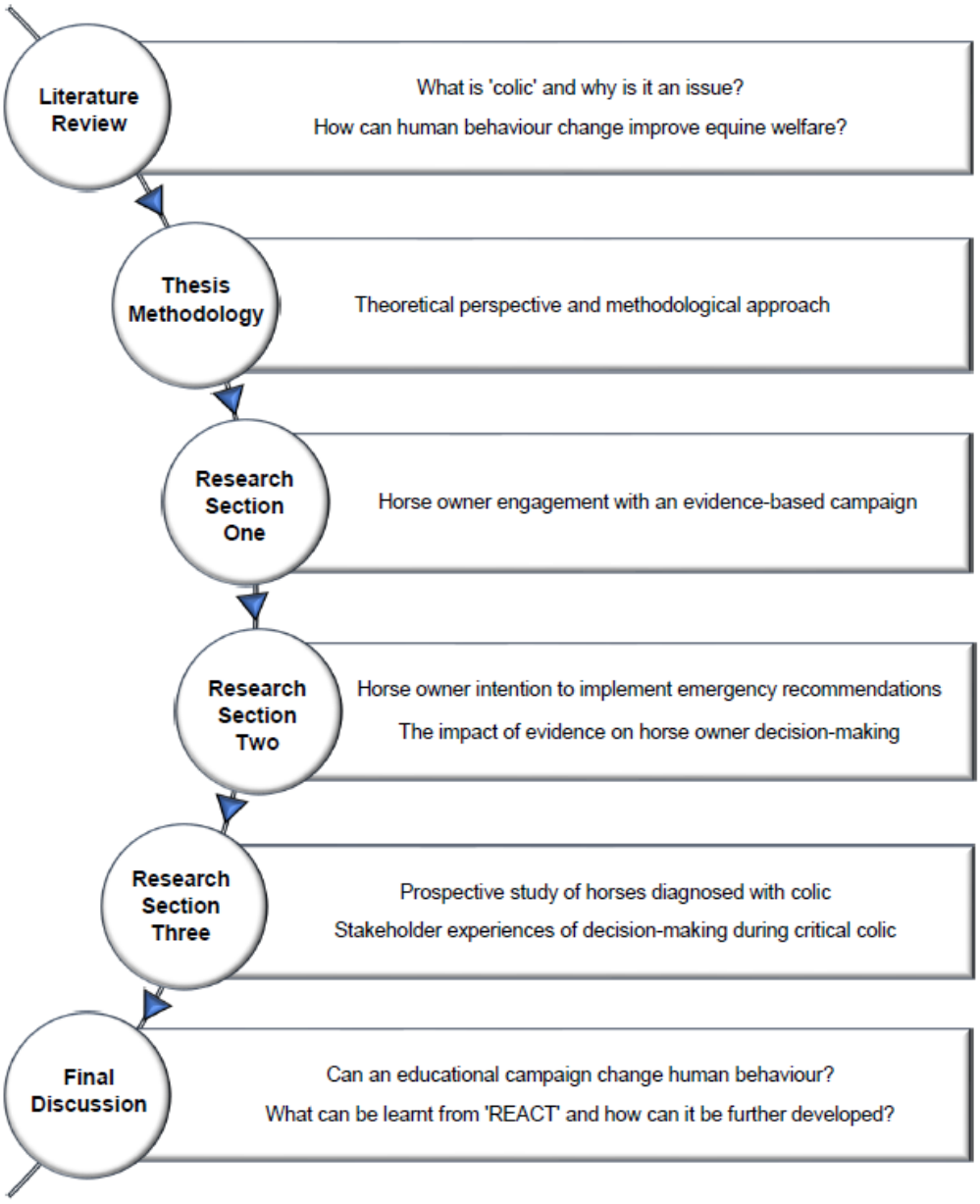


Figure 1-1: Overview of thesis structure and content

1.2 Thesis structure

1.2.1 Literature review

Chapter Two is a traditional, narrative literature review of current evidence. This section commences with a description of equine colic, the implications of delayed veterinary treatment and the essential role of horse owners in early case recognition. The growing discipline of human behaviour change will then be explored, with a particular focus on methods designed to elicit change and the use of educational campaigns. Finally, the design and purpose of the 'REACT Now to Beat Colic' campaign is discussed, followed by the aims and objectives of this thesis.

1.2.2 Thesis methodology

Chapter Three provides an overview of the methods used within this thesis. A summary of epistemology and ontology is presented, leading to an explanation of the theoretical perspective of this thesis. The concept of 'process evaluations' will then be introduced alongside an argument for its application in relation to the 'REACT' campaign. Following this, a mixed-methods approach to data collection is discussed, with sections dedicated to the specific quantitative and qualitative methods of investigation employed within this thesis. As a result of this approach, the outputs of this thesis are divided into three distinct research sections.

1.2.3 Research section one

Chapter Four represents the first, novel research element of this thesis. Based on the key components of a process evaluation (as described in Chapter Three), the ‘REACT Now to Beat Colic’ campaign is assessed using an online survey of UK horse owners one year after launch. Aspects such as campaign awareness, engagement with program resources and current levels of colic knowledge will be explored. This chapter identified potential issues with campaign delivery and highlighted areas for further investigation in subsequent research chapters.

1.2.4 Research section two

This section is comprised of two research chapters (five and six) and explores the underpinning determinants of horse owner behaviour (as described by the COM-B model) in relation to colic recognition and response. Concepts such as owner intention to adopt emergency colic recommendations (as described by the ‘REACT’ campaign) and the influence of scientific evidence on decision-making were investigated using a theoretical approach. Additionally, contextual factors that may affect engagement with the ‘REACT’ campaign, such as the horse-human relationship, were explored.

1.2.5 Research section three

Chapters Seven and Eight are presented in the final research section of this thesis and provide further insight into the clinical and social-ecological factors involved in colic decision-making. Chapter Seven adds to the current body of veterinary evidence through the collection of prospective data relating to horses diagnosed with abdominal pain. In addition, Chapter Eight used qualitative research methods to explore stakeholder experiences of critical colic decision-making, subsequently highlighting contextual implications for the ‘REACT’ campaign.

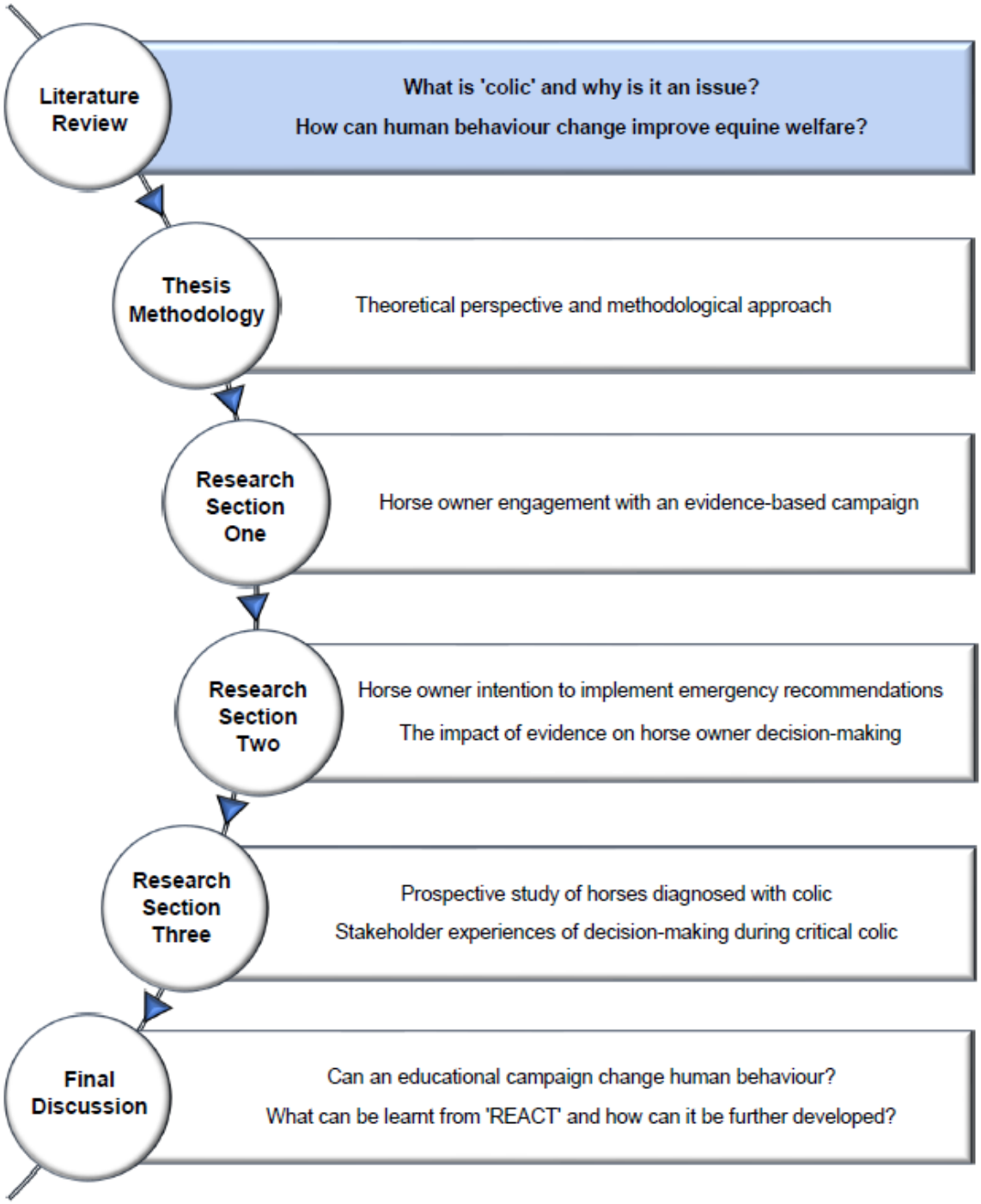
1.2.6 Final discussion

The final section of this thesis provides an in-depth discussion of the thesis results. An overview of key findings relating to the evaluation of the ‘REACT’ campaign is presented, along with suggestions for further development. Additionally, this chapter will argue the importance of a systematic approach to intervention design, as well as a thorough understanding of those being asked to change.

1.2.7 Image acknowledgement

Icons used throughout this thesis have been attributed to the relevant creator in Appendix I.

Chapter 2: Literature review



2.1 Equine Colic: The nature of the problem

2.1.1 Overview

Colic is the generalised term used to describe clinical signs of abdominal pain in equids (Hackett, 2012). Although a multitude of pathological abnormalities can be attributed to the development of abdominal pain, acute gastrointestinal disease remains the most frequent cause of colic in the domesticated horse (Curtis *et al*., 2015). Ranked highly by horse owners in terms of concern (Bowden *et al*., 2019, Mellor *et al*., 2001), colic is the most common reason for emergency veterinary attendance in the United Kingdom (UK) (Bowden *et al*., 2017). Significant welfare and economic implications are associated with this condition (Archer and Proudman, 2006, Traub-Dargatz *et al*., 2001), yet despite extensive advances in both the diagnosis and treatment of gastrointestinal disease, colic continues to be a frequent cause of equine mortality (Mair and Smith, 2005a, Curtis *et al*., 2015, Ireland *et al*., 2011b, Tinker *et al*., 1997b). Rapid decision-making, on the part of both the owner and attending practitioner, can help to maximise a horse's chances of a successful outcome. However, there are many factors, such as the range of underlying diseases that can be attributed to colic (Dukti and White, 2009) and knowledge limitations within the horse owning population (Bowden *et al*., 2020, Scantlebury *et al*., 2014), which can potentially result in delayed recognition and veterinary treatment.

2.1.2 Incidence of colic

The reported occurrence of abdominal pain is wide-ranging, with existing evidence suggesting a yearly frequency of 3 to 19 cases per 100 horses (Kaneene *et al*., 1997, Mellor *et al*., 2001, Hillyer *et al*., 2001, Tinker *et al*., 1997b, Traub-Dargatz *et al*., 2001, Uhlinger, 1992). However, an annual variation of 0-30% has been identified depending on the establishment or group in focus (Hillyer *et al*., 2001, Traub-Dargatz *et al*., 2001, Uhlinger, 1992). Hillyer *et al*., (2001) reported a yearly frequency of 7.19 cases per 100 horses during a cross-sectional study of UK Thoroughbred training premises, whereas a national study of equine establishments in the USA observed only 4.2 cases per 100 horses (Traub-Dargatz *et al*., 2001). This variation can most likely be attributed to differences in both management systems and horse characteristics, which have frequently been identified as significant risk factors in the development of abdominal pain (Curtis *et al*., 2019).

2.1.3 Risk factors for the development of colic

A recent scoping review of existing veterinary literature identified 22 risk factor categories associated with colic in the adult horse (Curtis *et al*., 2019). When grouped into three broad areas (Figure 2-1) the majority of published evidence attributes the development of colic to various aspects of equine management.

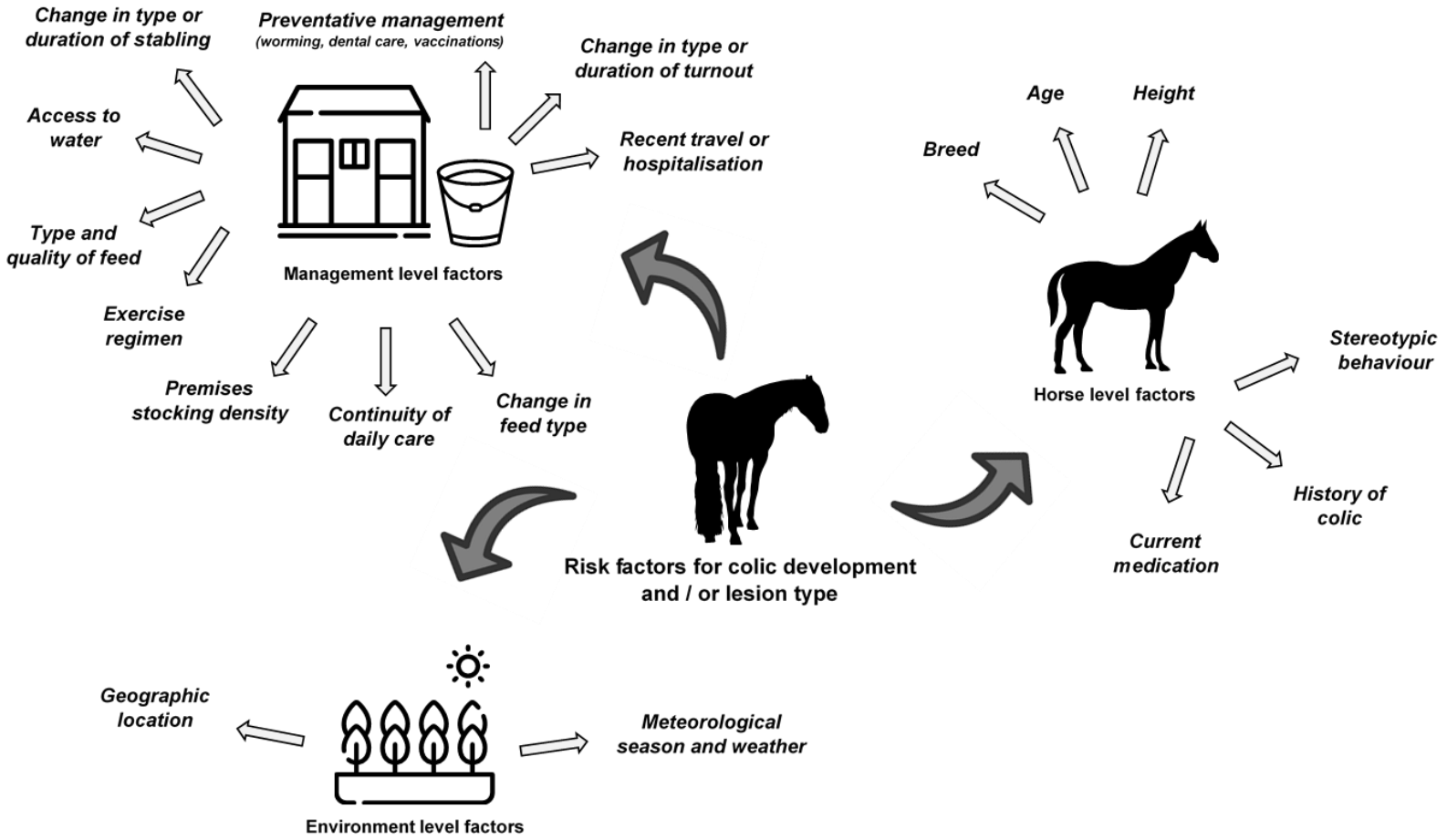


Figure 2-1: Range of factors associated with an increased risk of colic development. (Based on the findings of a systematic review performed by Curtis *et al*., 2019)

Management related risk factors included the duration of time spent stabled (Escalona *et al*., 2014, Hillyer *et al*., 2002, Hudson *et al*., 2001, Suthers *et al*., 2013) or at pasture (Hudson *et al*., 2001), feeding regimens (Cohen *et al*., 1999, Cohen and Peloso, 1996a, Cohen *et al*., 1995, Cohen and Peloso, 1996b, Escalona *et al*., 2014, Salem *et al*., 2016, Scantlebury *et al*., 2015, Suthers *et al*., 2013) and access to water (Kaya *et al*., 2009, Williams *et al*., 2015). Horse-level risk factors, such as age (Archer *et al*., 2014, Cohen *et al*., 1999, Cohen and Peloso, 1996b, Kaneene *et al*., 1997, Tinker *et al*., 1997b), gender (Suthers *et al*., 2013) and breed (Cohen *et al*., 1999, Cohen and Peloso, 1996b, Cohen *et al*., 2000, Hudson *et al*., 2001), may also predispose individuals to a greater risk of colic. Additionally, seasonal changes (Archer *et al*., 2006), weather patterns (Cohen *et al*., 1999) and geographic location (Archer *et al*., 2014) have been associated with specific types of gastrointestinal lesion. However, caution must be taken when interpreting published results as the existing studies vary in both quality and methodological approach, with many not being representative of the general population. For instance, Curtis *et al* (2019) identified seven publications which suggested that age was a significant risk factor for the development of colic, yet both age category and range varied between studies. Nevertheless, this evidence highlights an abundance of modifiable risk-factors that can be controlled by a horse's primary owner or carer.

2.1.4 Recurrence of colic

Horses which have suffered previous colic episodes are also more likely to experience future events (Reeves *et al*., 1996, Hillyer *et al*., 2001, Scantlebury *et al*., 2011, Tinker *et al*., 1997b). A number of management and horse-level risk factors, such as dental disease (Scantlebury *et al*., 2011) and stereotypic behaviour (Escalona *et al*., 2014, Scantlebury *et al*., 2011, Scantlebury *et al*., 2015), have been associated with repeated colic events. Additionally, recurrence following cases of medically treated colic has been reported as being as high as 50 cases per 100 horse-years-at-risk (HYAR) (Scantlebury *et al*., 2011). This figure becomes slightly lower at 35 episodes per 100 HYAR when only veterinary attended cases are considered.

For horses undergoing abdominal surgery, post-operative colic prior to discharge is a common morbidity (Mair and Smith, 2005b, Proudman *et al*., 2002a), with recurrence reportedly associated with the pathological nature and location of the lesion. Although post-operative colic is often an immediate complication of surgery, incidences are not confined to animals still receiving hospital care. In a longitudinal cohort study of 974 horses undergoing abdominal surgery, 48.2% experienced at least one episode of post-operative colic during the first 12 months following discharge, resulting in an overall yearly frequency of 36.5 cases per 100 horses (Burford, 2016). Therefore, early recognition and prompt veterinary treatment is essential when colic is suspected to prevent both short and long term complications.

2.1.5 Primary assessment

The primary assessment of horses with colic is usually performed at an owner's premises by those in first opinion practice. Obtaining a history is the first step in primary assessment (Southwood, 2012b), with accurate knowledge pertaining to horse signalment essential for establishing a list of differential diagnoses (Southwood, 2012b, Tinker *et al*., 1997b). Specific behavioural signs, such as continuous rolling or in appetence, can help determine both the severity of abdominal pain (see section 2.1.7.1) and the most appropriate treatment plan. Duration of signs and changes in severity over time can also assist in establishing the underlying cause. Though frequently relied upon, behavioural signs and degree of visual pain will vary amongst horses (Desrochers and White, 2017), with owners rarely able to provide an approximate duration of colic (Southwood, 2012b). Therefore, it is vital that a thorough physical examination (Figure 2-2) is performed. The origin of abdominal pain can often be determined using diagnostic procedures such as rectal palpation or nasogastric intubation (Dabareiner and White, 1995b, Kalsbeek, 1973, Kalsbeek, 1975, Kopf, 1997, Sanchez and Merritt, 2005, White *et al*., 2005). However, the field assessment of horses with colic can be fraught with difficulties. Additionally, the vast array of aetiologies, and accompanying clinical signs, associated with colic can make establishing the true nature of the disease upon primary evaluation problematic (Curtis *et al*., 2015, Dukti and White, 2009).

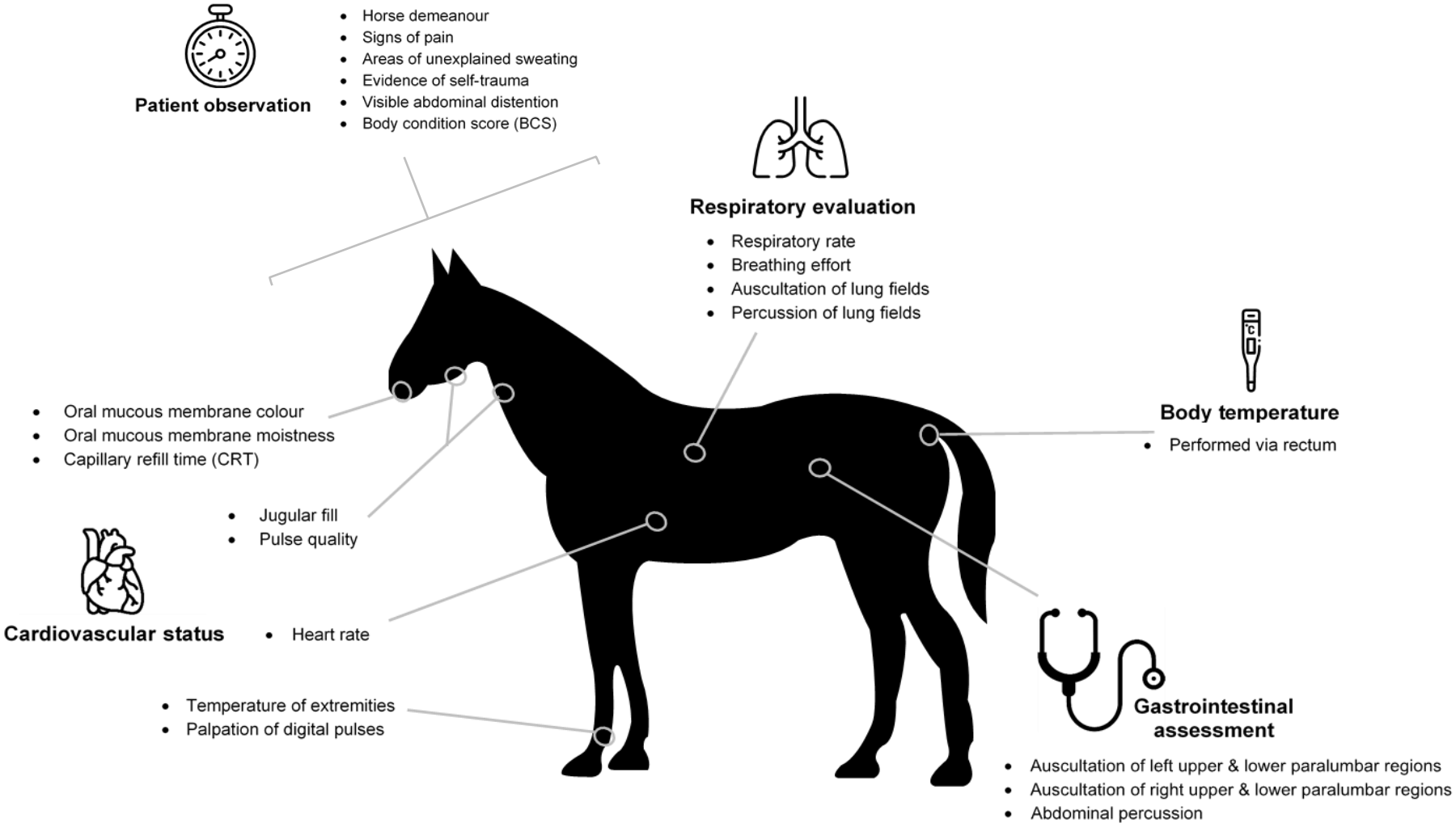


Figure 2-2: Key elements and observations performed during an initial physical examination of a colic patient. Based on guidelines described by Southwood (2012) and Desrochers and White (2017)

2.1.6 Pathophysiology of common gastrointestinal diseases

A multitude of conditions can result in the development of abdominal pain, with causes often categorised according to the anatomic region affected and degree of intestinal injury (Blikslager, 2017).

2.1.6.1 Simple, non-strangulating obstructions

Intestinal obstructions resulting from the intraluminal accumulation of foreign material or ingesta are frequently termed ‘simple’ or ‘non-strangulating’ (Blikslager, 2017). Though these lesions typically involve ingested material, endogenous causes of simple obstructions, such as enteroliths (Maher *et al*., 2011) and non-strangulating lipomas (Edwards and Proudman, 1994, Munday *et al*., 2016), have been frequently reported. Non-strangulating lesions can develop throughout the gastrointestinal tract (Figure 2-3) and result in an accumulation of fluid, gas and food material proximal to the mass. Although intestinal blood flow is not directly affected, persistent blockages can result in the compression of intramural blood vessels and eventual intestinal ischemia (Dabareiner *et al*., 1993, Dabareiner *et al*., 2001). In addition to a compromised blood supply, experimental studies have suggested that prolonged small intestinal dilation can result in an abnormal increase of paracellular spaces (Allen *et al*., 1988) and adhesion formation due to seromuscular injury (Lundin *et al*., 1989). Though these results have not been replicated *in vivo*, they have been supported by more recent studies, which have shown that paracellular

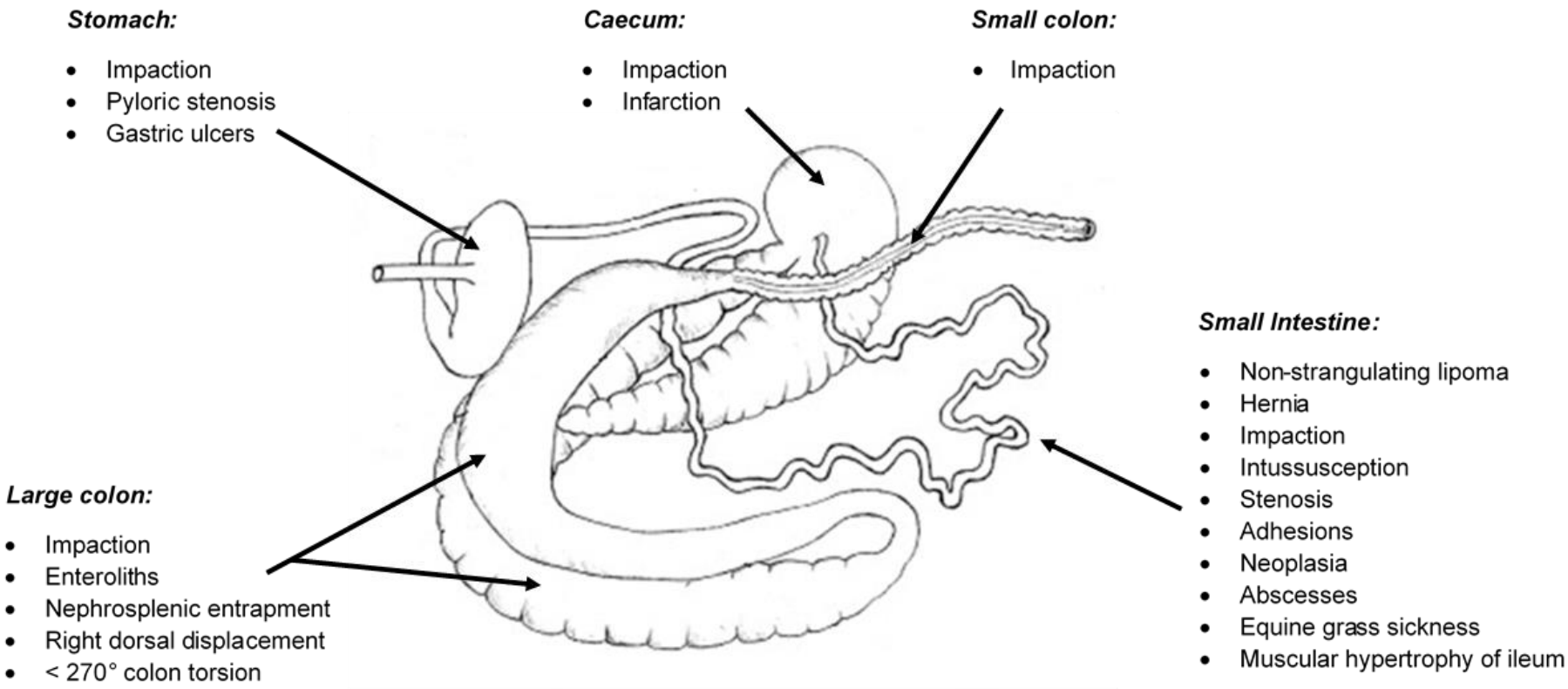


Figure 2-3: The location and various causes of simple, non-strangulating obstructions in the horse (Image reproduced from Van Weyenberg *et al*., 2006)

changes are associated with an increase in mucosal permeability and subsequent absorption of bacterial toxins (Little *et al*., 2005). Additionally, inflammatory seromuscular lesions have been identified in the resected margins of naturally occurring strangulating obstructions, confirming the impact of persistent distension on intestinal viability (Gerard *et al*., 1999, van den Boom and van der Velden, 2001). However, it must be noted that simple obstructions can eventually lead to severe ischemic injury, as a result of progressive occlusion of the intestinal blood supply, if prompt veterinary treatment is not sought (Allen *et al*., 1988, Dabareiner *et al*., 1993)

2.1.6.2 Strangulating obstructions

Strangulating obstructions can occur throughout the digestive tract, including the small intestines (e.g. epiploic foramen entrapment) and large colon (e.g. 360-degree volvulus). In contrast to simple obstructions, strangulating lesions result in the simultaneous constriction of the intestinal lumen and associated blood supply. As a result, the effected region displays all of the pathophysiologic characteristics of a simple obstruction, but the onset of ischemic injury is more rapid (Blikslager, 2017). The speed at which intestinal damage is sustained will vary depending on the type of vascular occlusion. For instance, haemorrhagic strangulating obstructions occur when a lesion first occludes the venous blood supply, thus allowing oxygenated blood to enter the effected region but hindering venous return (Dabareiner and White, 1995a, Moore *et al*., 1995, Vatistas *et al*., 1998). In contrast,

some lesions will exert enough pressure to occlude both vessels simultaneously, resulting in a complete ischemic strangulation (Reeves *et al*., 1990a, Snyder *et al*., 1988). In all instances, a prolonged reduction in blood flow will eventually lead to cellular necrosis (McAnulty and Stone, 1997) and severe injury of the intestinal mucosa (Blikslager *et al*., 1997). The degree of damage sustained is entirely time-dependent, with an investigational study in pigs reporting partial or complete sloughing of intestinal villi epithelium within 60 -120 minutes of a strangulating obstruction occurring (Blikslager *et al*., 1997). Furthermore, irreversible damage of the equine colon has been observed within 3-4 hours of a 360-degree volvulus (Snyder *et al*., 1988). As a result, intestinal viability must be assessed following lesion correction, (Adams and Mcilwraith, 1978) with prolonged strangulation of the intestine associated with an increased need for surgical resection (Freeman *et al*., 2000, Freeman *et al*., 2014). Unfortunately, the only accurate way to determine severity of ischemic injury, and therefore prognosis, is by performing mucosal histology during abdominal surgery (Van Hoogmoed *et al*., 2000). Consequently, obstructions of this type are associated with a high level of pre and intra-operative mortality (Proudman *et al*., 2002b, Proudman *et al*., 2002a), with the latter often associated with the discovery of extensive mucosal injury during surgical exploration (Table 2-1) (Blikslager, 2019, Freeman, 2018b). However, one study has highlighted that early recognition and prompt surgical correction of strangulating lesions can lead to a more favourable prognosis (Hackett *et al*., 2015).

Table 2-1: Grades of intestinal mucosal injury used to determine the need for resection in strangulated small intestines (Freeman *et al*., 2014)

Grade of mucosal injury	Time until circulation improvement	Appearance	Motility
One	≤ 15 minutes of lesion correction	• Similar to adjacent healthy bowel • Slightly darker pink • Mild oedema and ecchymoses	Spontaneous or induced by 'snapping' finger against intestinal wall
Two	≤ 15 minutes of lesion correction	• Diffuse patches of red against dark pink background • No circumferential constrictions at point of strangulation • Marked oedema with extensive ecchymoses	Weak or induced by 'snapping' finger against intestinal wall
Three	≤ 15 minutes of lesion correction	• Similar to grade two injury • May have black patches against a red background • May have constrictions at the point of strangulation equal to or less than half intestinal circumference	Weak or induced by 'snapping' finger against intestinal wall
Four	Slight or no improvement within 15 minutes of lesion correction	• Predominantly dark red, blue or purple • Bowel thickness ranges from thin to thick • May have black striations • Necrotic odour • Constrictions at point of strangulation	Little or no motility even following snapping finger
Five	No improvement	• Diffusely grey, black or green discolouration • May have a necrotic odour	Amotile

2.1.7 Decision for referral and surgical intervention

Cases which resolve spontaneously or after primary medical intervention are often termed ‘simple colic’ and represent the majority (80-85%) of cases seen (White, 2009). However, though a large proportion of animals recover following a single veterinary treatment (Dukti and White, 2009) around 8 - 20% will require intensive medical treatment, surgery or euthanasia (Bowden *et al*., 2017, Curtis *et al*., 2015, Hillyer *et al*., 2001). These cases are often termed ‘critical’ (Curtis *et al*., 2015) and require rapid-decision making to minimise unnecessary suffering. Additionally, the early referral of horses identified as having a surgical lesion allows anaesthesia and surgery to occur before the patient becomes systemically unstable (Cook and Hassel, 2014, Macdonald *et al*., 1990, Salem *et al*., 2016).Though the urgency and need for referral can often be determined by the identification of a specific lesion, it is not always possible for a diagnosis to be made. In these circumstances, differentiation between critical and non-critical cases is often based on the severity of clinical findings (Figure 2-4) (White, 2017a).

2.1.7.1 Observations on physical exam

Degree of pain is frequently used to assess colic severity, with persistent (White *et al*., 2005) or recurrent (Cohen and Peloso, 1996a) discomfort despite analgesia considered an indication for referral. Horses suffering severe bouts of pain will often resort to violent

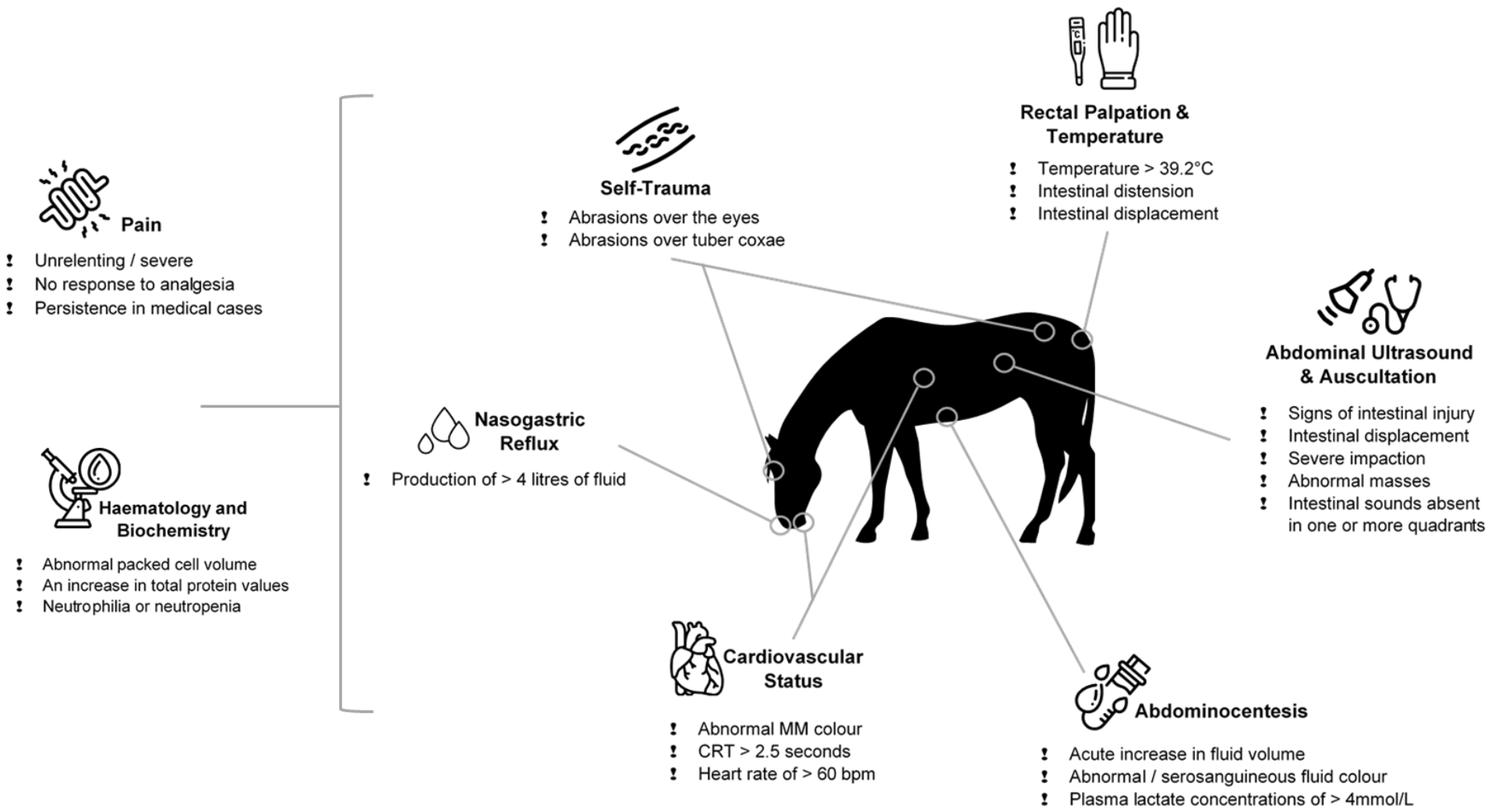


Figure 2-4: Clinical findings that can be used to identify 'critical' cases of colic and the need for urgent referral or surgical intervention. Based on signs described by White (2017).

behaviours, such as continuous rolling, in an attempt to alleviate their discomfort (Pritchett *et al*., 2003, Southwood, 2012c). As a result, evidence of self-trauma, particularly in the form of abrasions over the eyes and around the tuber coxae may be observed. Over-exertion in response to severe pain may also result in profuse sweating (White, 1990), although this can also be an indication of shock or over-stimulation of the sympathetic nervous system (Desrochers and White, 2017).

Though regularly assessed, caution must be taken when interpreting equine pain as signs will vary depending on the individual horse. Furthermore, pain assessment can be a subjective process with practitioner approach reportedly influenced by both year of graduation and attendance at a particular University (Price *et al*., 2002). In an attempt to standardise assessment, several scoring systems specific to colic have been developed (Graubner *et al*., 2011, Mair and Smith, 2005a, Pritchett *et al*., 2003, Sutton *et al*., 2019, Sutton *et al*., 2013a, Sutton *et al*., 2013b, Taffarel *et al*., 2015, van Loon *et al*., 2014), including White's (1990) early five point behaviour-based scale (Table 2-2). However, there is currently no universally accepted scoring system (Dugdale, 2014, Gleerup and Lindegaard, 2016, Wagner, 2010) with many focusing on post-operative colic (Graubner *et al*., 2011, Taffarel *et al*., 2015, van Loon *et al*., 2014) rather than acute signs of abdominal pain.

T**able 2-2:** White's (1990) early five point behavioural-scoring system used for assessing colic severity in horses.

Pain severity	Behavioural signs	Response to analgesia or ease of horse control
 ***(1) None / normal***	• Horse is bright and responsive (BAR) • No signs of pain or discomfort • Displaying normal behaviours	N / A
 ***(2) Mild***	• Horse is quiet and responsive (QAR) • Lying down for long periods of time • Occasional pawing at the ground • Turning to look at flank • Stretching out as if to urinate • Bruxism	• Horse will usually respond to analgesia for 8 – 12 hours • Horse easily distracted from pain (e.g. via gentle walking) • Horse can be safely handled
 ***(3) Moderate***	• Horse is restless or agitated • Frequent attempts to lie down • Frequent kicks towards abdomen • Frequent flank watching • Violent pawing at the ground • Rolling • 'Dog sitting'	• Horse will usually respond to analgesia for 2 – 4 hours • Horse is difficult to distract from pain • Horse is becoming difficult / dangerous to handle

 ***(4) Severe***	• Horse is severely agitated • Frequent attempts to lie down • Frequent kicks towards abdomen • Frequent flank watching • Violent pawing at the ground • Violent rolling • 'Dog sitting'	• Very brief or no response to analgesia • Horse cannot be distracted from pain • Horse is dangerous to handle • Horse is at risk of self-trauma or injury
 ***(5) Depression***	• Horse is unresponsive to external stimuli • No interest food or water • Head is held low to the floor • Horse is reluctant to move • 'Tucked-up' appearance of abdomen	• No response to analgesia • Depression can be: – shown **before or after** acute pain – a sign of exhaustion – a sign of shock

In addition to behavioural signs, routine indicators of health, such as respiratory rate, pulse and rectal temperature, can be helpful in establishing both the category and severity of the underlying disease (Table 2-3) (Desrochers and White, 2017). Although reliant on both level of pain and sympathetic response, an increase in heart rate has been shown to be a significant prognosticator for colic survival (Furr *et al*., 1995, van der Linden *et al*., 2003), as well as a useful gauge of cardiovascular status (Morton and Blikslager, 2002). However, tachycardia can also be influenced by behavioural responses, such as fear or excitement (Desrochers and White, 2017, White *et al*., 2005), highlighting that heart rate should not be relied upon as a sole indicator of severity. Similarly, though the respiratory rate of horses with abdominal pain is usually increased, with shallow breaths allowing for a decrease in diaphragmatic movement (Desrochers and White, 2017), a direct correlation to abdominal pain severity has not yet been established (Graubner *et al*., 2011, Sellon *et al*., 2004).

In colic, the rectal temperature of horses generally remains normal, unless influenced by physical exertion (e.g. rolling), environmental changes (White, 1990) or a systemic and/or local inflammatory response (Nolen-Walston *et al*., 2007). Concurrent with both pulse and respiratory rate, studies investigating physiological measures of pain have reported no association between rectal temperature and severity

Table 2-3: Physiological parameters routinely assessed in the colic patient, their normal value ranges and associated indications of disease severity as described by Desrochers and White (2017)

Clinical factor	Normal range / description	Indication of disease severity
Heart rate	28 – 44 beats per minute*	• 40 – 70 beats per minute: simple obstruction • 50 – 90 beats per minute: early strangulation • 70 – 120 beats per minute: late strangulation • 40 – 100: inflammatory disease ** These figures were reported by White (1990) however, they will vary depending on the individual case **
Respiratory rate	8 – 12 breaths per minute*	• Rate increases and becomes shallower with disease severity
Rectal temperature	37.5 – 38.5°C*	• ≥ 39.2°C indicative of inflammatory disease
Mucous membrane colour	Pale / salmon pink	• Very pale: mild dehydration • Hyperaemic: shock • Cyanotic: advanced shock

** Excitement, fear or physical exertion can also cause an increase in this physiological parameter*

of discomfort (Bussières *et al*., 2008, Gleerup *et al*., 2015). However, an increase in rectal temperature may assist practitioners in differentiating between strangulating lesions and infectious or inflammatory disease (such as peritonitis or enterocolitis), with the latter frequently associated with temperatures of 39°C or higher (Desrochers and White, 2017).

Factors reflecting changes in cardiovascular status have been linked with both prognosis and need for intensive treatment (Adams and Mcilwraith, 1978, Hillyer and Wright, 1997, Parry *et al*., 1983). Although it has been suggested that changes to oral mucous membrane colour is an unreliable predictor of the need for surgery (White *et al*., 2005), deviation from a pale or 'salmon' pink appearance is usually indicative of dehydration or poor tissue perfusion (MacKay, 1992). Additionally, studies have identified that the need for surgery often increases when a weak peripheral pulse (Thoefner *et al*., 2003) and high packed cell volumes (PCV) (White *et al*., 2005) were present. Hydration can also be evaluated by performing a combination of tests (Table 2-4), including capillary refill time and skin tent retraction (Corley, 2002), with the latter being significantly associated with survival (van der Linden *et al*., 2003).

The normal frequency and amplitude of abdominal borborygmi will vary amongst horses (Ehrhardt and Lowe, 1990) however, it is generally accepted that most cases of abdominal pain will be accompanied by a decrease in propulsive sounds (Desrochers and White, 2017, Reeves *et al*., 1988, Singer and Smith, 2002, White *et al*., 2005).

Table 2-4: Elements of a physical examination that can help to ascertain hydration status in the horse (Corley, 2002).

Degree of dehydration	Skin tent retraction	Moistness of mucous membranes	Capillary refill time (CRT)
Mild	1 – 3 seconds	Moist or tacky	≤ 2.5 seconds
Moderate	3 – 5 seconds	Tacky	2 – 3 seconds
Severe	≥ 5 seconds	Dry	≥ 4 seconds

In severe cases, such as those involving strangulating lesions, borborygmi may be completely absent, indicating the need for urgent surgical intervention (White *et al*., 2005).

2.1.7.2 Results of diagnostic tests

Additional diagnostic tests can assist practitioners in distinguishing between medical and surgical cases of colic. For instance, the production of over 4 litres of nasogastric reflux (White, 2017a) and abnormal findings on rectal palpation, such as severe intestinal distension or displacement (Adams and Mcilwraith, 1978, Ducharme *et al*., 1989, Huskamp and Scheidemann, 2000, Reeves *et al*., 1988, White *et al*., 2005), are frequently linked with the need for surgical intervention. Additionally, the serosanguinous appearance of peritoneal fluid has been found to be 98% specific for surgical lesions (Matthews *et al*., 2002), with elevated levels of peritoneal lactate indicative of advancing bowel ischemia (Peloso and Cohen, 2012). However, no single diagnostic test is 100% accurate in predicting the need for

referral and cannot be used as sole indicators of lesion type or severity, with several authors reporting variations in both test specificity and sensitivity (Desrochers and White, 2017, Ducharme *et al*., 1989, Noordhuizen *et al*., 2001, Reeves *et al*., 1988, White *et al*., 2005).

2.1.7.3 Use of predictive models

To further aid practitioners in determining the need for surgical intervention, the aforementioned factors have been incorporated into several predictive models (Ducharme *et al*., 1989, Matthews *et al*., 2002, Pascoe *et al*., 1990, Pihl *et al*., 2013, Reeves *et al*., 1990b, Reeves *et al*., 1992). Yet, many of these tools have been found to be unreliable (Thoefner *et al*., 2003), with statistical methods susceptible to differences in disease prevalence within each target population (White, 2017a). Additionally, the majority of models have been developed using data obtained in a referral hospital setting, meaning evidence of clinical factors associated with the need for referral on primary assessment is deficient (Bowden *et al*., 2017). To address this knowledge gap, Curtis *et al*., (2015) identified five variables that could be utilised to identify critical cases: combined pain score, heart rate, capillary refill time, weak pulse, and absence of gut sounds. Heart rate and reduce borborygmi were also reported as potential ‘red flag’ indicators of critical colic by Bowden (2017), with abnormal mucous membrane colour also being a significant value. However, as with predictive models developed using a hospital population, statistical tests are rarely used in determining the need for referral due to the need for computer access (White, 2017a).

Nevertheless, knowledge of potential critical indicators can help to prevent delays in referral, a subsequent decline in cardiovascular status and a negative impact on survival (Hackett *et al*., 2015, Harrison, 1988, Southwood, 2004).

2.1.8 Prognosticating colic

2.1.8.1 Determining risk of mortality

Due to the multifactorial nature of colic, determining survival still remains a challenge (White, 2017b). Yet, a number of factors can be used to provide both practitioners and owners with an indication of treatment success. Though all horses can develop colic, Thoroughbred types and draft breeds have been identified as being at increased risk of death (Proudman *et al*., 2006). Additionally, Rothenbuhler *et al*. (2006) suggested that, due to a longer duration of anaesthesia, mortality of draft horses undergoing surgical correction for colic was higher than that of lighter breeds. The effect of age on colic survival has been a much debated topic, with two large retrospective studies identifying advanced age as a negative indicator of surgical survival (Mair and Smith, 2005a, Proudman *et al*., 2006). In contrast, more recent evidence suggests that geriatric horses (≥ 16 years of age) were just as likely to survive surgical intervention when compared to non-geriatric horses (Gazzerro *et al*., 2015, Krista and Kuebelbeck, 2009, Southwood *et al*., 2010). This casts doubt on the role of advanced age on colic survival, with Southwood *et al*. (2010) highlighting that a higher rate of euthanasia in geriatric horses is more likely attributed to owners

being adverse to surgical intervention than being a direct result of colic treatment.

Many studies have attempted to establish a link between routine health parameters and survival, with cardiovascular status and severity of pain frequently found to be associated with an increased risk of mortality (Furr *et al*., 1995, Grulke *et al*., 2001, Ihler *et al*., 2004, Orsini *et al*., 1988, Parry *et al*., 1983, Proudman *et al*., 2006, Puotunenreinert, 1986, Thoefner *et al*., 2001, van der Linden *et al*., 2003). However, as previously mentioned, pain assessment in horses is yet to be standardised and should always be used in conjunction with clinical findings when providing a prognosis. Additionally, though an increase in PCV and heart rate have been repeatedly linked with decreased survival (Proudman *et al*., 2005a), specific values that will reliably predict mortality are yet to be reported. In addition to findings on physical examination, clinicopathologic values, such as an increase in blood and peritoneal fluid lactate concentrations (Hinchcliff *et al*., 2005, McCoy *et al*., 2011), are frequently used to estimate survival. Moreover, Garcia-Seco *et al*., (2005) reported that serosanguineous peritoneal fluid was a strong indicator of mortality in a study of 102 horses with strangulating lipomas. However, though reportedly linked with mortality, none of the aforementioned variables have been used to accurately predict non-survival in individual horses.

In response to this issue, several studies have developed mathematical algorithms to assist in prognosticating colic survival using a number of

the variables described above (Furr *et al*., 1995, Orsini *et al*., 1988, Parry *et al*., 1983, Pascoe *et al*., 1990, Reeves *et al*., 1989, Reeves *et al*., 1992). Additionally, Grulke *et al*. (2001) created the 'gravity and shock score', which calculates the risk of death based on pulse, respiratory rate, arterial blood pressure, PCV, lactate concentration and blood urea nitrogen. However, though a few of these studies reported good fit with model data (Reeves *et al*., 1989), promising levels of sensitivity and specificity (Furr *et al*., 1995) and an increased ability to predict mortality (Grulke *et al*., 2001), many have not yet been validated on an independent population. Nevertheless, models such as these, used in conjunction with survival data reported from hospital studies investigating lesion type and surgical survival, can assist both vet and owner in making an informed decision.

2.1.8.2 Current rates of survival

Emergency presentation of abdominal pain is a common occurrence (Bowden *et al*., 2017) and primary assessment is often performed by those in first opinion practice. Yet, a large proportion of literature pertaining to the survival of horses diagnosed with colic is based upon evidence accumulated within referral hospitals. Though this data is useful in assessing both surgical techniques and post-operative care (Burford, 2016), it is of little use in situations where hospital referral is not an option. To address this gap in knowledge, two recent studies investigated the primary (Curtis *et al*., 2015) and out-of-hours (Bowden *et al*., 2017) evaluation of colic by first opinion practitioners in the UK. In

addition to providing vital information on potential critical indicators of colic, these studies reported elective rates of euthanasia as 13% and 18% respectively. Although these figures are higher than those stated by others (Tinker *et al*., 1997a, Traub-Dargatz *et al*., 2001), all horses included within these studies received veterinary attention which could suggest that only cases perceived as severe by owners were seen. This would coincide with Traub-Dargatz *et al*., (2001) who reported a difference in mortality rates between cases attended by a veterinarian (15.9%) and those which were not evaluated (6.2%). However, it is important to note that mortality rates at primary evaluation do not always represent euthanasia as a direct result of colic severity. Factors such as financial constraints, lack of transport or owner aversion to colic surgery have anecdotally been attributed to the decision not to refer. In these situations, or for horses that are likely to have a very poor outcome, euthanasia on initial examination is the most humane option (Southwood, 2012a, Southwood and Fehr, 2012). Yet, in addition to the 13% of horses euthanased, Curtis *et al*. (2015) reported that 12 horses died (without referral) as a result of colic severity (Figure 2-5), raising significant welfare concerns regarding delayed treatment.

Survival rates for colic surgery have improved significantly over the last 50 years due to advances in surgical techniques, hospital protocols and anaesthetic recovery (Burford, 2016, Freeman, 2018b, Southwood, 2012a).

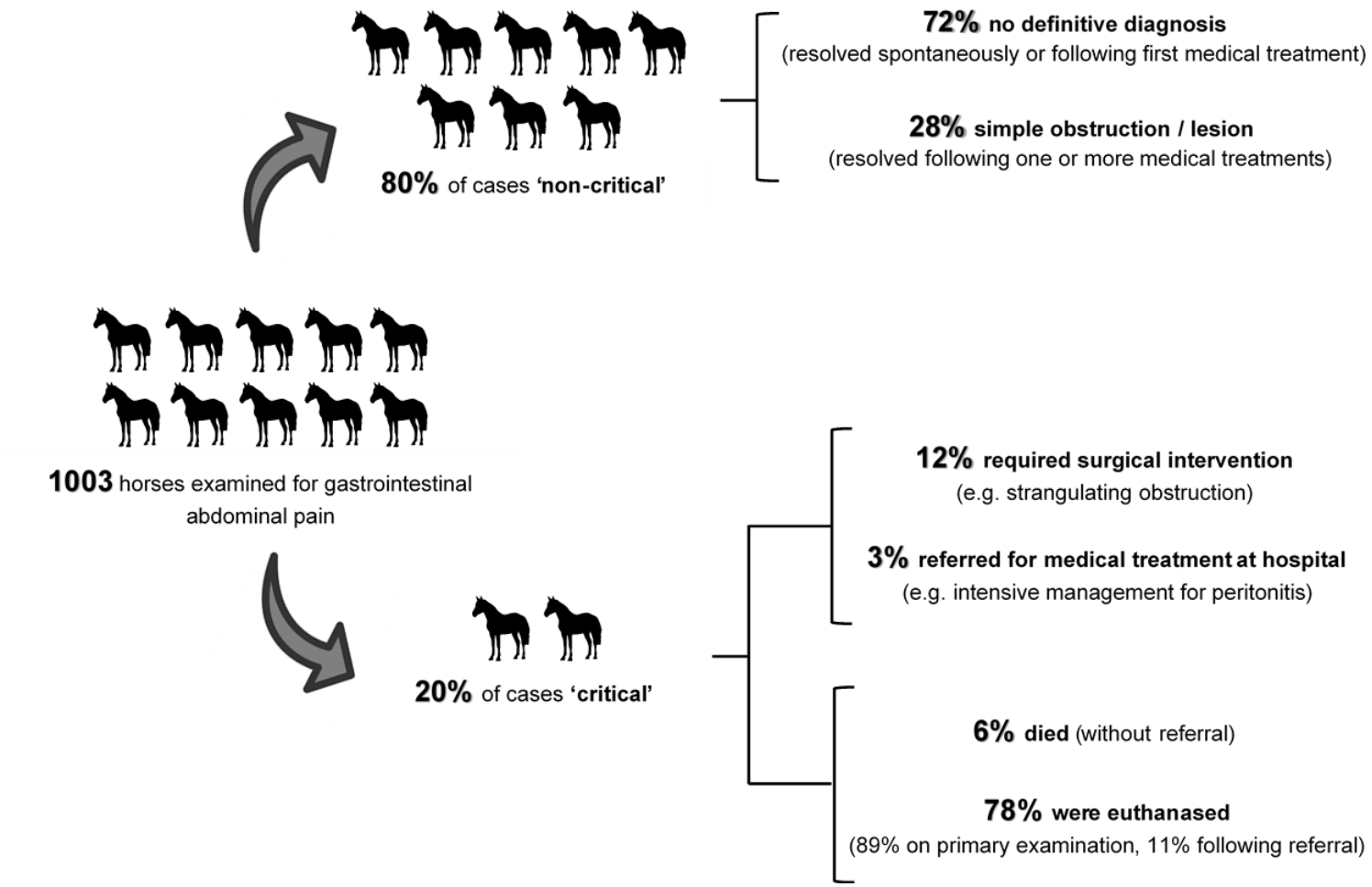


Figure 2-5: Survival of 1003* horses diagnosed with gastrointestinal related colic in a study by Curtis *et al.*, 2015 (* 13 horses have been removed from the original study population of 1016 due to having non-gastrointestinal causes of colic).

For instance, surgical correction of strangulating lesions of the small intestine, which carried a survival rate of 30 - 50% during the late 1980s and early 1990s (Edwards and Proudman, 1994, Macdonald *et al*., 1990), is now associated with a 80 - 95% success rate (Freeman and Schaeffer, 2005, Morton and Blikslager, 2002). Hospital survival can generally be grouped into two main categories: short-term survival (all horses undergoing surgical treatment and surviving until hospital discharge) and long-term survival (all horses successfully discharged from hospital and surviving to a defined time point in the future).

A review of existing evidence suggests that around 42 – 70% of all horses undergoing surgical exploration for colic will survive (Abutarbush *et al*., 2005, Christophersen *et al*., 2014, Johnson and Keller, 2005, Mair and Smith, 2005a, Sutton *et al*., 2009, van der Linden *et al*., 2003, Voigt *et al*., 2009, Wormstrand *et al*., 2014). In contrast, survival of all horses recovering from anaesthetic following exploratory laparotomy is typically expected to be around 74 – 85% (Figure 2-6). (Abutarbush *et al*., 2005, Christophersen *et al*., 2014, Freeman *et al*., 2000, Johnson and Keller, 2005, Mair and Smith, 2005a, Morton and Blikslager, 2002, Naylor *et al*., 2014, Stewart *et al*., 2014, Sutton *et al*., 2009, van der Linden *et al*., 2003, Voigt *et al*., 2009, Wormstrand *et al*., 2014). Although encouraging, caution must be taken when using this figure to provide a prognosis, as this data represents averages for large numbers of horses presenting with varying types and severities of colic.

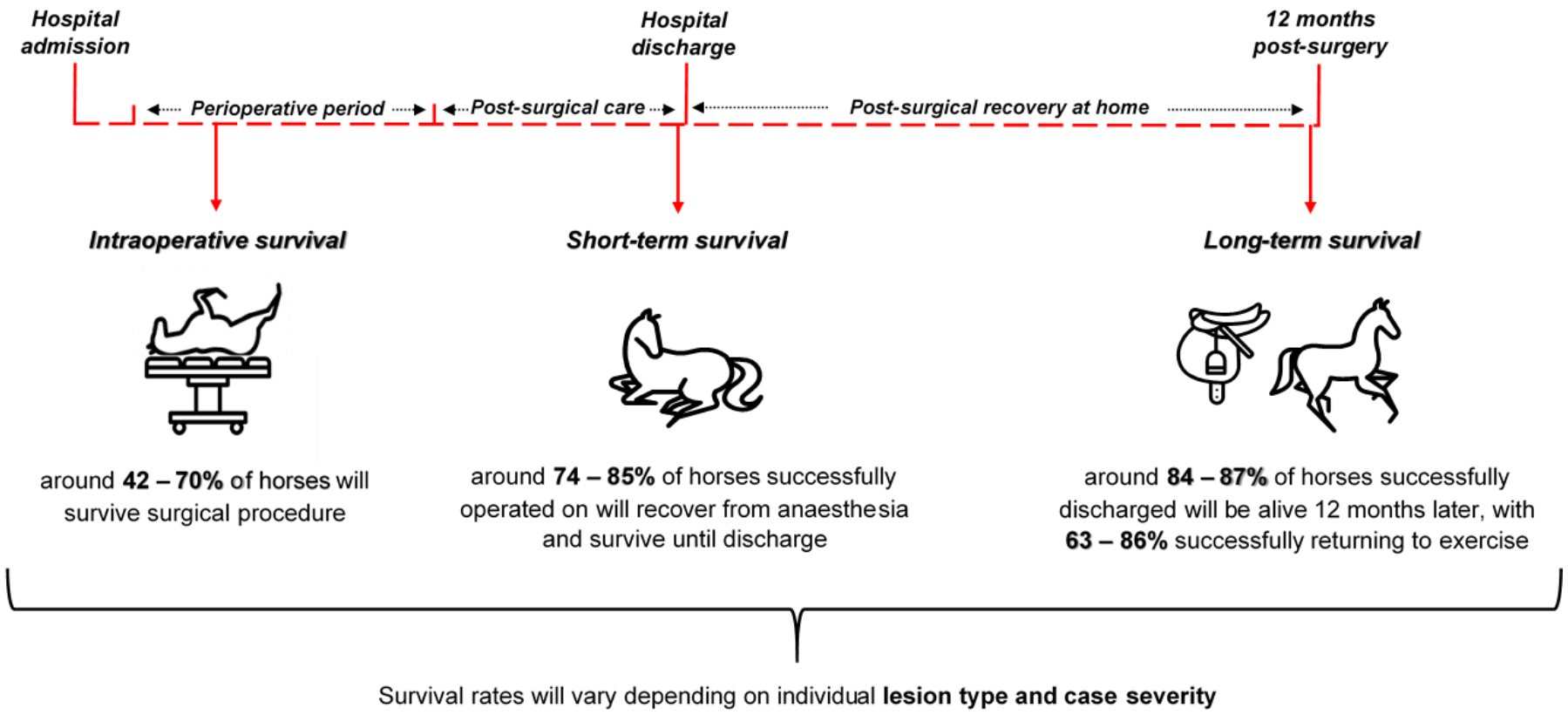


Figure 2-6: The average short and long term survival of horses undergoing surgical intervention for colic based on current evidence (Abutarbush *et al*., 2005, Christophersen *et al*., 2014, Christophersen *et al*., 2011, Immonen *et al*., 2017, Johnson and Keller, 2005, Mair and Smith, 2005a, Mair and Smith, 2005c, Morton and Blikslager, 2002, Naylor *et al*., 2014, Stewart *et al*., 2014, Sutton *et al*., 2009, van den Boom and van der Velden, 2001, van der Linden *et al*., 2003, Voigt *et al*., 2009, Wormstrand *et al*., 2014)

As a result, individual horses may have a substantially poorer prognosis depending on the underlying disease process. For example, large intestinal obstructions are associated with a much higher short-term survival rate when compared to horses diagnosed with a small intestinal lesion (Ducharme *et al*., 1983, Immonen *et al*., 2017, Mair and Smith, 2005a, Pascoe *et al*., 1983). Conversely, horses with simple obstructions of the small intestine are more likely to survive until hospital discharge (Freeman *et al*., 2000, Underwood *et al*., 2008) than those with strangulating lesions (Archer *et al*., 2011, Bergren *et al*., 2015, Freeman and Schaeffer, 2005, Gayle *et al*., 2000, Mair and Smith, 2005a, Semevolos *et al*., 2002, Stephen *et al*., 2004).

Following hospital discharge, it is currently reported that 84 – 87% of horses will be alive at 12 months (Christophersen *et al*., 2011, Mair and Smith, 2005c, van den Boom and van der Velden, 2001), with around 63 – 86% successfully returning to athletic use (Christophersen *et al*., 2011, Davis *et al*., 2013, Hart *et al*., 2014, Tomlinson *et al*., 2013). Concurrent with survival statistics reflecting short-term survival, these figures will vary depending on the underlying disease process and individual circumstances of the horse and owner. One must also take into account methodological discrepancies, such as variation in the definition of ‘long-term’ and number of cases lost-to-follow-up, when interpreting these figures (Burford, 2016). Nevertheless, current evidence on colic survival reflects the importance of early recognition and prompt help-seeking if a critical case is suspected.

2.1.9 Maximising chances of survival

As the primary carer, an owner's ability to recognise and act upon primary indicators of poor health is essential, with many welfare concerns being associated with inadequate equine management and gaps in knowledge (Hemsworth *et al*., 2015).

Traditionally those who chose to keep or work with horses were perceived to have an extensive equestrian background, yet an increasing number of less experienced owners have emerged over recent years (Leckie, 2001). Results published by Buckley *et al*., (2004) on owner perceptions of equine health amongst members of two Australian Pony Clubs support this notion. Qualitative interviews were performed with 32 families and revealed that 37% had no prior equine experience when they joined the club. Although a direct comparison between owner knowledge and the health of their horse was not conducted, Buckley *et al*. (2004) suggested that limited experience could have implications on the level of care these horses received. Conversely, 'traditional' horse owners may be less likely to adopt new approaches which also has the potential to negatively impact equine welfare. For example, they may be more inclined to try lay treatments, such as feeding a bran mash, for the treatment of colic before calling for a vet (Scantlebury *et al*., 2014). In both cases veterinary assessment, and subsequent treatment, is delayed therefore increasing the risks to the horse.

Though the majority of owners will seek veterinary advice on issues relating to equine health some will often only contact their vet as ‘a last resort’ (Buckley *et al*., 2004, Hockenhull and Creighton, 2013, Scantlebury *et al*., 2014). Additionally, less experienced owners will often seek advice from those they perceive as ‘mentors’ first rather than a veterinary practitioner (Buckley *et al*., 2004, Scantlebury *et al*., 2014). This may be due to a number of factors including the perceived expensive of a veterinary assessment and subsequent treatment (Buckley *et al*., 2004). However, others have implied that the vast array of information freely accessible on the internet may be having a negative effect upon the relationship between owner and vet (Kogan, 2010).

Disease prevalence and management strategies have often been the focus of many owner based studies, yet insights into an owner’s ability to identify signs of illness are limited. For instance, although it has been reported that owners are more likely to request a veterinary visit for an episode of colic (Ireland *et al*., 2011a), little is known about what clinical signs are being recognised.

As early recognition is vital Bowden *et al*., (2020) investigated horse owner knowledge and experience of colic using a survey based approach. A total of 1061 UK horse owners responded with the authors concluding that owner knowledge is limited with many taking a varied approach to colic management. Surprisingly, although a large proportion of owners (61%) reported that they could recognise most

incidences of colic, many participants had limited knowledge relating to basic health parameters.

An under-reporting of disease by horse owners has been highlighted by Ireland *et al*., (2012) in a study focusing on owners of geriatric horses within the UK. Clinical examinations were performed on 200 horses and the findings were compared with owner-reported signs and ailments recorded prior to each assessment. Results revealed that a high proportion of conditions, such as dental and hoof abnormalities, were being under-reported by owners. This is concerning given those directly involved in the day to day care of horses are most likely to notice slight indicators of disease. This evidence highlights the need for further owner education, especially in regard to colic, where survival may rely to some extent on the owner's ability to recognise a potential emergency and respond accordingly. However, the ability to positively influence behavioural change can be fraught with difficulties, with potential barriers often being associated within the target population itself.

2.2 Changing human behaviour: what, why and how?

2.2.1 A brief history of behaviour change

For millennia, controlling human behaviour has been at the forefront of humanity. From the hunter-gatherer societies of the early Neanderthals to the warring factions of 11th century England, early methods of control were based on violence (Blair, 2003, Pinker, 2011). Thankfully, the

majority of modern societies have moved away from state brutality as a means of subject control. Instead, desirable behaviour is now promoted through education or the advertisement of appropriate social etiquette. Additionally, explicit regulations and guidelines (supported by law enforcement) are frequently implemented to minimise undesirable actions, such as theft or speeding (Marteau *et al*., 2015).

To successfully elicit change, interventions must be based on an intricate knowledge of human behaviour and its determinants (Michie, 2014, Michie and Prestwich, 2010). Therefore, many techniques implemented by societal leads are based on evidence generated by behavioural scientists. Whilst early studies focused primarily on *understanding* human behaviour, work published by Sigmund Freud and colleagues in the early 20th century led to increasing interest in the ability to *change* behaviour (Figure 2-7)**.**

Following this rise in popularity, scientists began to challenge existing philosophical beliefs, which many argued focused solely on the influence of internal factors, such as feelings or individual personality traits, on human behaviour (Chatterton, 2016). Subsequent work published by American psychologist B. F. Skinner between 1940 and 1960 highlighted the significant effect an individual's environment had on their behaviour (Skinner, 1948, Skinner, 1969, Skinner, 1957, Skinner, 1965). Skinner suggested that, *'Almost all major problems involve human behaviour…*,' (Skinner, 1971),

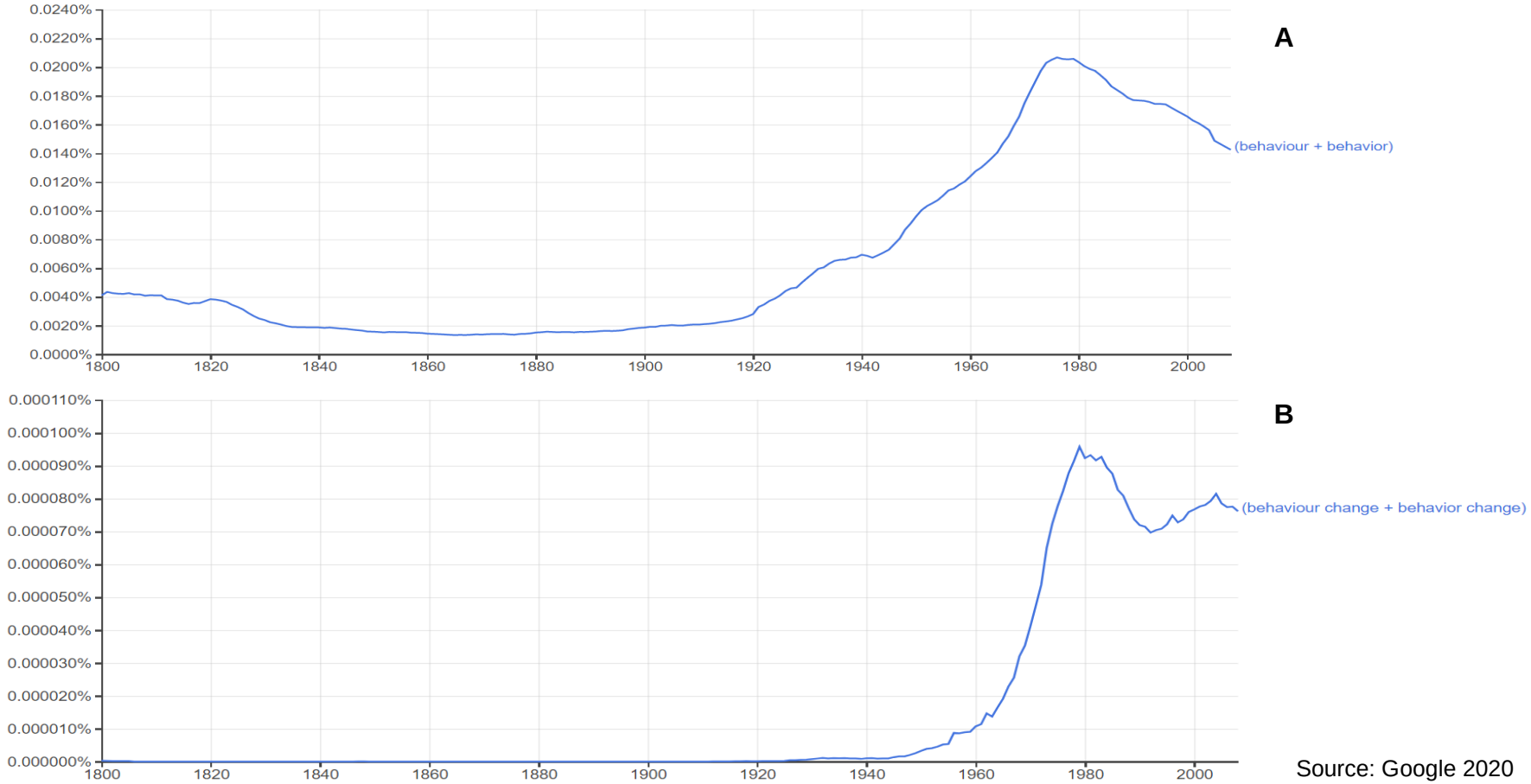


Figure 2-7: Graphs created using Google Ngram viewer indicating the popularity / use of the terms A) behaviour and B) behaviour change in books using the English language between 1800 and 2008.

with much of his research focusing on how behaviour could be manipulated through environmental adaptation (e.g. verbal and visual cues). This research was pivotal in opening up the field of behavioural sciences to contest the role of both individual factors, such as personal attitudes and beliefs, and social-ecological systems in human behaviour change (Figure 2-8) (Chatterton, 2016). This consequently led to an increase in the development of behavioural models or 'theories', many of which underpin our current understanding of human behaviour and interventions designed to elicit change.

2.2.2 Theories of behaviour

The term 'theory' can be defined in many ways, but is described in the Oxford English dictionary as:

"Theory, noun (pl. theories) -

1) *A formal set of ideas that is intended to explain why something happens or exists.*
2) *The principles on which a particular subject is based.*
3) *An opinion or idea that someone believes is true but that is not proved."*

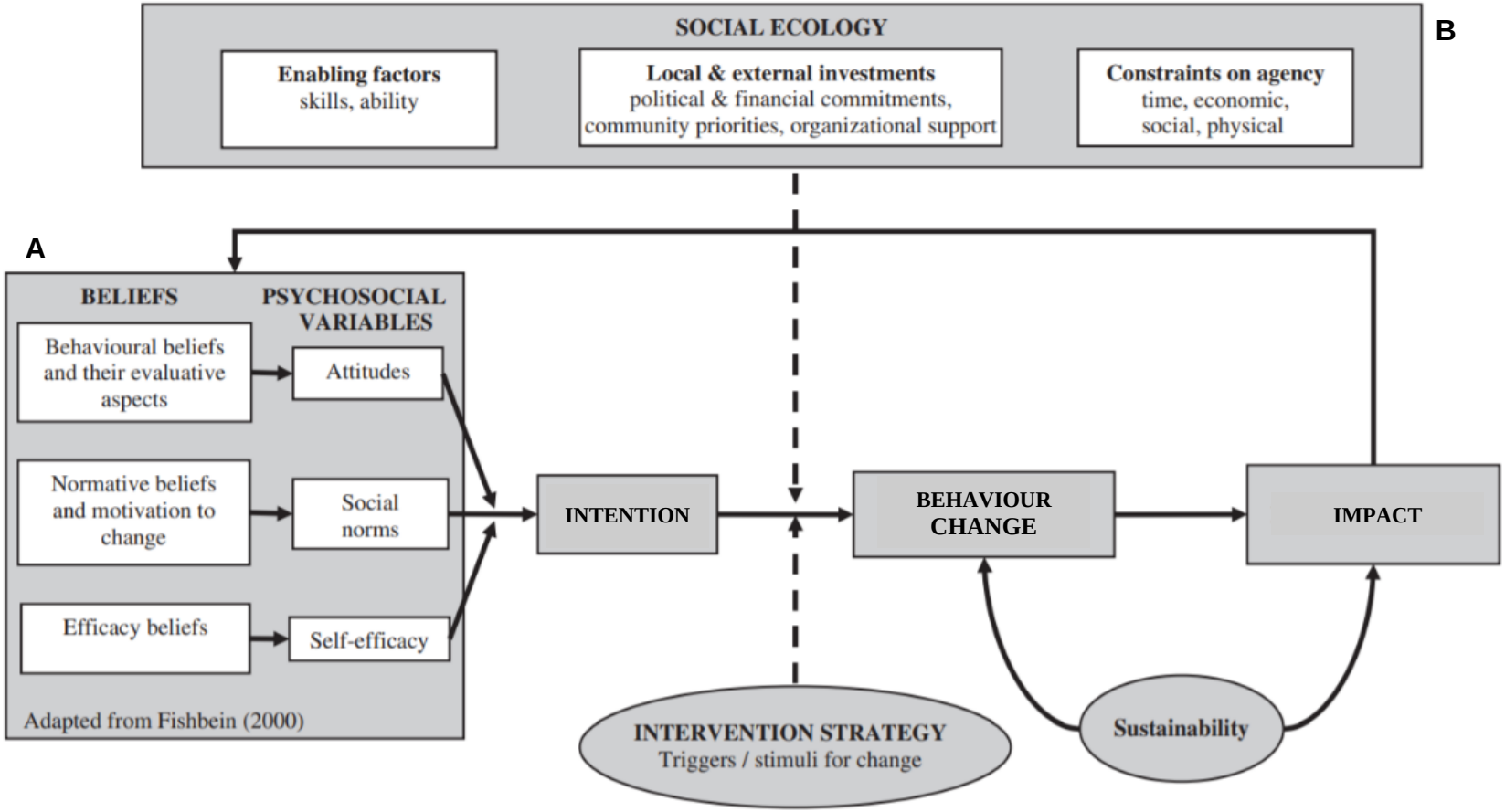


Figure 2-8: The 'social ecology model of behaviour change' which describes the importance of both individual (A) and environmental (B) influences on a person's intention to change their behaviour. Reproduced from Panter-Brick et al. (2006).

In behavioural science, theories are used to explain when, why and how a behaviour occurs. They also seek to identify reasons for non-compliance and sources of influence that can be targeted in order to elicit a desired behavioural change (Michie *et al*., 2014). Although many have yet to be scientifically verified or tested in 'real-world' situations (Gigerenzer, 2010), it is generally accepted that theories do not need to be proven so long as they stimulate the development of new ideas or frames of reference (Blumer, 1986).As a result, there are currently over 80 published theories of behaviour (Appendix II), exploring concepts such as consumer decision-making (Bagozzi, 2000, Olander and ThØgersen, 1995, Spaargaren, 2003), the impact of social influence (Miller and Dollard, 1941, Perkins and Berkowitz, 1986, Vries and Mudde, 1998) and health-protective behaviours (Catania *et al*., 1990, Flay and Petraitis, 1994, Rogers, 1975). In addition, there are several 'models' of behaviour, which describe key factors that can determine whether or not a behaviour is performed (Ajzen, 1991b, Ajzen and Fishbein, 1979, Bandura, 1977, Deci and Ryan, 2012, Fishbein and Ajzen, 1977, Fishbein and Ajzen, 1980, Michie *et al*., 2011, Prochaska *et al*., 1998, Rogers, 1975, Rogers and Prentice-Dunn, 1997, Rosenstock, 1966, Rosenstock, 1960, Rosenstock *et al*., 1988). Classic examples that remain hugely influential today include Fishbein and Ajzen's Expectancy-Value Model (EVM) (Fishbein and Ajzen, 1977) and Theory Of Reasoned Action (TRA) (Ajzen and Fishbein, 1979,

Fishbein and Ajzen, 1980), as well as Ajzen's Theory Of Planned Behaviour (TPB) (Ajzen, 1991b).

The EVM posits that people are primarily goal orientated and will only perform a behaviour if they deem it to be of value and in line with their personal beliefs (Figure 2-9). However, the authors identified that although one may have every intention to behave in a certain way, people frequently fall short of planned actions. Therefore, the TRA was developed to address what is commonly referred to as the 'value-action gap' (Chatterton, 2016). Based on the notion that behaviour is a direct consequence of intention, the TRA suggests that intent is shaped by both personal attitude (as defined by the EVM) and subjective norms (perceived social pressure to perform a behaviour) (Figure 2.9). This concept was further developed by Ajzen during the early 1990's, who acknowledged that additional constraints, such as time, money, or practical skill, can have a huge bearing on a person's intention to adopt a new behaviour. Therefore, the TPB suggests that people who believe that they can change (*perceived* behavioural control) are more likely to succeed (Figure 2-10). Although early theories tended to focus on intra-personal determinants of behaviour, modern theories have begun to acknowledge the role of social and environmental factors when seeking to influence change. For instance, the COM-B model (Figure 2-11) (Michie *et al*., 2011) proposes that both internal and external factors should be equally considered when evaluating a potential change in behaviour.

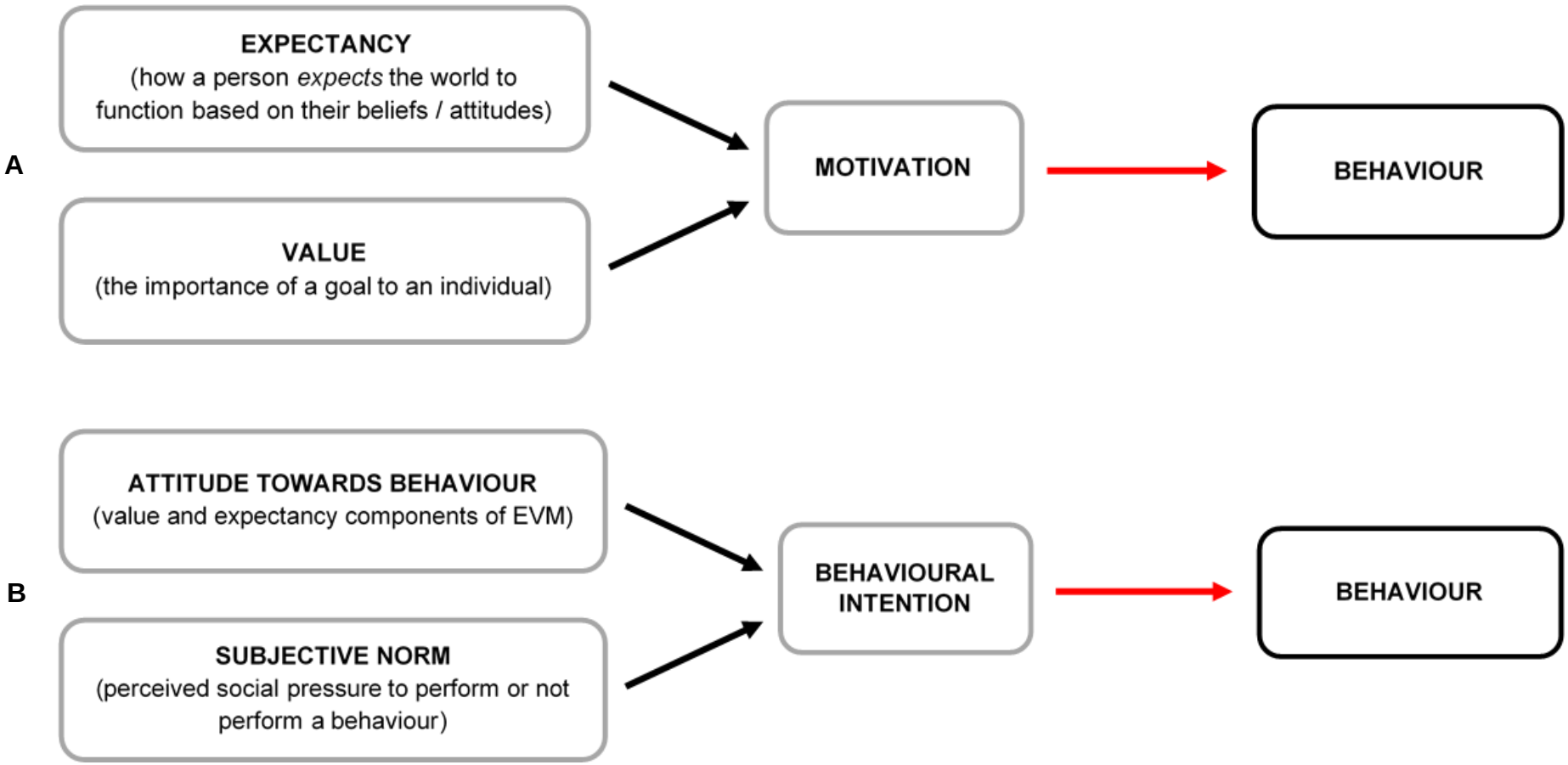


Figure 2-9: The A) Expectancy-Value Model and B) Theory of Reasoned Action as described by Ajzen and Fishbein. Both models describe how behaviour is dependent on personal motivation, which in turn depends on various social and intra-personal factors. Reproduced from (Ajzen and Fishbein, 1979, Fishbein and Ajzen, 1977)

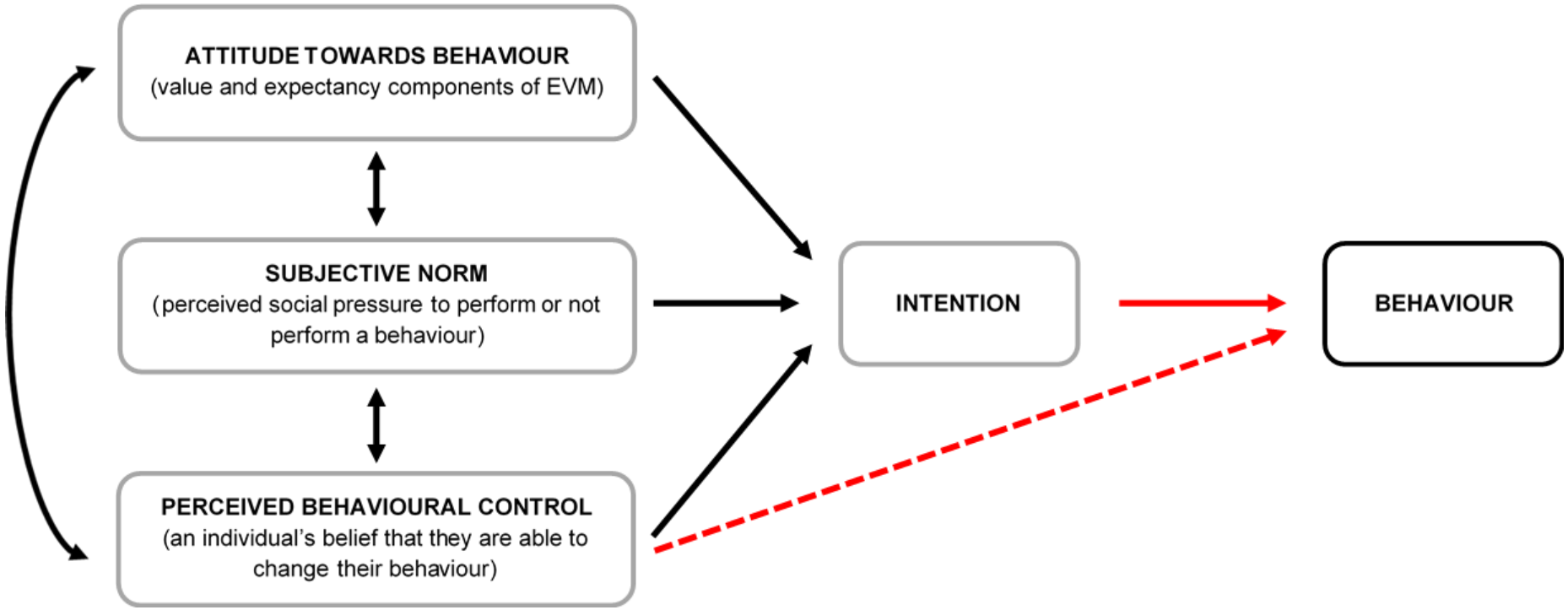


Figure 2-10: The Theory of Planned Behaviour as described by Ajzen (1991b).

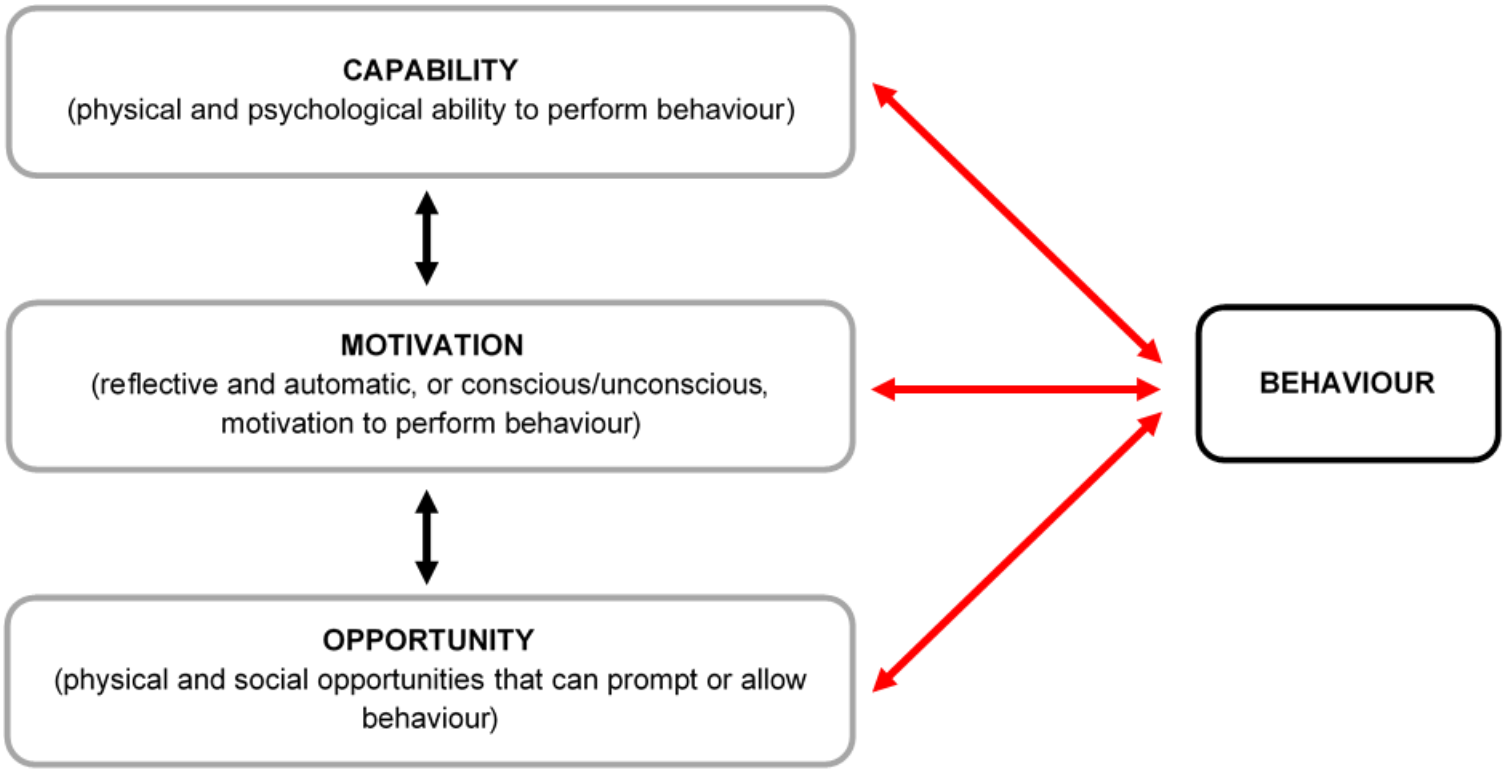


Figure 2-11: The COM-B model as describe by Michie et al. (2011).

As a result, no single priority is placed on either the individual or social / environmental viewpoint.

In addition to a shift in theoretical perspective, the application of theory when designing behavioural change interventions is becoming more commonplace. Theoretical concepts can provide a framework for assessing which underlying behaviour should be targeted in order to elicit the desired outcome (Michie *et al*., 2014). However, the vast array of published theories can make the selection of an appropriate construct challenging. For example, a review of over 200 guideline and implementation studies indicated that only 22% had used behaviour change theories, with 4% providing no rationale for use (Davies *et al*., 2010). Additionally, many interventions are often designed based on several, overlapping constructs, which can make identifying the key behavioural issue difficult (Cane *et al*., 2012, Nigg *et al*., 2002, Weinstein, 1993). To assist intervention designers, the Theoretical Domains Framework (TDF) was developed to make theory more accessible for all disciplines (Atkins *et al*., 2017, Michie *et al*., 2005). As a result, the authors synthesised 33 theories and 128 key constructs into 12 theoretical domains, which can be explored via interviews or focus groups in order to identify target behaviour. This framework has been primarily used by healthcare systems to identify barriers and influencers of guideline use (Amemori *et al*., 2011, Dyson *et al*., 2011, Francis *et al*., 2009a, Francis *et al*., 2009b, French *et al*., 2012, McKenzie *et al*., 2010, Michie *et al*., 2007). More recently, the TDF was

validated as a key method for selecting the most appropriate theory during intervention design (Cane *et al*., 2012) however, it must be noted that the use of theory alone cannot guarantee intervention success. Therefore, developers must ensure that the most appropriate and effective *type* of intervention is chosen in order to prompt change.

2.2.3 Interventions for change

Behaviour change interventions, recently defined as, *'… coordinated sets of activities designed to change specified behavioural patterns'* (Michie *et al*., 2011), are used to promote desirable activities and address key social issues. However, designing and implementing an effective intervention is a complex and challenging process (Denford *et al*., 2016). Despite there being a plethora of seemingly successful behaviour change projects (Grimshaw *et al*., 2002), many more have failed to produce anticipated results (Coleman, 2010, Summerbell *et al*., 2005). Reasons for failure include ineffective use of behavioural theories (Davies *et al*., 2010, Michie *et al*., 2009), lack of a systematic approach to intervention design (Michie *et al*., 2011) and an insufficient understanding of target behaviours (Johnston and Dixon, 2008). In response to these concerns, several frameworks have been published to guide developers from intervention conception to evaluation. These include models to elicit cultural changes (Knott *et al*., 2008), increase the impact of research (Walter *et al*., 2003) and reduce the frequency of workplace injuries (Geller *et al*., 1990). Furthermore, tools such as

AGREE (Brouwers *et al*., 2010, Brouwers *et al*., 2012) and MINDSPACE (Dolan *et al*., 2010) are available to policymakers wishing to successfully implement evidence-based guidelines.

Frameworks of note include Intervention Mapping (IM) (Bartholomew Eldredge *et al*., 2016) and the recently developed Behaviour Change Wheel (BCW) (Michie *et al*., 2011), both of which provide a systematic and detailed approach to intervention design. IM provides developers with a six stage 'map', starting with a needs assessment of the problem ('logic model') and ending with a thorough evaluation of intervention success (Figure 2-12). IM is an iterative process and designers are encouraged to constantly review each stage in order to maximise intervention effect.

In contrast, the BCW represents the synthesis of 19 frameworks identified during a systematic review of published literature (Michie *et al*., 2011). Centred around the COM-B model of behaviour , the remaining two layers of the BCW represent various interventions and supporting policies that can be chosen depending on the target behaviour (Figure 2-13) (Michie, 2014). However, although BCW provides a method of intervention design, it does not provide guidance on how to evaluate interventions once they have been implemented.

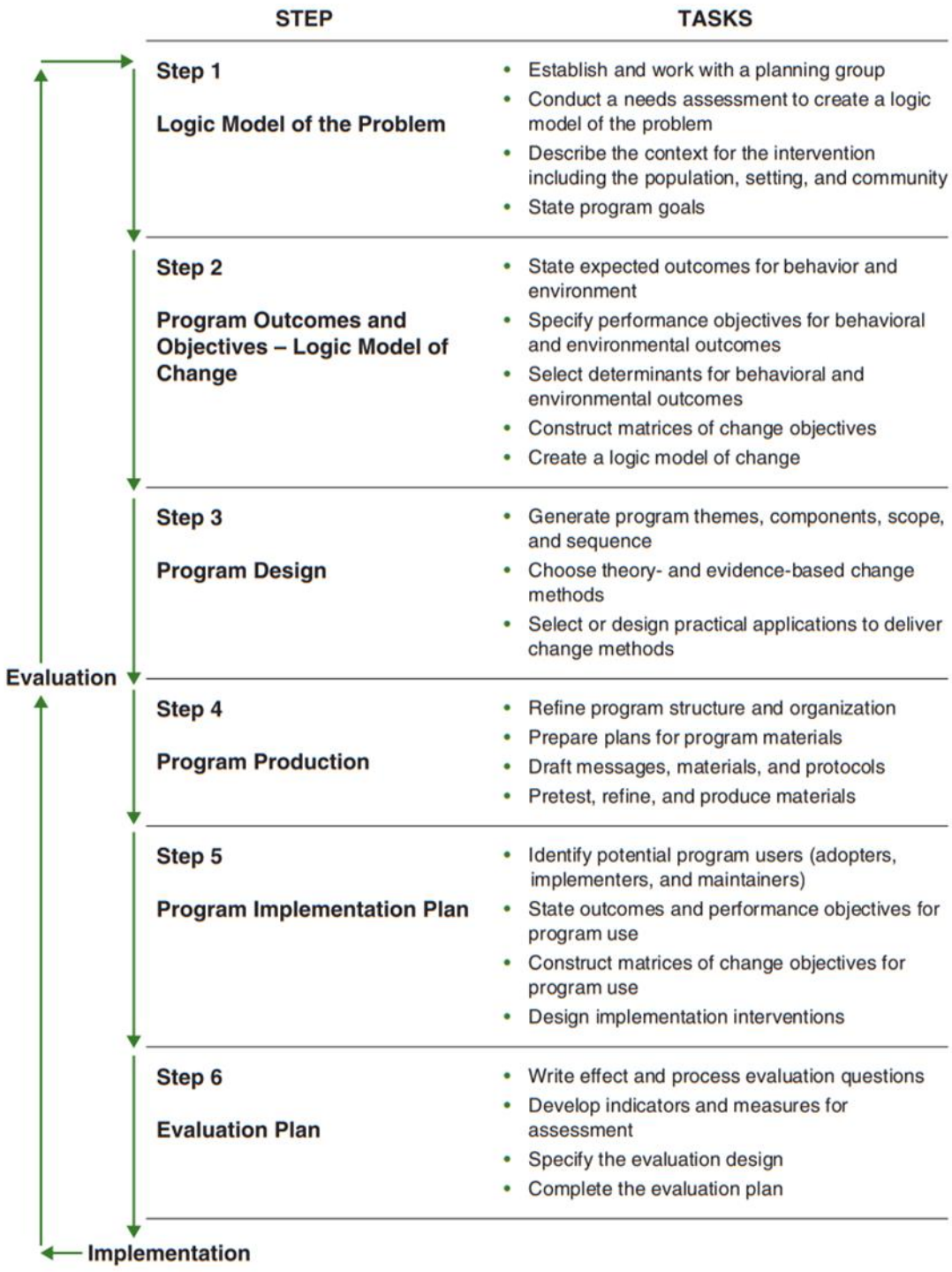


Figure 2-12: The six steps of Intervention Mapping. Reproduced from Bartholomew Eldredge et al. (2016)

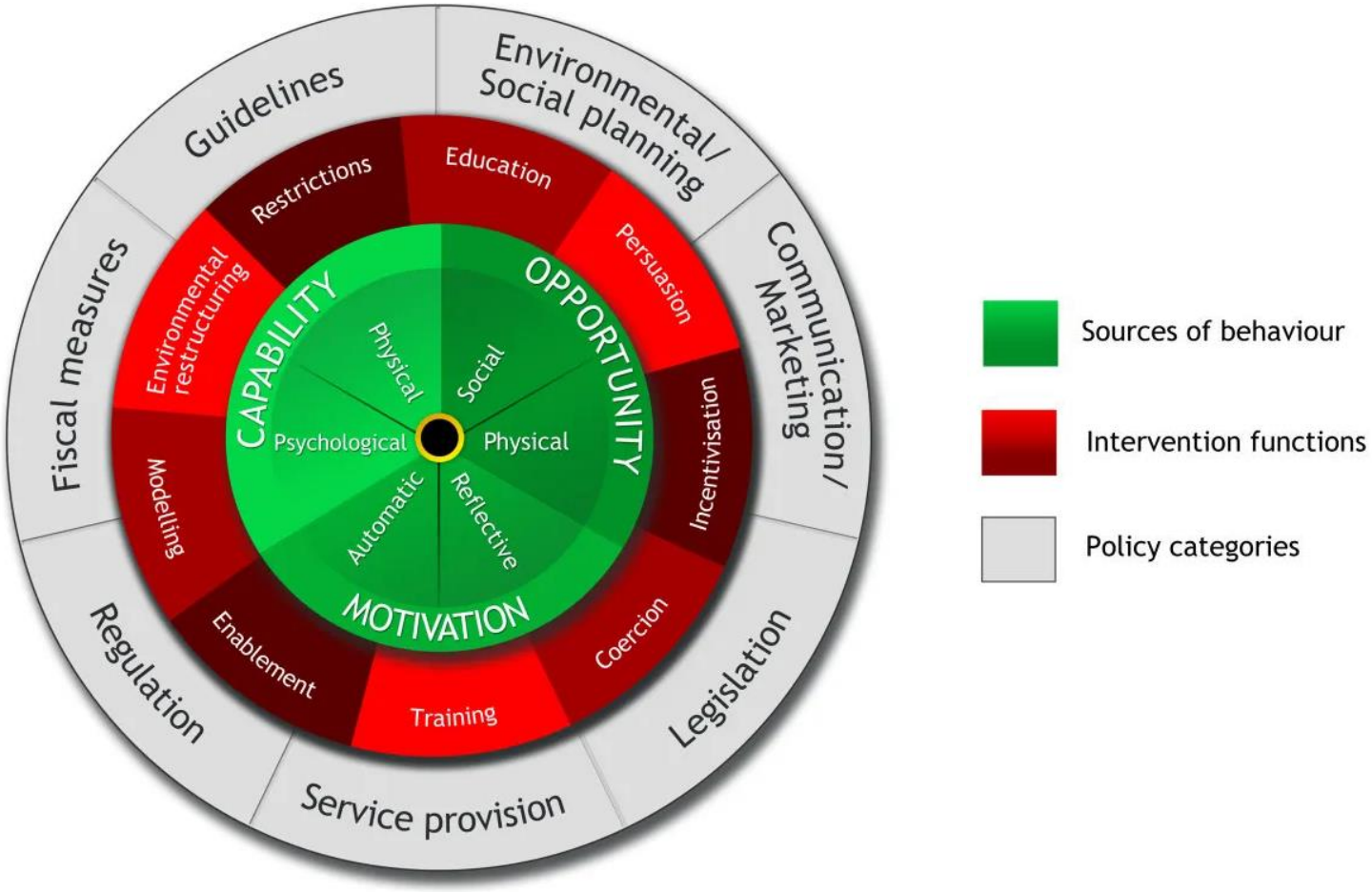


Figure 2-13: The Behaviour Change Wheel. Reproduced from Michie et al. (2011)

A common theme in the majority of frameworks is the importance of stakeholder involvement during intervention design, implementation and evaluation (Israel *et al*., 2017, Krieger *et al*., 2002, Minkler, 2004, Minkler, 2005, Minkler *et al*., 2002, Wallerstein and Duran, 2006, Yoo *et al*., 2004). Inclusivity at both an individual and community level is thought to ensure programs resonate with those being targeted (Israel *et al*., 2017). Furthermore, broad participation brings a greater set of skills and expertise to intervention design, which will improve validity and community acceptance (Green and Mercer, 2001, Israel *et al*., 2017). Participatory action and partnership principles should be applied during intervention development to facilitate stakeholder involvement (Belansky *et al*., 2011, Horn *et al*., 2008, Israel *et al*., 2001, Israel *et al*., 1998, Israel *et al*., 2017). In addition to including the target population in all stages of design, developers must ensure that the intervention they have chosen targets the correct regulatory mechanism in order to elicit change.

2.2.4 Targeting regulatory processes

It is now theorised that the disparity between intent and action ('value-action gap') is the result of two internal models by which human behaviour is governed (Strack and Deutsch, 2004). Interventions designed to elicit change must ensure that the correct mechanism of behaviour is being targeted (Denford *et al*., 2016).

The ‘automatic’ system makes rapid, unconscious decisions based on environmental cues or internal processes (Strack and Deutsch, 2004). For example, an automatic response to hunger would be to seek out nourishment, whereas observing a traffic light turn from green to red would causes us to stop our vehicle. Retailers, policy makers, and more recently public health specialists, frequently seek to alter behaviour by targeting our automatic thinking (Beaglehole and Horton, 2010, Marteau *et al*., 2011). For instance, accepted social practices such as standing to the right side of an escalator to allow others to pass on the left is often encouraged by the placement of visual cues within the environment (Figure 2-14).



Figure 2-14: The use of visual cues strategically placed within our environment is just one example of ‘nudge theory’ being used to encourage desirable behaviour.

Such methods are commonly referred to as ‘nudge theory’, a concept that draws on both behavioural economics and social psychology (Thaler and Sunstein, 2008), and dates back to over a century (Durkheim and Suicide, 1952, Ross and Berkowitz, 1977, Thorndike, 2013). Although many have reported successful outcomes when using nudge theory to promote such behaviours as healthy eating (Just and Wansink, 2009) and a reduction in alcohol consumption (Moreira *et al*., 2009), long-term evaluations of interventions utilising this approach have not yet been conducted (Marteau *et al*., 2011). Nevertheless, a growing interest in influencing behaviour through policy change has been observed over the past 20 years (Fletcher-Morgan and Leyland, 2010). Consequently, this has seen nudge theory adopted by the UK government and the formation of the Behavioural Insights Team (BIT), to tackle complex challenges such as obesity and climate change (Hallsworth and Sanders, 2016).

In contrast to automatic thinking, the goal-orientated ‘reflective’ system is primarily driven by human values and intent. Being the rational part of human cognition, the reflective system critically processes external information before making a deliberate and weighted judgement (Kelly, 2016). As a result, modern approaches to changing health-related behaviours seek to engage this system through the provision of knowledge, most frequently through the use of public awareness campaigns.

2.2.5 Use of campaigns

Campaigns aim to raise awareness of select issues and elicit a positive change in behaviour (Coffman, 2002). Utilised by a multitude of professions, this method can be an effective way of targeting specific populations, both human and animal, in order to improve health and welfare. Behaviour may, for example, refer to an increased use of evidence-based medicine by veterinary practitioners, or it may be related to a change in how horse owners perceive changes in their horse's general health.

Campaigns are widely used within human medicine to increase recognition of potential indicators of serious disease. The 'HeadSmart: Be Brain Tumour Aware' campaign, for instance, is focused upon reducing the total diagnostic interval (TDI) of childhood brain tumours by increasing public awareness of symptoms (Walker *et al*., 2015). Conversely, the use of campaigns within the veterinary industry is often aimed at encouraging owners to use prophylactic treatments to protect their animals. A prime example being the 'Act Against Lungworm' initiative, launched by Bayer Animal Health in 2012.

A number of techniques have been employed by campaigners to ensure the 'message' of the intervention is received by the target audience. Mass media coverage, such as the use of television and radio advertising, has been heavily featured within many stroke awareness campaigns for example (Hodgson *et al*., 2009, Lecouturier

et al., 2010). Social media, including networking platforms such as Facebook and Twitter, has also become a powerful and valued communication tool (Tunnecliff *et al*., 2015). The ability of social media to reach a variety of audiences unhindered by demographic location or socioeconomic status has resulted in increased use within the medical profession. Additionally, the capability to facilitate discussion and feedback without the need for face to face meetings highlights its convenient and accessible nature (Tunnecliff *et al*., 2015). A prime example of social media use is the 'HeadSmart' campaign which effectively used this medium to disseminate information to a wide range of stakeholders including GP's, schools and local authorities (Walker *et al*., 2015).

'Fear' and the use of hard-hitting imagery or metaphors are often incorporated into campaigns (Peters *et al*., 2013). It is applied by many in the hope of eliciting a fear induced behavioural change, however many studies suggest the use of this method produces limited or even detrimental effects (Peters *et al*., 2013, Ruiter *et al*., 2001, Witte and Allen, 2000). In light of these findings, it could be suggested that campaigns must ensure focus is upon the desired behavioural change, i.e. calling emergency services, rather than the consequences of a disease or issue.

To encourage audience engagement campaigners often use models that the target population can easily identify with. To incite those with potential symptoms of cancer to seek advice from their general

practitioner (GP), images of friendly and ‘normal’ GP’s were a predominant feature of the ‘Be Clear On Cancer Campaign’ (Power and Wardle, 2015). Campaigners hoped that the use of such images, alongside messages such as ‘just tell me’, would depict GP’s as ‘approachable’. However, despite the use of such strategies, reluctance to visit GP’s is still reported as a major barrier to cancer diagnosis and treatment (Power and Wardle, 2015, Smith *et al*., 2016). A unique and alternative approach employed by ‘HeadSmart’ was the recruitment of community and clinical ‘champions’ (Walker *et al*., 2015). These individuals were seen as the ‘voice’ of the campaign and assisted in raising awareness of the campaign within their local area and various medical centres throughout the UK.

Yet, despite the importance of behavioural change on improved health outcomes, many suggested interventions fail to elicit the desired effect. For instance, during a systematic review of current literature Summerbell *et al*., (2005) concluded that despite a plethora of methods being employed to tackle childhood obesity, no significant impact on weight status has been achieved. Some may argue that these shortcomings are the fault of the policy makers themselves taking an un-scientific approach to change views (Kelly and Barker, 2016). Conversely others suggest factors such as an individual’s motivation to modify their behaviour can influence the success of an intervention (Cane *et al*., 2012, Grol and Grimshaw, 2003).

Therefore, when developing interventions, one must consider basic concepts that can influence success. Firstly, behavioural change is not simply the result of the 'message' being successfully conveyed to the target audience. This view is highlighted by results published from a recent evaluation of a national stroke awareness campaign ('Act FAST'). Dombrowski *et al*., (2015) suggested that although awareness of the mass media campaign, and the central acronym 'FAST', had some apparent impact upon stroke recognition, the desired change in response behaviour to symptoms was low. Additionally, simply providing the information or knowledge required to elicit change does not necessarily mean the desired change will occur (Kelly and Barker, 2016). In 2015 a review by Power and Wardle investigated the impact of the 'Be Clear on Cancer' campaign on public recognition of potential signs of cancer and subsequent help-seeking behaviour. Study outcomes indicated a significant increase in the recognition of signs, such as a 'persistent cough', as being potential indicators of cancer. However, the authors suggested that despite the provision of knowledge, through a variety of channels including TV advertising and information booklets, reluctance to seek further advice was still present. These studies suggest that potential barriers to behaviour change must be considered when devising potential campaign strategies. These may include the method of dissemination or even the acknowledgement that what may be considered rational to some may be deemed irrational by others (Kelly, 2016).

However, despite these concerns and the multitude of methods employed, few have investigated campaign success. The importance of campaign assessment has been highlighted by a small number of studies reporting the impact of movements aimed at raising disease symptom awareness in humans. Results indicate only short-term impact upon recall and knowledge of potential disease indicators and limited effect upon response behaviour (Dombrowski *et al*., 2013, Hodgson *et al*., 2009, Lecouturier *et al*., 2010, Power and Wardle, 2015). Assessing the impact of campaigns can draw attention to potential barriers which may have been missed. Given that eliciting behavioural change is critical to campaign success, careful consideration should be given to the target audience and associated barriers (Kelly and Barker, 2016, Slater, 1999).

2.2.6 The 'REACT Now to Beat Colic' campaign

The Nottingham Equine Colic project was established in 2012 in order to facilitate initial PhD research at the University of Nottingham's School of Veterinary Medicine and Science (Issaoui, 2012). Colic is a major cause of morbidity and mortality in the equine population (Tinker *et al*., 1997a, Traub-Dargatz *et al*., 2001) and the project aimed to develop evidence-based resources to aid in the early recognition and diagnosis of abdominal pain in the horse (Figure 2-15).

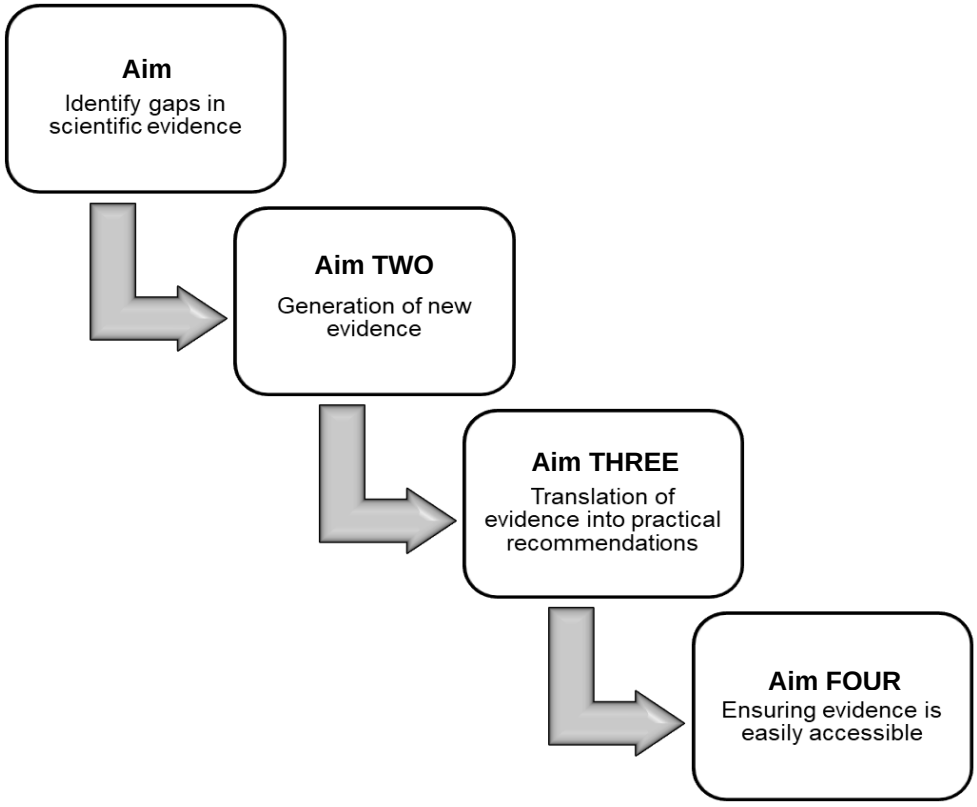


Figure 2-15: The four main aims of the Nottingham Equine Colic Project

An evidence-based approach has been growing in popularity within the veterinary profession. Initial research involved systematic reviews of current literature and identified a lack of evidence around diagnostic approach and a bias towards referral-hospital populations (Curtis *et al*., 2019, Curtis *et al*., 2015). Subsequent studies concentrated upon generating new evidence on primary recognition and assessment of equine colic. Results from this research were used to develop evidence-based guidelines and resources to assist with colic recognition and diagnosis (Wild *et al*., 2017b, Yeoman *et al*., 2017). In line with AGREE tool recommendations primary stakeholders including first opinion veterinary practitioners (Bowden *et al*., 2017, Curtis *et al*., 2015, Jennings *et al*., 2014) and horse owners (Bowden *et al*., 2020,

Bowden *et al*., 2019) were engaged during guideline development. Barriers that could potentially affect knowledge transfer (Wild *et al*., 2017a), as well as, potential methods of information dissemination were investigated.

As a result of this work, the ‘REACT to beat colic’ campaign was launched in September 2016 by the British Horse Society (BHS), in association with the University of Nottingham (Bowden *et al*., 2017). The campaign has been designed to increase awareness of abdominal pain and encourage a proactive approach to colic management by horse owners. Current levels of owner knowledge, and potential areas for resource development, were initially identified using an online survey (Bowden *et al*., 2020). The most common signs of colic were established through two multidisciplinary workshops (88 participants) and online surveys (Yeoman *et al*., 2017, Wild *et al*., 2017b). Statements which ranked highest at the conclusion of the consensus process were used to form the basis of the campaign. Targeted at increasing colic recognition, the ‘REACT’ clock acronym (Figure 2-16) is central to the campaign. Clinical signs depicted upon the clock face represent the most common and important signs of colic based upon evidence generated by the project (Bowden *et al*., 2020, Wild *et al*., 2017b, Yeoman *et al*., 2017). Areas in which limited knowledge was identified were targeted through educational leaflets for horse owners (Burford *et al*., 2017, Bowden *et al*., 2020).

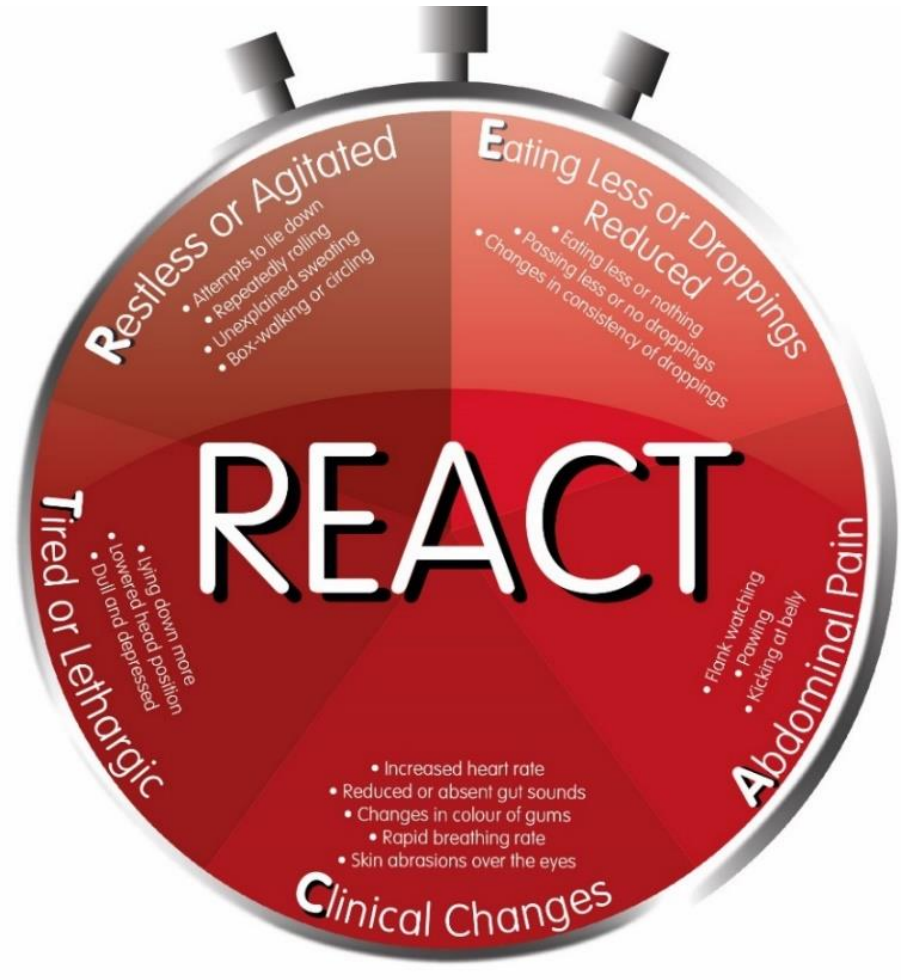


Figure 2-16: The 'REACT' clock depicts the five most common signs of equine colic

Information included within the leaflets was based upon systematic reviews and additional research by the research team (Curtis *et al*., 2015, Jennings *et al*., 2014) and existing epidemiological research (Ireland *et al*., 2011a, Scantlebury *et al*., 2011, Tinker *et al*., 1997a). Specialist contributions from industry experts were also obtained to develop resources on emergency decision-making and the referral process. The campaign and related resources were advertised using a variety of methods including social media, press releases in peer

reviewed publications, specialist talks and distribution at key equestrian events across the UK (Bowden *et al*., 2017).

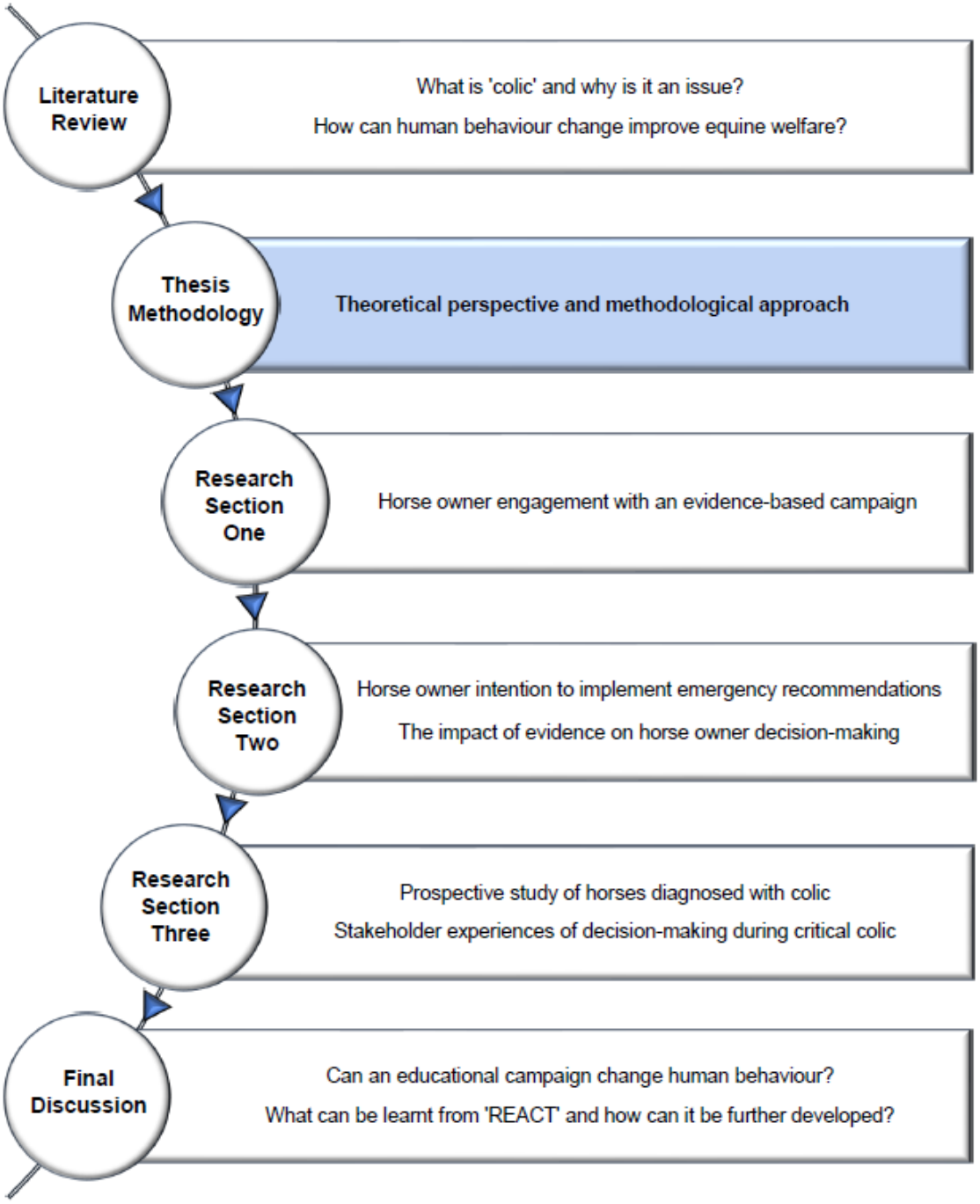
During the first 12 months, over 20,000 hard copies of the owner information packs were distributed by the BHS. Advertisement through social media has allowed open access to additional resources such as the campaigns educational video, which received over 100,000 views. Though these figures are encouraging, campaign awareness and subsequent levels of resource engagement are yet to be determined. Additionally, owner knowledge of 'normal' equine health, and approach to managing a horse with colic, has not been re-evaluated since the launch of the campaign. With a primary emphasis on increasing equine welfare through rapid-decision making in the event that colic occurs, it is essential that the methods employed by the campaign are assessed to ensure the desired behavioural change is being elicited. Therefore, an investigation into horse owner awareness of and engagement with available resources is necessary in order to identify areas of success and those requiring further development.

2.3 Thesis aims and objectives

The main aim of this thesis was to evaluate horse owner knowledge of, and approach to, equine colic in response to the ‘REACT Now to Beat Colic’ campaign. Additionally, this research aimed to identify potential barriers to knowledge transfer and areas for further campaign development. The objectives were to:

- Assess horse owner awareness of the ‘REACT’ campaign and subsequent engagement with educational resources.
- Evaluate current horse owner knowledge associated with ‘normal’ signs of equine health and potential indicators of colic.
- Investigate owner intention to adopt emergency recommendations, as described by the ‘REACT’ campaign.
- Explore the potential influence of scientific knowledge on horse owner decision-making.
- Describe the treatment and outcome of horses diagnosed with colic and reasons associated with end-of-life decision-making.
- Identify contextual factors that may hinder the implementation of the ‘REACT’ campaign and highlight areas for further development.

Chapter 3: Thesis methodology



3.1 Philosophical underpinnings

3.1.1 Ontology and Epistemology

Philosophy provides scientists with a framework in which human reality can be studied and consequently understood (Spirkin, 1983). Failure to recognise the underlying principles that guide theoretical thinking can lead to distorted or limited interpretation of study outcomes (Sievanen *et al*., 2012). Therefore, when selecting the most appropriate study methodology, investigators should strive to acknowledge both the theoretical perspective of the research and their own epistemological and ontological viewpoint (Moon and Blackman, 2014).

'Ontology' refers to an understanding of reality and whether or not an object exists outside of human knowledge and understanding (Braun and Clarke, 2013, Moon and Blackman, 2014). Researchers can adopt one of many ontological positions (Feyerabend, 1985, Johnson and Gray, 2010, Morton, 1996, Spirkin, 1983, Stokes, 1998, Tashakkori and Teddlie, 2010) however, the vast array of standpoints can be described as being a dichotomy between realism and relativism (Figure 3-1). On one side, realist ontology states that only one reality exists and that this 'truth' can be studied and explained using research. Conversely, relativist ontology suggests that reality is a construct of human thought and as such, is dependent on individual experiences (Moon and Blackman, 2014).

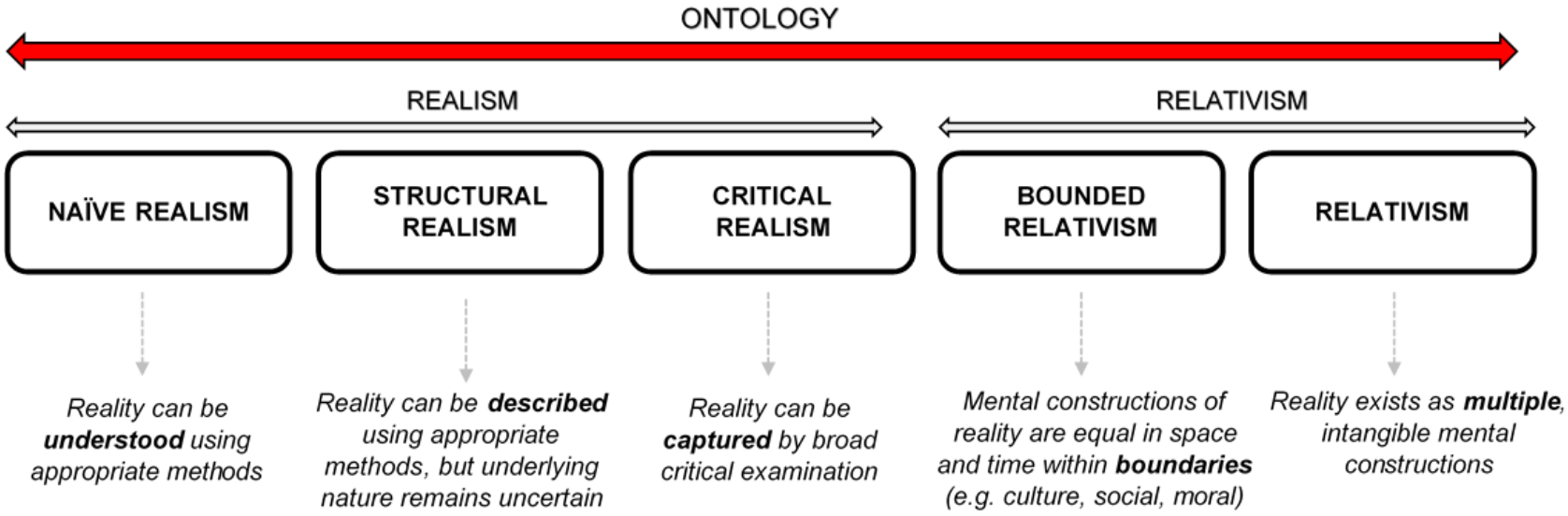


Figure 3-1: The various ontological positions as described by Moon and Blackman (2014)

In contrast, ‘epistemology’ is concerned with how human knowledge is acquired and subsequently validated (Braun and Clarke, 2013, Moon and Blackman, 2014). As with ontology, there are numerous epistemological positions however, they are generally described as being on a continuum between objectivity and subjectivity (Crotty, 1998). For instance, an objectivist standpoint views reality as existing independent of human thought, whereas subjective epistemology views reality as the result of an individual’s perception of the world (Figure 3-2).

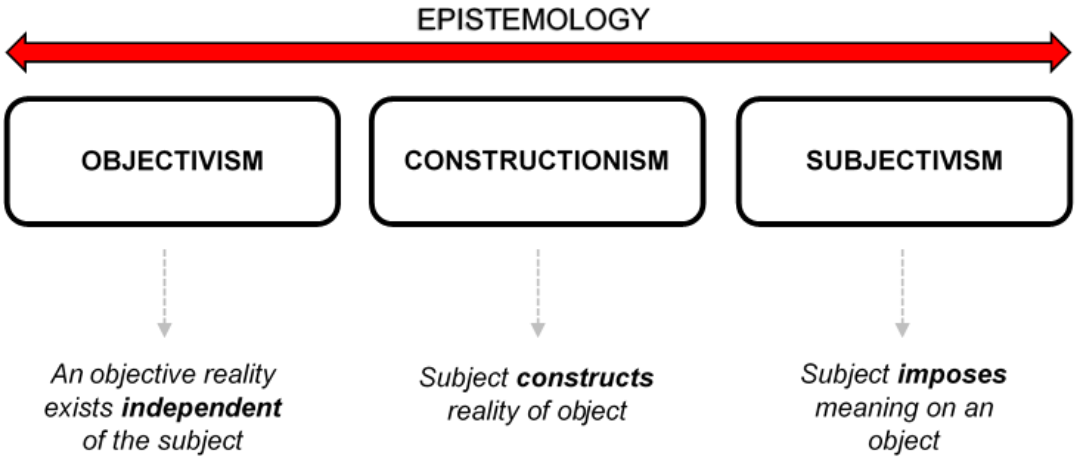


Figure 3-2: The various epistemological positions as described by Moon and Blackman (2014)

Ontological and epistemological viewpoints underpin a scientist's theoretical perspective and ultimately influence the direction and interpretation of research (Moon and Blackman, 2014). Philosophical orientations range from positivism to pragmatism (Figure 3-3) however, it is common for an individual's theoretical perspective to evolve overtime (Moses and Knutsen, 2012). As such, it is widely acknowledged that researchers do not necessarily commit themselves to a single theoretical viewpoint (Biesta, 2010).

3.1.2 Theoretical perspective of thesis

The author of this thesis (KL) recognises their ontological position as primarily being a critical realist. However, they also acknowledge the influence of factors, such as culture, beliefs, and personal experiences, on an individual's perception of reality. As such, their ontological standpoint ultimately lies between critical realism and bounded relativism. Therefore, this thesis has been written using a pragmatic theoretical perspective, in which all appropriate methods (both quantitative and qualitative) will be used in an attempt to understand the research problem.

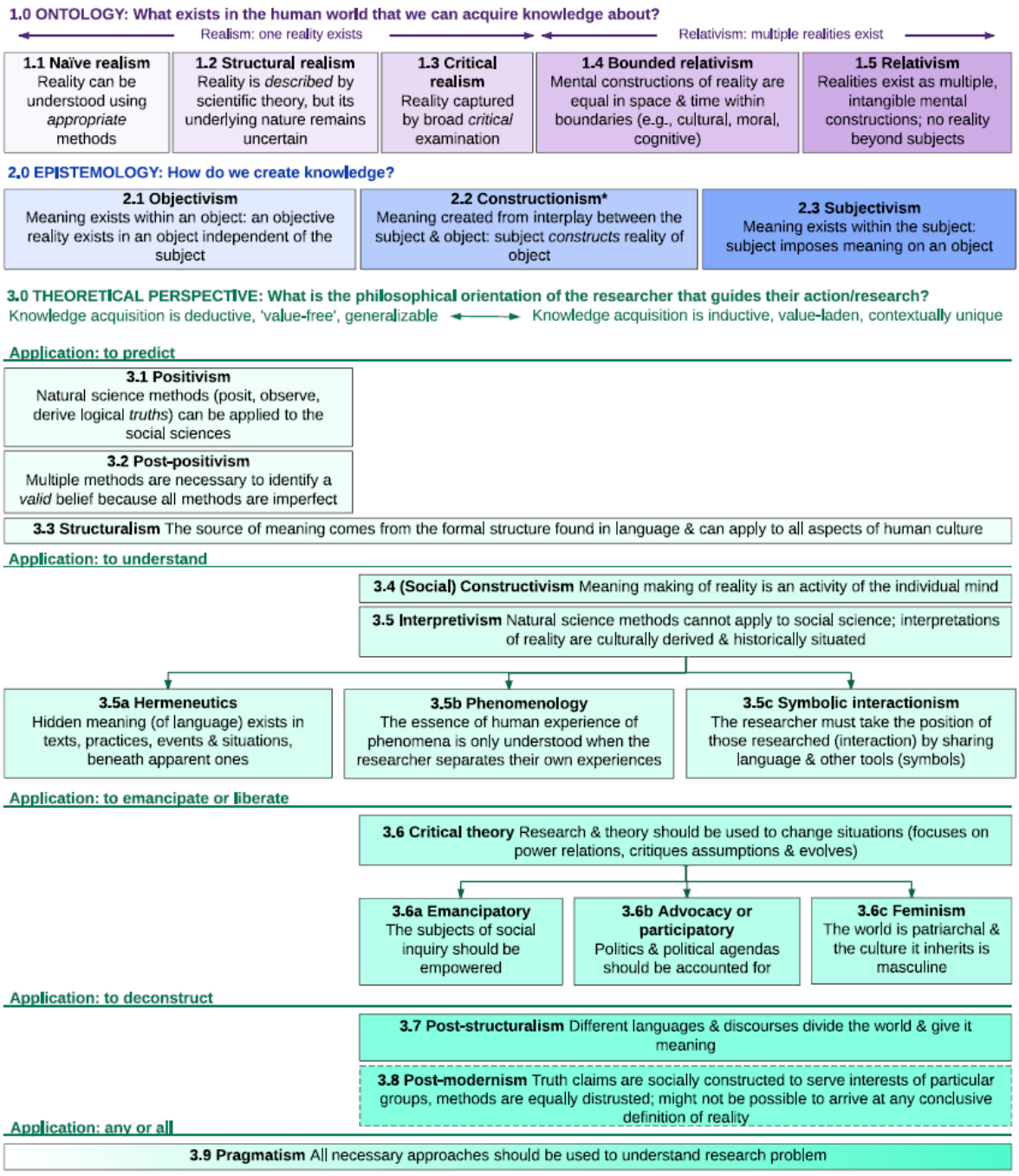


Figure 3-3: The relationship between ontological and epistemological positions and a researcher's subsequent theoretical perspective. Reproduced from (Moon and Blackman, 2014)

3.2 Evaluating intervention success

3.2.1 Methods of evaluation

As previously mentioned in Chapter Two, evaluating interventions is an essential step in ensuring program success. Critical appraisal of an intervention's efficacy (results under controlled conditions) and effectiveness (results in 'real-world' situations) not only adds to the growing body of implementation science (Bartholomew Eldredge *et al*., 2016) but also provides crucial feedback that can be used to maximise a programs impact (Fetterman *et al*., 2017, Patton, 2017). There are currently two main approaches to assessing behaviour change interventions: outcome and process evaluations. The decision on which method to use depends on many factors including how an intervention was designed (Harachi *et al*., 1999, Stame, 2004, Steckler *et al*., 2002), what key information is needed (Steckler *et al*., 2002) and the timeframe available (Bartholomew Eldredge *et al*., 2016).

Outcome evaluations, often referred to as 'impact' or 'effect' assessments, aim to describe differences between those who participated in a program and those who did not (Bartholomew Eldredge *et al*., 2016). Due to the vast number of outcomes that could be measured, the decision on what should be evaluated and how is usually determined during the initial stages of intervention design (Newcomer *et al*., 2015, Rossi *et al*., 2018). This is especially important when seeking to make comparisons between groups, which will have to be recruited and followed in order to obtain valid results. Traditional

methods of measuring program effect include the Randomised Controlled Trial (RCT), which remains the ‘gold-standard’ for assuring the internal validity of intervention design (Akobeng, 2005, Hariton and Locascio, 2018, Kaptchuk, 2001, Meldrum, 2000). However, many have argued that the random assignment of individuals in order to obtain pre- and post-program effects is not always feasible in ‘real world’ situations (Mercer *et al*., 2007, Reeves *et al*., 2013, Sanson-Fisher *et al*., 2007, West *et al*., 2008). As a result, there is growing acceptance amongst scientists regarding the application of ‘quasi-experimental’ designs, such as observational studies with propensity score matching and time series models (West *et al*., 2008), when evaluating public health or educational interventions (Anglemyer *et al*., 2014, El Feky *et al*., 2018, Fletcher *et al*., 2016, Skivington *et al*., 2018). The timeframe in which program effects are expected is also an important consideration when choosing to perform an outcome evaluation. Interventions aimed at eliciting long-term change, such as programs designed to alter behaviour, will need time to develop and would therefore not be suitable for short-term evaluations goals (Bartholomew Eldredge *et al*., 2016).

In contrast, process evaluations are more concerned with *how* an intervention has, or is currently being, implemented (Steckler *et al*., 2002). Utilisation of this method provides crucial feedback that can be used to correct unforeseen problems with delivery (Newcomer *et al*., 2015, Patton, 2017, Rossi *et al*., 2018, Steckler *et al*., 2002) and the

opportunity to reflect on an intervention's current design in order to develop alternative options for future dissemination (Grimshaw *et al*., 2007). Furthermore, process evaluations primarily seek feedback from those within the intervention group (Bartholomew Eldredge *et al*., 2016), information which can be critical in assessing engagement with the target population. Several studies have also warned against so called 'black box evaluations', in which programs are assessed based solely on outcome measures (Harachi *et al*., 1999, Patton, 2017, Stame, 2004). An approach such as this fails to acknowledge process elements of an intervention's design, for example targeted determinants, practical delivery, and subsequent population engagement. As a result, evaluators are provided with little or no insight into factors that may have contributed to a program's success or failure (Bartholomew Eldredge *et al*., 2016, Patton, 2017). In contrast, process evaluations bridge the gap between intervention design and outcome by providing those involved with feedback that can be used to maximise success. According to Steckler *et al*. (2002) there are several key questions that should be considered during a process evaluation:

1. ***Recruitment***: how is the intervention attracting participants?
2. ***Fidelity***: is the intervention being delivered as intended?
3. ***Reach***: what proportion of the target population are aware of the intervention?
4. ***Dose delivered***: how much of the intervention (e.g. resources, information) is being delivered?
5. ***Dose received***: to what extent is the target population engaging with the intervention?

6. ***Context***: what social-ecological components have, or may, affect implementation?

Alternative frameworks for process evaluations include the RE-AIM (Glasgow *et al*., 1999) and Logic (Kaplan and Garrett, 2005) models. However, Morgan-Trimmer (2015) argues that despite the availability of guidance, many evaluation techniques fail to adopt theory as a means of explaining intervention effects. Theory has been shown to provide a clear rationale for choosing one type of intervention design over another, as well as enabling developers to identify key determinants of behaviour in which to target. Additionally, theory can have major implications for validity and reliability, as it can help to determine whether or not an intervention will work in an alternative population (Michie *et al*., 2009). Consequently, it is recommended that process evaluations also have theory-based elements incorporated into their design.

3.2.2 Evaluating the 'REACT Now to Beat Colic' campaign

Considering this evidence, it was decided that a process evaluation of the 'REACT' campaign would be conducted. Furthermore, in addition to assessing the key elements outlined by Steckler *et al*. (2002), theory driven aspects of evaluation would also be included (Figure 3-4). This decision was based on three main factors: time availability, campaign aim and original intervention design.

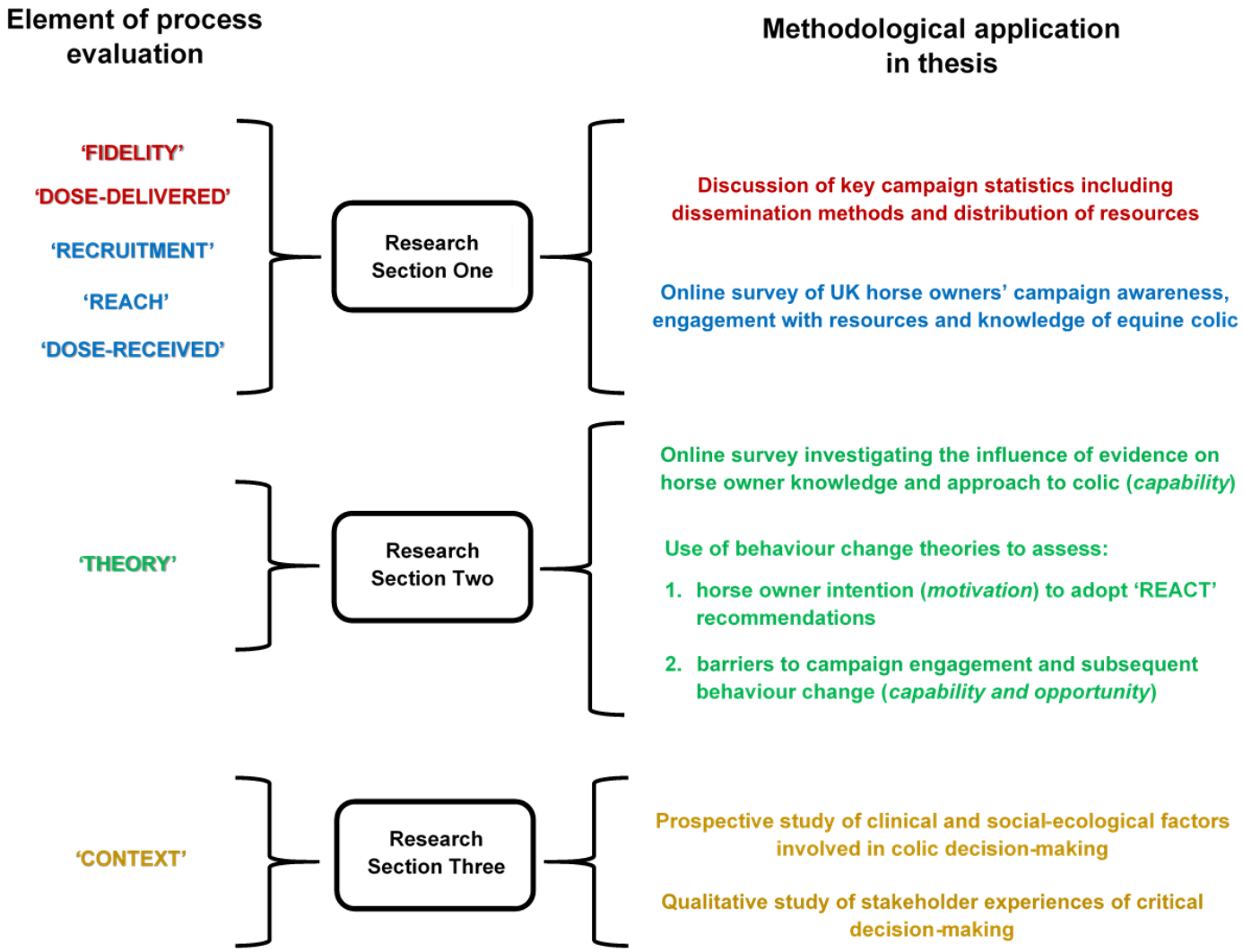


Figure 3-4: Diagram illustrating the process evaluation described within this thesis

The ‘REACT’ campaigns main goal is to encourage horse owners to adopt a proactive approach to colic management through the dissemination of key evidence. As this is intended to be a sustained, long-term change in behaviour, the relative infancy of the intervention (12 months at the time of initial evaluation) does not support an assessment of behavioural outcomes at this stage. Additionally, as the researcher (KL) recruited to evaluate the campaign was not involved in the initial stages of design, this approach allows underlying behavioural mechanisms to be re-assessed (Bartholomew Eldredge *et al*., 2016).

3.3 Mixed-methods research

3.3.1 Qualitative and quantitative methods

The design and execution of a research study frequently depends on whether quantitative or qualitative methods are employed. Though both approaches strive to examine and explain human reality, fundamental differences in aspects such as theoretical stance and data typology can present issues if misunderstood (Neuman, 2013).

Founded on a positivist theoretical perspective, quantitative research uses quantifiable (numerical) data in order to explain phenomena or determine causal inferences (Bowling, 2014, Fowkes and Fulton, 1991, Neuman, 2013). It employs an objective and systematic approach to data collection (Yilmaz, 2013), with methods such as cross-sectional surveys, cohort studies and randomised controlled trials frequently utilised (Hoe and Hoare, 2012). Data analysis is also subject to strict

objectivity, with statistical software packages commonly used to perform complex mathematical calculations (Martin and Bridgmon, 2012).

In contrast, qualitative research is not concerned with numerical variation or significance. Instead, words replace numbers in an attempt to gain a deeper understanding of human reality (Braun and Clarke, 2013), in particular aspects of life which cannot be quantified, such as beliefs, attitudes and individual experiences. Frequently used methods of collecting qualitative data include focus groups, in-depth interviews and textual data, such as written words in diaries or free-text survey answers (Braun and Clarke, 2013, Hoe and Hoare, 2012, Tashakkori and Teddlie, 2010). Several analytic methods are available for qualitative data with some, such as Grounded Theory (GT) (Charmaz and Belgrave, 2007) and Interpretative Phenomenological Analysis (IPA) (Smith and Shinebourne, 2012), providing researchers with a theoretical framework in which to collect and interpret data (Braun and Clarke, 2013).

3.3.2 Combining research paradigms

Johnson and Onwuegbuzie (2004) define mixed-methods research as an approach *'… where the researcher mixes or combines quantitative and qualitative […] techniques, methods, approaches, concepts or language into a single study.'* As a result, mixed-methodologies draw on the strengths of both research paradigms, whilst minimising potential

weaknesses associated with the use of a single method. Additionally, though many have debated the use of both qualitative or quantitative approaches (Brannen, 2017, Firestone, 1987, Greene and Caracelli, 1997, Johnson and Onwuegbuzie, 2004, Morgan, 2007), there is growing recognition of the use of mixed-methods research in the evaluation of complex interventions (Campbell *et al*., 2000, Hawe *et al*., 2004, Oakley *et al*., 2006). As such, assessors are frequently seen to be utilising mixed-methods research, especially when conducting process evaluations (Bartholomew Eldredge *et al*., 2016, Steckler *et al*., 2002).

There are two main types of mixed-methods research from which the majority of studies have been designed: mixed-model and mixed-methods (Figure 3-5) (Johnson and Onwuegbuzie, 2004). Choice of research typology depends solely on the focus of investigation, with a combination of both models permitted within a single research project. However, consideration must be given to both paradigm emphasis (the decision to give equal or dominant status to qualitative and quantitative aspects) and the time of data collection for each method (whether this is sequential or concurrent) (Morgan, 1998, Morse, 1991). Additionally, a frequent failure of studies claiming to utilise a mixed-methods approach is a lack of data integration when reporting overall findings (Lewin *et al*., 2009). Therefore, it is important to ensure that elements of both qualitative and quantitative studies are combined when interpreting the results of mixed-methods research.

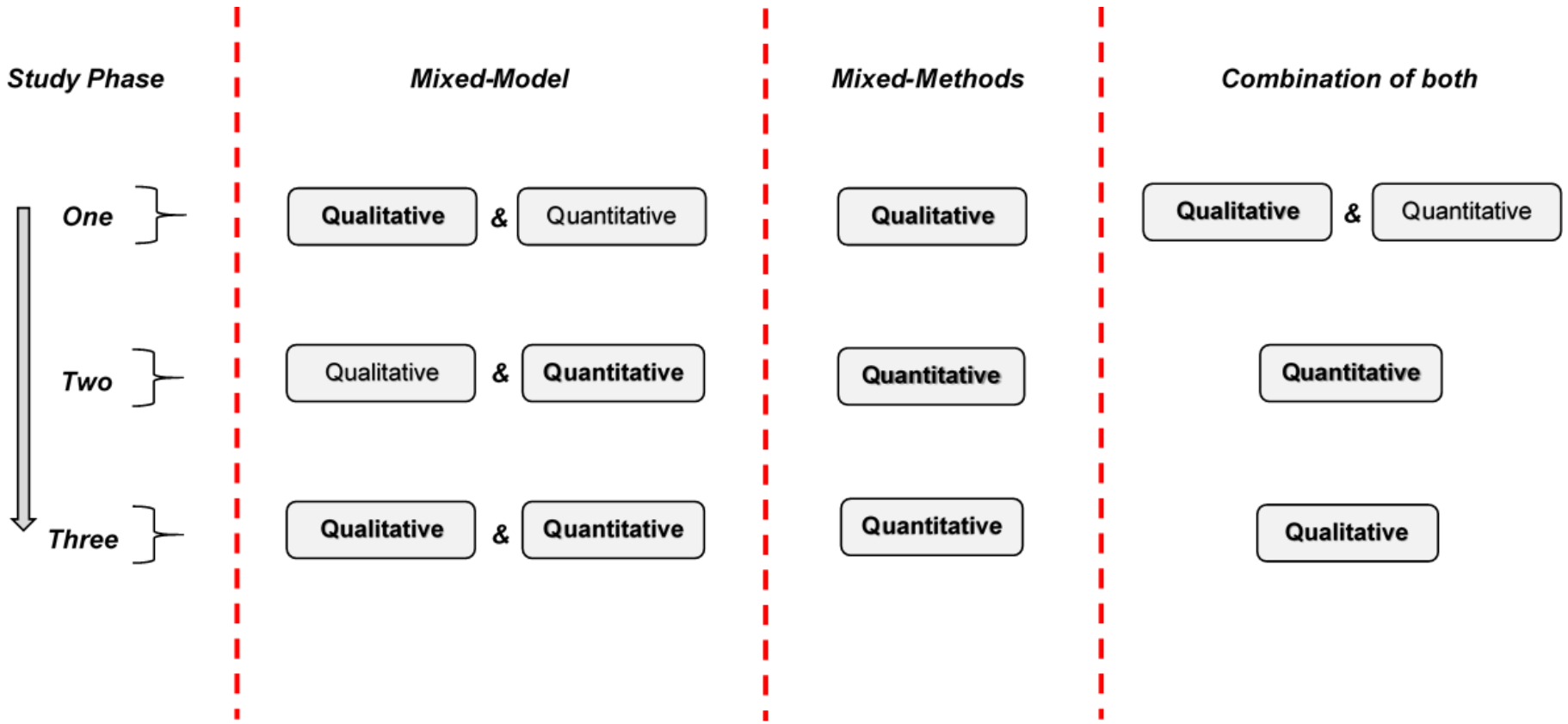


Figure 3-5: The two main typologies of mixed-methods study design, and a combination of both methods, as described by Johnson and Onwuegbuzie (2004)

Key benefits of using a mixed-method approach include the ability to use collected data to inform subsequent studies (Sandelowski, 2000) and the use of qualitative findings to explain those of quantitative investigations, or vice versa (Bamberger, 2012). Based on this evidence and the recommended use of mixed-methods research when performing a process evaluation, this approach was chosen as the methodological foundation for this thesis. Data was collected using both mixed-model (research sections one and two) and mixed-method (research section three) study designs, with the findings of research section one informing the investigation focus of all subsequent sections (Figure 3-6).

3.4 Reliability and Validity

When assessing research quality, consideration must be given to both the results of a study and the precision with which a project was conducted (Heale and Twycross, 2015). In quantitative research, rigour is maintained through the measurement of *validity* (is the construct in focus truly being measured?) and *reliability* (can obtained results be replicated?) (Heale and Twycross, 2015, Martin and Bridgmon, 2012, Neuman, 2013), most frequently through the use of standardised and well-documented research methods, which adhere to the principles of objectivity and neutrality (Neuman, 2013). Therefore, quantitative studies in this thesis will employ proven and replicable methods of both

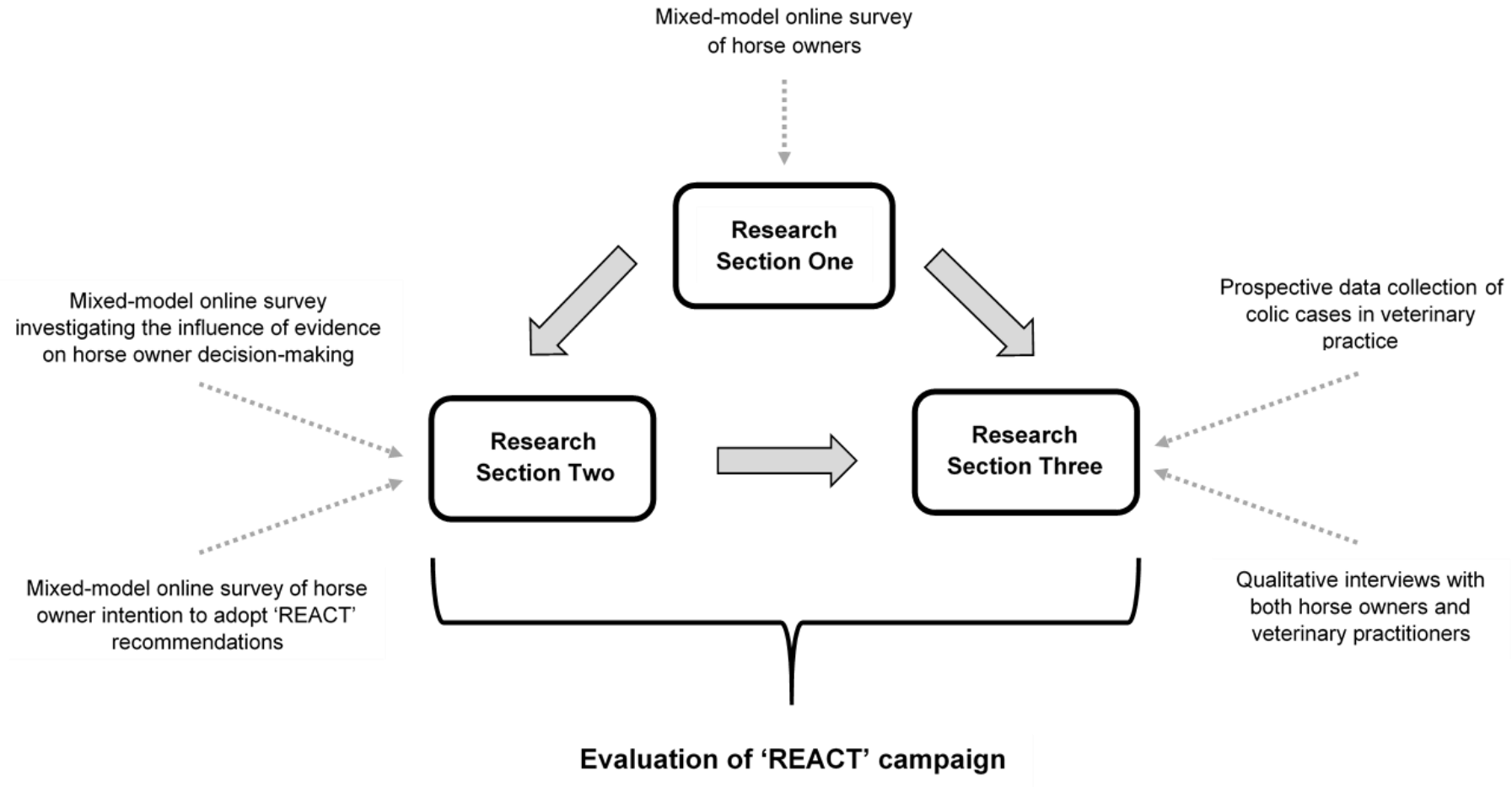


Figure 3-6: Diagram illustrating the use of both mixed-model and mixed-method study designs within this thesis

data collection (e.g. questionnaire design) and analysis (e.g. choice of statistical tests).

Though the principles of validity and reliability also apply to qualitative research (Mays and Pope, 2000), methods of ensuring rigour within these types of study differ from quantitative approaches. Qualitative researchers achieve reliability through the emphasis of 'dependability' or 'auditability' (Miles *et al*., 2014) using computer software to manage data and enlisting multiple coders to analyse transcripts (Bartholomew Eldredge *et al*., 2016, Braun and Clarke, 2013). Additionally, the use of more standardised analytical methods, such as Thematic Analysis (Braun and Clarke, 2006) (see section 3.4.1), enables a more replicable methodology. Validity, described by Guba (1981) as the truth or credibility of findings, can be achieved using a combination of procedures including purposely selecting cases based on relevance (*purposive sampling*, Tongco (2007)), the triangulation of findings (see section 3.4.2) and researcher reflexivity (see section 3.4.3).

3.4.1 Thematic analysis

Unlike most other qualitative analytical methods, Thematic Analysis (TA) does not provide researchers with a theoretical framework for data collection and interpretation (Braun and Clarke, 2013), but a method for data analysis *only* (Braun and Clarke, 2006). Based on an iterative, six-staged framework (Figure 3.7), TA is theoretically flexible and can be used to analyse almost any type of qualitative data (Braun and Clarke,

2013). As a result, TA was chosen as the methodological approach most suitable for the qualitative section of this thesis.

3.4.2 Triangulation

Triangulation is a measure of rigor and was used in this thesis for several reasons. Firstly, the term ‘triangulation’ refers to the process of using two or more data collection methods or sources in order to gain a better understanding of the same phenomenon (Braun and Clarke, 2013, Krefting, 1991). This research project uses triangulation of both research methods (qualitative and quantitative) and sources of information (horse owners and equine veterinary surgeons) to evaluate the ‘REACT’ campaign (see Figure 3.6). Secondly, triangulation strives to obtain a richer perspective of a construct, rather than an accurate truth (Braun and Clarke, 2013). As such, it fits with the theoretical viewpoint of the primary researcher. Finally, triangulation can enhance the credibility (‘rigor’) of qualitative research through the elimination of researcher bias, the cross-checking of data and the strengthening of analytic claims (Krefting, 1991, Silverman, 2015, Smith, 1996).

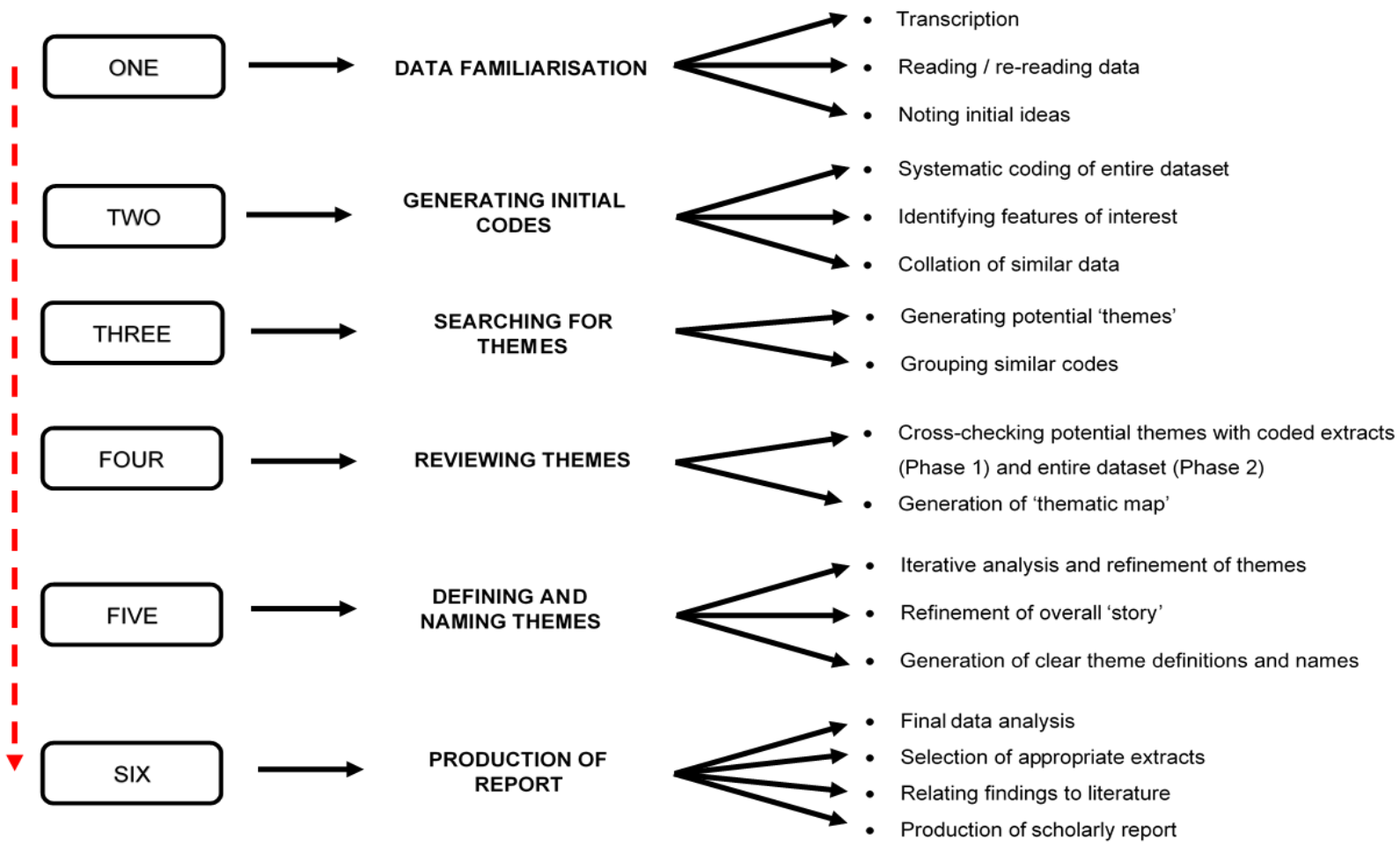
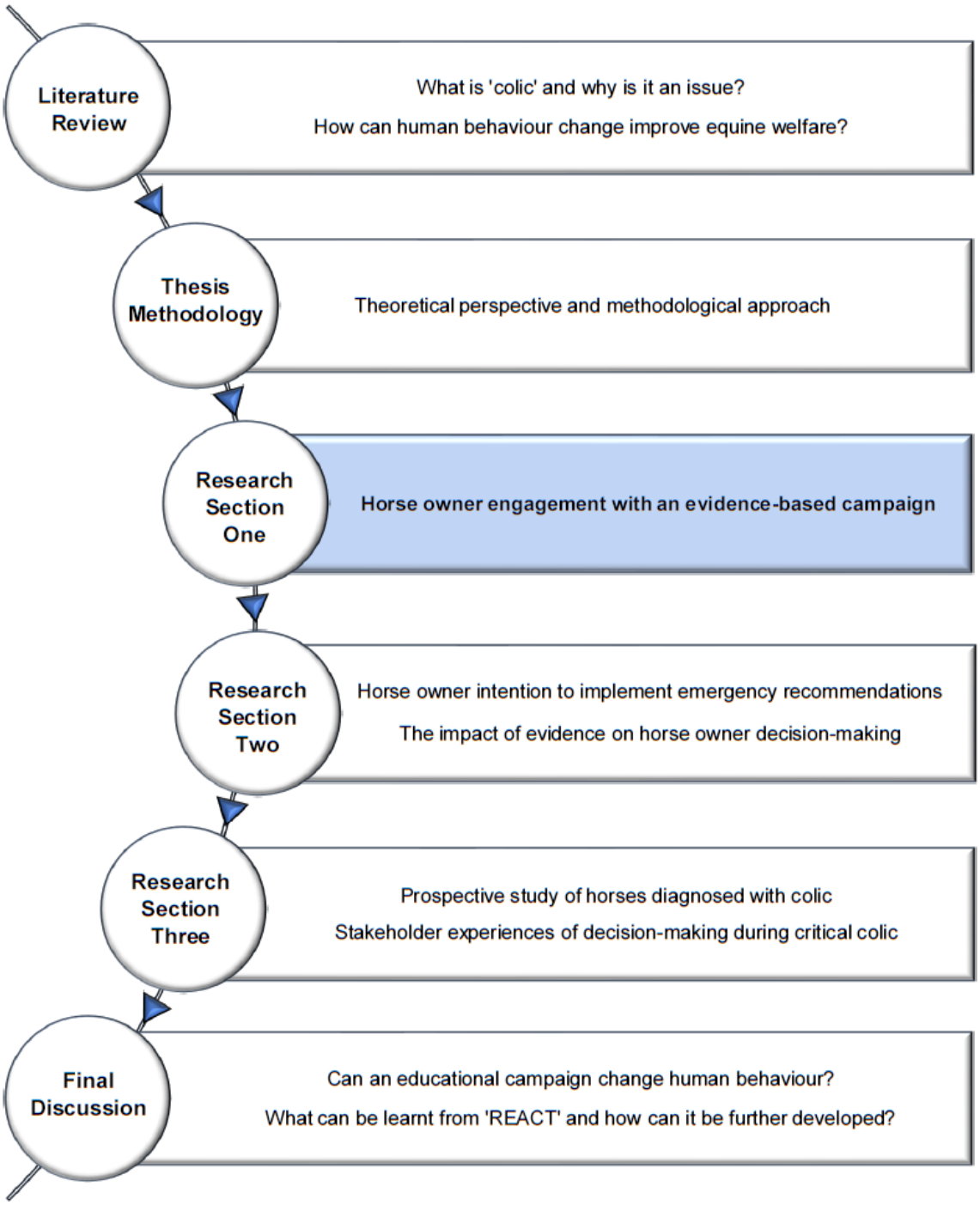


Figure 3-7: The six-steps of Thematic Analysis, as described by Braun and Clarke (2006)

3.4.3 Reflexivity

Reflexivity is an essential aspect of good qualitative research and refers to the continuous process of critical reflection (Berger, 2015, Braun and Clarke, 2013). There are two recognised forms of reflexivity: personal and functional (Wilkinson, 1988), with the latter referring to the conscious acknowledgement of the way in which chosen methods may influence data collection. Consequently, individual research methods employed within this thesis will be critically assessed in each relevant chapter. In contrast, personal reflexivity critically evaluates the role of the researcher in the production and interpretation of data. As such, the author of this thesis (KL) would like to acknowledge that this PhD research was co-funded by the University of Nottingham's School of Veterinary Medicine and Science and the international charity World Horse Welfare. All aspects of data collection was conducted by KL over a three-year period as part of a full-time studentship. An in-depth personal reflexivity statement can be found in Appendix III.

Research Section One



Chapter 4: Survey-based investigation of horse owner awareness of and engagement with an evidence-based campaign

4.1 Introduction

Campaigns aim to raise awareness of select issues and elicit a positive change in behaviour (Coffman, 2002). This method can be an effective way of targeting specific populations, both human and animal, in order to improve health and welfare. The 'HeadSmart: Be Brain Tumour Aware' campaign, for instance, focuses on reducing the total diagnostic interval (TDI) of childhood brain tumours by increasing public awareness of symptoms (Walker *et al*., 2015). Conversely, the use of campaigns within the veterinary industry are often aimed at encouraging owners to use prophylactic treatments or adopt proactive biosecurity recommendations to protect their animals. For example, the 'Act Against Lungworm' initiative, launched by Bayer Animal Health in 2012, and the 'Stamp Out Strangles' campaign developed by Redwings Equine Charity in 2016.

Equine abdominal pain ('colic') is a common emergency condition (Bowden *et al*., 2017) in which early recognition is key to a successful outcome (Proudman *et al*., 2002a). However, colic is often associated with subtle changes that can be easily overlooked (Southwood, 2012c). In a recent study of 1061 UK horse owners, Bowden *et al*. (2020) found that, although the majority of participants felt they could recognise most

cases of colic, significant gaps in basic knowledge, such as normal health values for heart and respiratory rate, were present. Additionally, a varied approach to colic management, such as symptom recognition and information seeking, within the equestrian population has also been recognised (Bowden *et al*., 2020, Lefebvre *et al*., 2017, Scantlebury *et al*., 2014). The ‘REACT Now to Beat Colic’ campaign was launched in 2016 by The British Horse Society (BHS) in collaboration with the University of Nottingham. This initiative aims to improving both owner recognition of colic; including changes in ‘normal’ health parameters; and approach to emergency decision-making, through the provision of free evidence-based resources (Burford *et al*., 2017). During the first twelve months, the campaign was disseminated by the BHS through national equestrian events, press releases, national and international presentations, and frequent advertisement on social media (Figure 4-1). Over 10,000 hardcopies of the ‘REACT’ information pack were distributed across the UK, with additional campaign information mailed or sent electronically to over 90,000 current or lapsed British Horse Society (BHS) members (The British Horse Society, 2017). Campaign promotion and resource distribution was primarily facilitated by representatives of the BHS and participating researchers at the University of Nottingham. Additionally, several UK veterinary practices held ‘REACT’ themed client evenings, in association with the BHS, with requests for campaign resources being received from multiple equestrian colleges and livery yards (The British Horse Society, 2017).

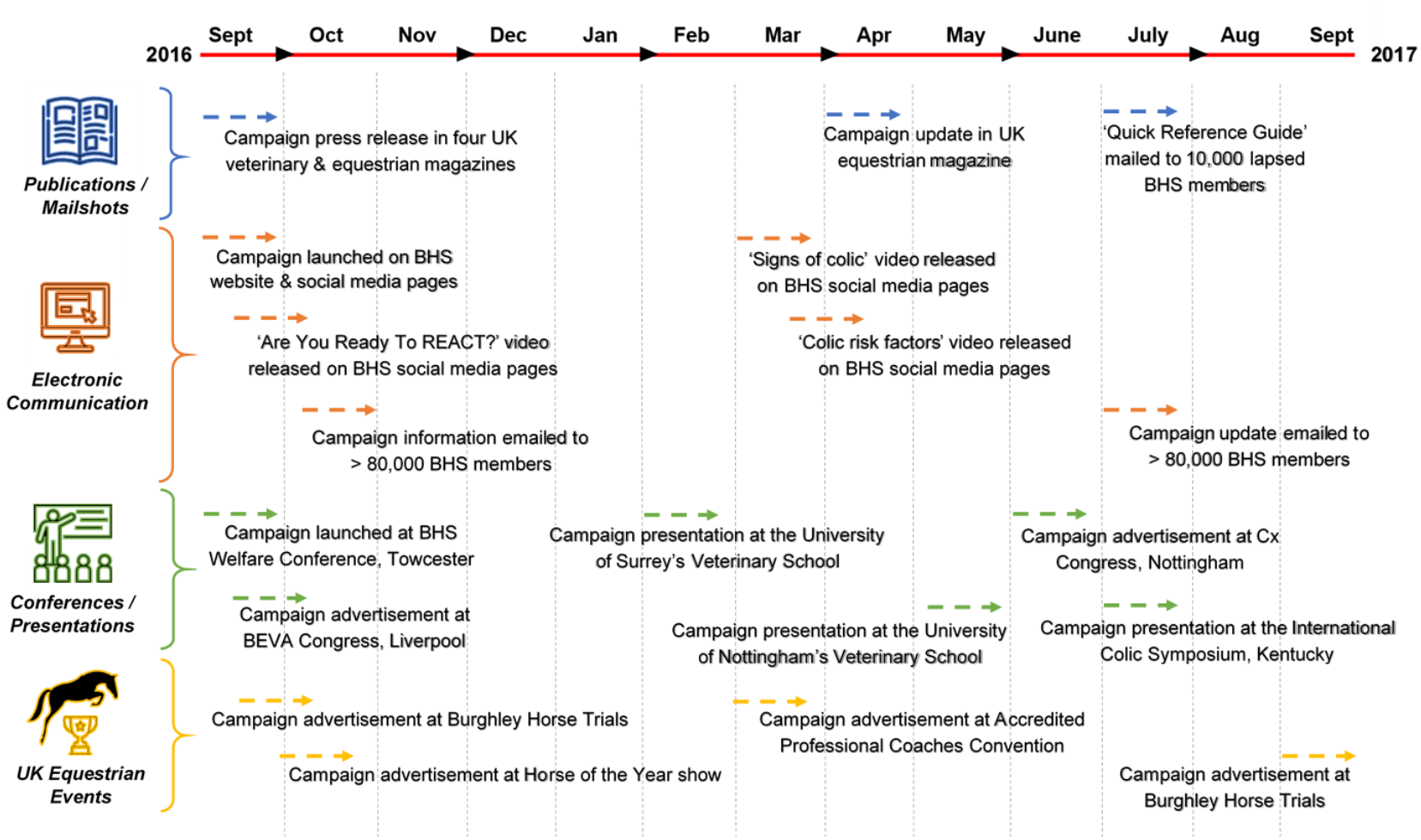


Figure 4-1: Dissemination of the 'REACT Now to Beat Colic' campaign during the first year of launch. Based on information provided by The British Horse Society (2017).

Yet, despite encouraging engagement ratings on social media and the vast distribution of hardcopy information nationwide, owner awareness of the 'REACT' campaign is currently unknown. Additionally, owner knowledge of 'normal' equine health, and approach to managing a horse with colic, has not been re-evaluated since the launch of the campaign. This is especially important given that existing evidence examining the impact of campaigns within human medicine, indicates that most produce only limited, short-term impacts on knowledge recall and behaviour change (Dombrowski *et al*., 2013, Hodgson *et al*., 2009, Lecouturier *et al*., 2010, Power and Wardle, 2015). Therefore, the first research chapter of this thesis will investigate horse owner awareness of and engagement with the 'REACT' campaign in order to identify areas of success and those requiring further development.

4.2 Aim and objectives

The aim of this study was to evaluate UK horse owner awareness of and engagement with an evidence-based health campaign (the 'REACT Now to Beat Colic' campaign).

The objectives of this study were:

- To evaluate whether horse owners were aware of the 'REACT Now to Beat Colic' campaign and associated resources.
- To document horse owners' current knowledge and confidence in assessing of 'normal' equine health parameters (as described within the 'REACT' campaign).
- To ascertain horse owners' current knowledge and approach to equine colic (as described within the 'REACT' campaign).
- To assess whether horse owners' have engaged with campaign resources and utilised them in decision-making.

4.3 Materials and methods

4.3.1 Sample population

The target population were individuals who owned or cared for equids within the United Kingdom (UK). Anyone over the age of 18, who was currently involved with equids on a regular basis, regardless of their discipline involvement, equine experience, or current horse ownership, were included within the sampling frame. Participants were recruited using a convenience sampling strategy through regular promotion on equestrian social media, as well as advertisement by equine veterinary practices and equestrian societies.

4.3.2 Survey development

The survey was developed using the Survey Monkey online publishing tool (Survey Monkey Inc., California, USA). An introductory page provided an overview of the study and was followed by a compulsory consent page.

The survey consisted of four sections:

1. Participants' knowledge of 'normal' equine health parameters
2. Participants' knowledge and approach to equine colic
3. Participant demographics
4. Participants' awareness of the 'REACT Now to Beat Colic' campaign and views on the potential impact of resources on their approach to colic

A number of questions included within sections one and two were adapted from the study conducted by Bowden *et al*. (2020). Survey logic was applied in section four to select for participants who were aware of the 'REACT' campaign. Those who were not aware were directed to an information page providing an overview of the 'REACT' campaign, before taking them to the end of the survey.

A short explanatory paragraph was included at the start of each section. Questions referring to 'normal' health values were preceded by value definitions. Questions were predominantly closed with pre-defined answers, with open questions used to establish knowledge of 'normal' equine health parameters, recognition of colic signs and understanding of the term 'colic'.

4.3.3 Pilot survey

The survey was piloted by five researchers from the Centre for Evidence-Based Veterinary Medicine, two equine veterinary practitioners and two non-veterinary horse owners.

Corrections (Appendix IV) were performed and the final survey design (Table 4-1) was submitted and approved by the University of Nottingham's School of Veterinary Medicine and Science Ethics Committee, before the survey was launched.

Table 4-1: Questions included in the final design of a survey exploring horse owner knowledge and approach to colic

Survey Section	Question	Question Type
Participant Consent	**1) If you agree to take part in this research study, please complete the following [*statement of consent*]**	Closed question with pre-defined answers
Previous study participation	**2) Have you previously completed a survey about equine colic by the Nottingham Equine Colic Project?**	Closed question with pre-defined answers
Section 1: *Recognising the 'normal' horse'*	**3) What do you think the normal heart rate range is for an average horse at rest?**	Open question with free text answer
	4) What do you think the normal respiration rate range is for an average horse at rest?	Open question with free text answer
	5) What do you think the normal temperature range is for an average horse at rest?	Open question with free text answer
	6) Which of the following [various health parameters] do you feel you could confidently measure accurately?	Closed question with pre-defined answers
Section 2: *Equine Colic*	**7) What do you think the term 'colic' means?**	Open question with free-text answer
	8) How confident would you be that you could recognise colic in a horse?	Closed question with pre-defined answers
	9) Please list (in no particular order) up to five signs that you would recognise as potential signs that your horse may have or be developing colic.	Open question with free-text answer

Section 2: *Equine Colic* *(Cont.)*	**10 – 13)** *Two colic scenarios depicting various severities and types of followed by the questions:* **Which of the following best describes what you would initially do in this situation?** **If you decided to call a vet out, which of the following best describes what you would do whilst waiting for the vet to arrive?**	Closed question with pre-defined answers Closed question with pre-defined answers
Section 3: *You and Your Horse*	**14) Please use this box to add any further comments relating to any of the scenarios you have just worked through.**	Open question with free-text answer
	15) What age category do you belong to?	Closed question with pre-defined answers
	16) Are you … *(gender options)***?**	Closed question with pre-defined answers
	17) Where are you based *(country of residence)***?**	Closed question with pre-defined answers
	18) How long have you owned or been involved in the care of horses/ponies for?	Closed question with pre-defined answers
	19) How many horses/ponies do you currently own or care for?	Open question with free-text answer
	20) Which of the following best describes the typical management of the horses you own/care for?	Closed question with pre-defined answers
	21) Do you have any formal equine qualifications?	Closed question with pre-defined answers

Section 3: *You and Your Horse (Cont.)*	**22) Are you a member of the British Horse Society (BHS)?**	Closed question with pre-defined answers
Section 4: *Campaign awareness*	**23) Are you aware of the 'REACT to beat colic' campaign?**	Closed question with pre-defined answers
	24) Where did you FIRST hear about the campaign?	Closed question with pre-defined answers
	25) For each of the following, please tell us if you are aware of that particular resource and if you have read/watched or used the content included.	Closed question with pre-defined answers
	26) If you have paper copies of the 'REACT to beat colic' fact sheets (shown below), where did you collect your copies?	Closed question with pre-defined answers
	27) Thinking about all of the topics covered by the 'REACT' campaign resources, which do you find useful?	Closed question with pre-defined answers
	28) Is there any aspect of colic NOT included within the campaign resources that you would like to know more about?	Closed question with pre-defined answers
	29) Please indicate how often you currently measure and record each of the following in your horse.	Closed question with pre-defined answers
	30) Considering your answers to question 29, has the information provided by the 'REACT' campaign changed how often you now measure and record your horse's temperature, heart rate and respiration rate?	Closed question with pre-defined answers

Section 4: *Campaign awareness (Cont.)*	**31) If you thought your horse had or was developing colic which of the following best describes how you would approach calling a vet out to examine your horse?**	Closed question with pre-defined answers
	32) Considering your answer to question 31, has the information provided by the 'REACT' campaign changed the way you would approach calling a vet out if you thought your horse had colic?	Closed question with pre-defined answers
	33) Has the information provided by the 'REACT' campaign had any impact upon your awareness and knowledge of the possible tests, such as rectal examination and nasogastric intubation, a vet may perform when examining a horse with potential colic?	Closed question with pre-defined answers
	34) Has the information provided by the 'REACT' campaign had any impact upon whether or not you would have your horse referred to a specialist equine hospital for further colic treatment (medical or surgical) if recommended by your vet?	Closed question with pre-defined answers
	35) Did you have an emergency plan for your horse (including emergency contact numbers and transport details) before being aware of the REACT campaign?	Closed question with pre-defined answers
	36. Which of the following best describes your current emergency plan for your horse?	Closed question with pre-defined answers
	37. On the sliding scale below please indicate how you feel the 'REACT to beat colic' campaign has impacted upon your knowledge and approach to equine colic overall.	Sliding scale (no impact – major impact)

4.3.4 Survey dissemination

Data was collected between 3rd October and 30th November 2017. Promotional flyers were distributed within veterinary practices and the survey was advertised within the British Horse Society's October e-newsletter and November quarterly magazine. Direct emails containing survey details were sent to 787 equine veterinary establishments (identified using the 'equine' filter on the RCVS 'Find a Vet' online tool) and 362 UK riding schools (identified using the BHS 'find a place to ride' online search tool). Follow up emails were sent two weeks post initial contact, with 'bounced' emails and respondents who did not wish to be involved removed from the emailing list on a regular basis. Survey promotion on social media platforms (Facebook and Twitter), using the research group profile the 'Nottingham Equine Colic Project', was performed daily to encourage participation and highlight the closing date of 30th November 2017.

4.3.5 Data management

Survey data was filtered on Survey Monkey© (Survey Monkey Inc., California, USA) to include completed and partial responses from participants. Data was imported directly from Survey Monkey into an Excel spreadsheet (Microsoft Office 2013, Microsoft) for data cleaning (Rahm and Do, 2000), with results updated and saved on a weekly basis. Data was stored on password encrypted software at all times and accessed only by researchers directly involved in the study.

4.3.6 Data analysis

4.3.6.1 Descriptive

Exploratory descriptive analyses were performed. The mean, median and range were computed for continuous data. Normality of distribution was determined using histograms and Kolmogorov Smirnov testing. Frequency percentages and mode values were calculated for categorical data, with optional free-text responses associated with the pre-defined answer of '*other*' being reviewed and grouped where appropriate into either existing or new answer categories. Non-parametric data were reported as the median (range), mean values were used for parametric distribution.

Answers which specifically requested a free-text answer were reviewed individually before answers were categorised by theme and ranked based on frequency of occurrence. Statistical testing was conducted in order to investigate specific research questions and trends identified during the descriptive analysis stage.

4.3.6.2 Recognising the 'normal' horse

Free-text answers associated with 'normal' value ranges for heart rate, respiratory rate and rectal temperature were manually categorised as either 'correct' or 'incorrect' in order to perform statistical comparisons. To facilitate this, correct values were classed as those that fell within the widest 'normal' physiological ranges as defined by Bowden *et al*.,

(2020) following consultation of existing equine veterinary literature (Colahan, 1999; Smith, 2008; Reece, 2009; Reed *et al.*, 2009; Sjaastad *et al.*, 2010). Correct value ranges were therefore as follows:

- Heart rate between 28 and 44 beats per minute.
- Respiratory rate between 8 and 16 breaths per minute.
- Rectal temperature between 36.5º C and 39 º C.

Submitted values which fell outside of these ranges were categorised as 'incorrect'. Where participants indicated that they did not know the 'normal' range or did not provide a complete range (i.e. provided just one answer for either the lowest or highest value), the category 'unknown' was used. Prior to statistical testing, descriptive analyses, involving the calculation of frequency percentages for each new category, was performed.

4.3.6.3 Statistical testing

Categorical responses were condensed where necessary (Appendix V) and converted into the appropriate format by the assignment of a number. Data was organised in Excel (Microsoft Office 2013, Microsoft) before being transferred to SPSS (Version 25, IBM Corp. 2017) for statistical analysis.

Plausible interactions between participant demographics and the following areas were explored using Chi-squared testing:

- Knowledge of ‘normal’ health parameters (provision of a correct or incorrect value range).
- Confidence measuring and interpreting health values.
- Confidence in recognising colic.
- Campaign awareness.
- Awareness of campaign resources.

Results were considered statistically significant when p = < 0.05 using exact 2 sided significance. Fisher’s exact test was used in all cases when over 20% of cells contained a count of less than 5.

4.4 **Results**

4.4.1 Survey engagement

A total of 2157 horse owners consented to participate in the online survey. Seven-hundred and seventy-eight participants did not answer any further questions and 93 horse owners were from outside of the UK. These participants were excluded from subsequent analysis. A total of 1286 participants took part in the survey with 1111 completing all relevant sections (Figure 4-2). The total number of responses is reported for each question.

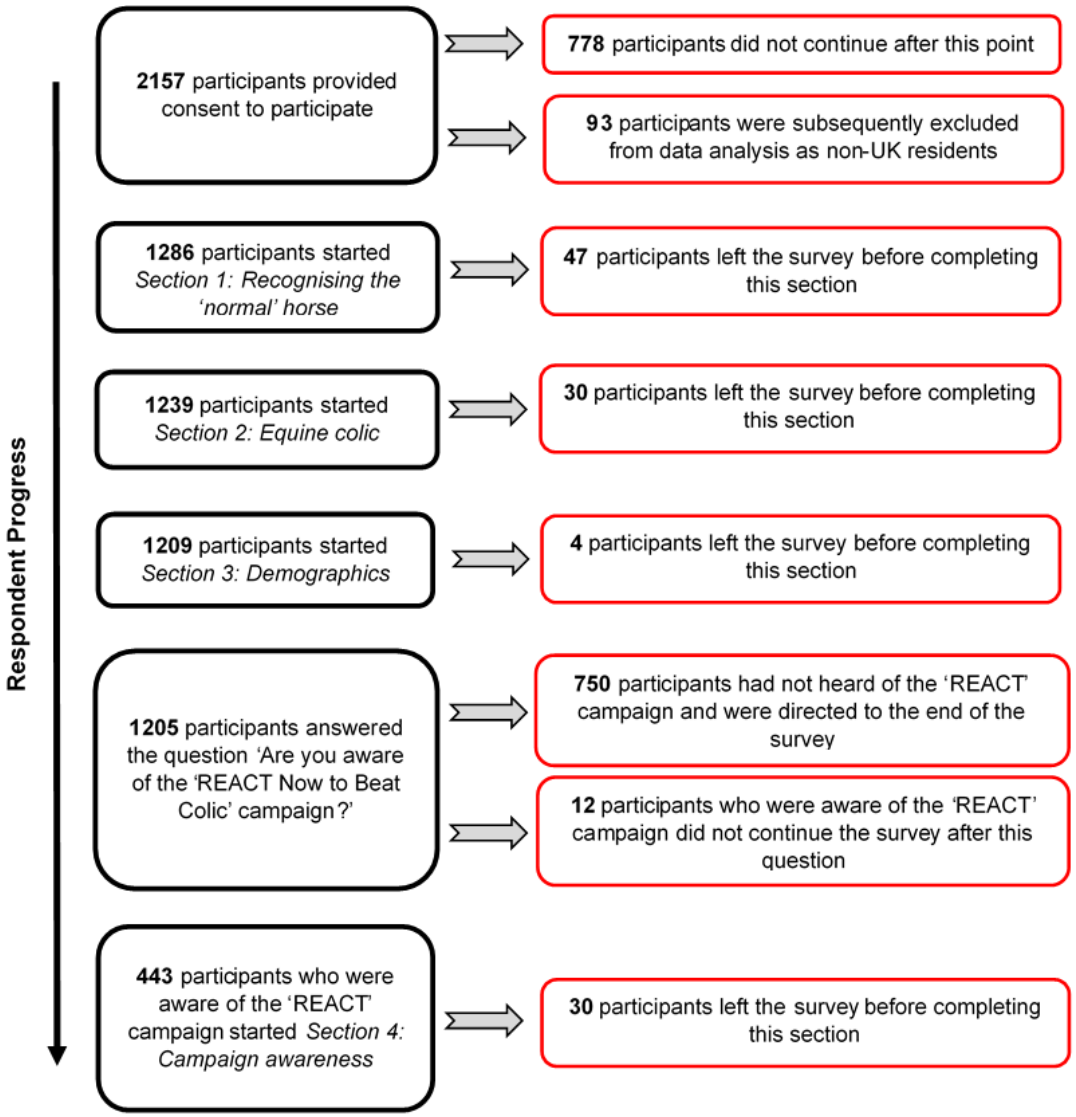


Figure 4-2: Flow diagram illustrating participant completion of an online survey exploring horse owner knowledge and approach of colic.

4.4.2 Participant demographics

The majority of survey respondents were female (98%, 1181/1204). A variety of age ranges were represented with most participants (51%, 621/1209) being aged between 18 and 44 years old. The modal age category was 18-24 years (14%, 166/1209) with the lowest represented age groups being 60-64 (7%, 83/1209) and over 65 (5%, 61/1209) years old, respectively.

Participants (n=1207) reported varying levels of equine experience with 25% (306/1207) having worked, cared for or owned horses for 11-20 years. Less than 5% (6/1207) of respondents had less than 1 years' experience, with 18% (222/1207) having more than 40 years involvement with equids.

Fifty-seven percent (687/1204) of participants held a formal equine qualification. Of these 48% (331/687) held a British Horse Society (BHS) qualification (Appendix VI) with the BHS stages 1 and 2 certificates being most frequently reported.

Participants (n=1197) currently owned or cared for a median of two horses (range, 0–100 horses). Thirty-five participants stated that they were owners or employees of large equestrian establishments, such as a riding school, and were therefore responsible for a median of 30 horses (range, 10–100 horses). Thirteen participants did not have access to a horse. Of those currently providing care to a horse, most

kept their animal/s on full DIY livery at a yard (30%, 355/1184) or at home (29%, 343/1184).

Participation in previous research exploring colic knowledge was reported by 19% of respondents (244/1286) with 63% having no prior involvement. British Horse Society (BHS) membership was held by 61% of participants (737/1209).

4.4.3 Recognising the 'normal' horse

A median heart rate of 32 beats per minute (range, 5 – 130 bpm) was reported for the lowest value (n=955), with a median of 42 beats per minute (range, 12 – 200 bpm) being provided for the highest (n=959) (Figure 4-3). Three-hundred and ten participants (25%) were unsure of the normal heart rate range for an average horse. Correct ranges (those which fell between 28 and 44 bpm) were given by 43% (546/1264) of participants with incorrect ranges being provided by 32% (408/1264).

A median respiratory rate of 10 breaths per minute (range, 2–66 breaths) was given for the lowest value (n=926) and a median of 15 breaths per minute (range, 7 – 150 breaths) for the highest (n=940) (Figure 4-4). In total 336 participants (27%) stated that they did not know the normal respiratory rate range for an average horse. Correct value ranges (those within 8 and 16 breaths per minute) were provided by 47% (589/1260) of participants with 27% (335/1260) submitting ranges which were outside of the normal range.

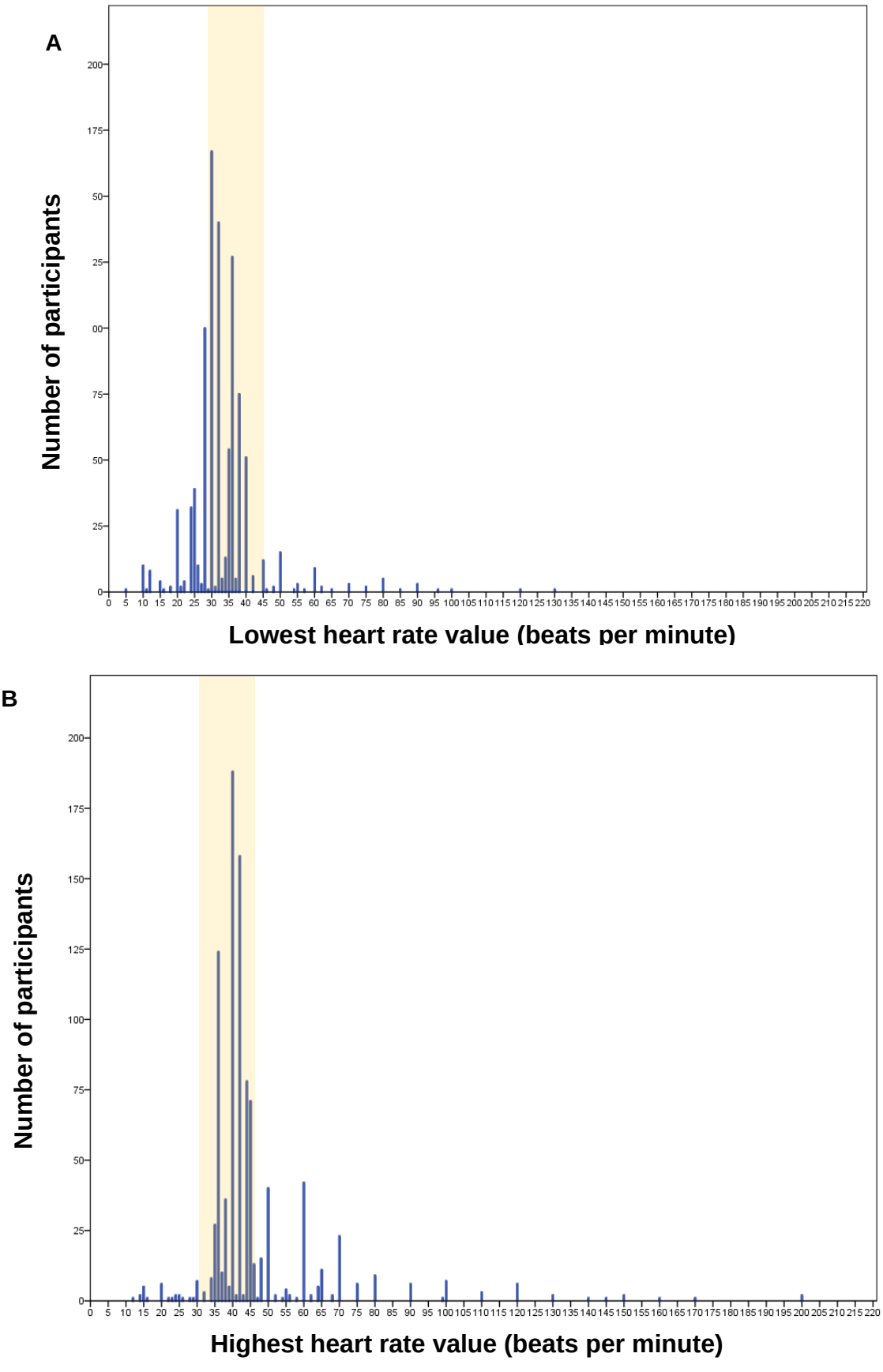


Figure 4-3: The lowest (A) and highest (B) heart rate values given by participants in an online survey investigating UK horse owner knowledge and approach to colic. The correct heart rate range, values falling within 28 and 44 beats per minute, is highlighted.

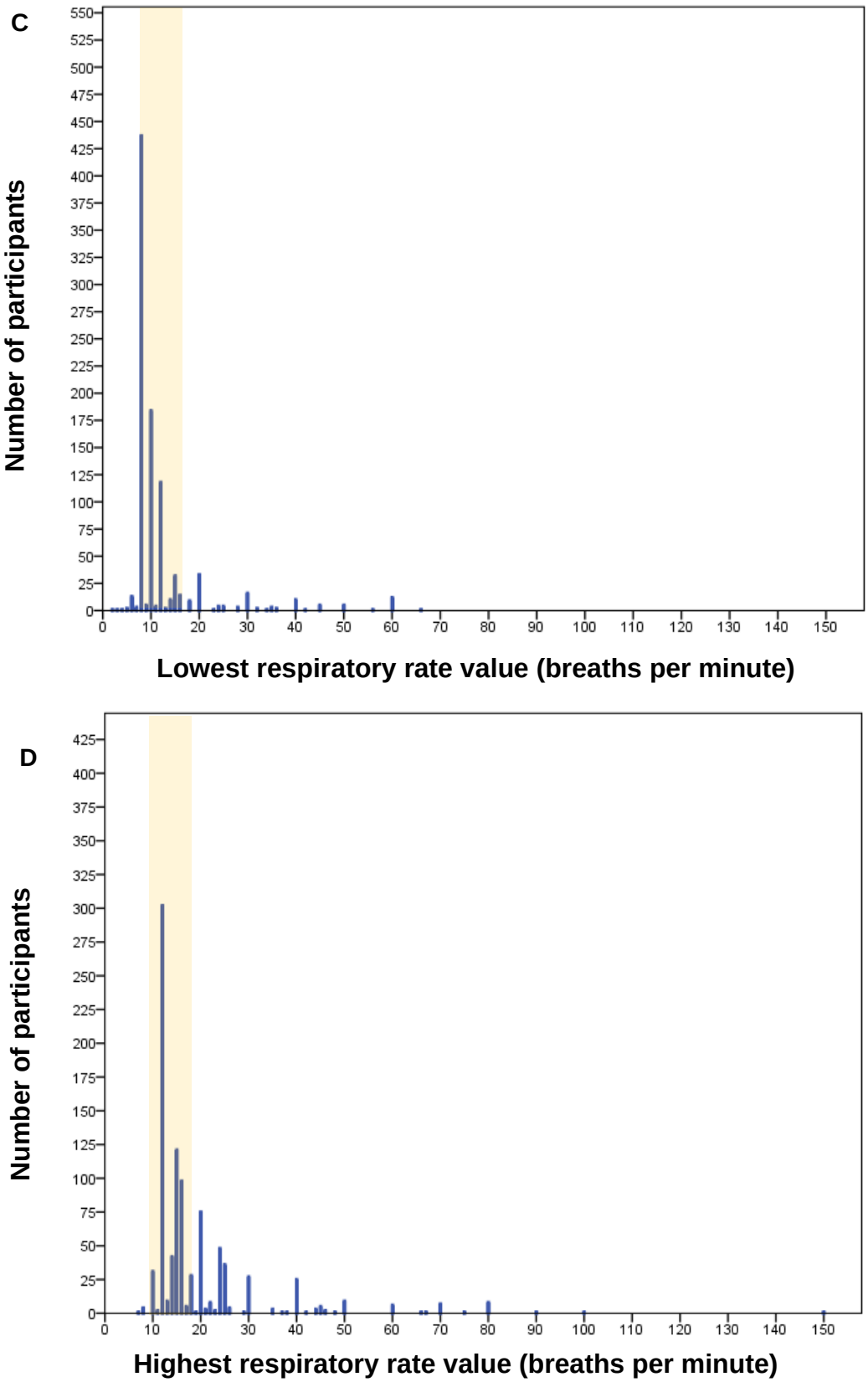


Figure 4-4: The lowest (C) and highest (D) heart rate values given by participants in an online survey investigating UK horse owner knowledge and approach to colic. The correct respiratory rate range, values falling within 8 and 16 breaths per minute, is highlighted.

A median body temperature of 37.0ºc (range, 12.7 – 47.0ºc) was reported for the lowest value (n=1021), whereas a median figure of 38.2ºc (range, 18.3 – 50.0ºc) was provided for the highest (n=1026). A total of 252 respondents (20%) reported that they did not know the correct temperature range for an average horse. Correct ranges (those within 36.5 and 39.0ºc) were given by 60% (756/1263) of participants with 20% (255/1263) providing an answer that was outside of the reference range.

Chi-squared testing found that correct value ranges for heart (p=< 0.001) and respiratory rates (p=<0.001) were significantly associated with participants who held a formal UK equine qualification. No statistical association between participant demographics and correct values for temperature range was found.

Confidence related to measuring and understanding equine health values varied with most participants feeling ‘fairly’ confident that they could measure and interpret each of the three values (Figure 4-5). Heart rate received the lowest rating with 35% (441/1276) of participants not feeling at all confident measuring this value. Chi-squared testing indicated that confidence was significantly associated with participants who held a formal UK equine qualification (p=<0.001).

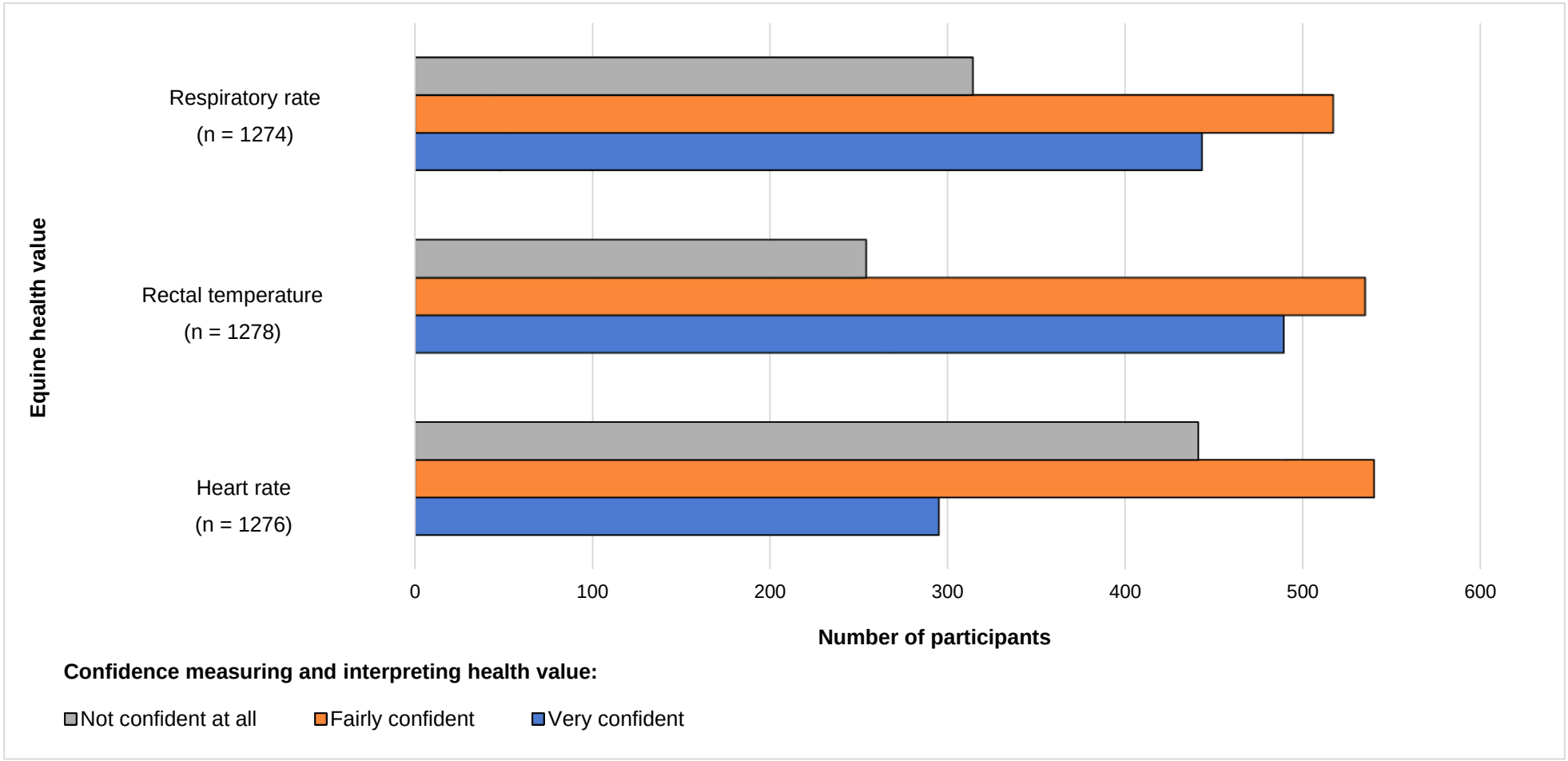


Figure 4-5: Participant confidence measuring and interpreting three equine health values; rectal temperature, heart and respiratory rate; in an online survey exploring UK horse owners' knowledge and approach to colic.

4.4.4 Recognition of equine colic

Most participants were confident that they could recognise most (63%, 780/1239) or some (27%, 340/1239) presentations of colic. A small proportion (7%, 84/1239) felt they could recognise every case, 3% (33/1239) of participants felt they would only be able to recognise very severe presentations and two participants felt they would not be able to recognise colic at all. No statistical association between participant demographics and confidence recognising colic was identified.

Participants' understanding of the term 'colic' was mainly associated with 'pain' (52%, 634/1218) or 'discomfort' (13%, 163/1218) of various anatomical regions, most frequently the abdomen (30%, 366/1218). Some (16%, 188/1218) participants referred to colic in colloquial terms, such as a 'tummy' or 'belly' 'ache'. Over 40 'causes' of colic were reported by participants (Appendix VI), including 'twists' (7%, 82/1218) and 'blockages' (9%, 109/1218).

Participants (n=1283) reported ninety-four various physiological and behavioural signs that would be recognised as potential indicators of colic (Appendix VI). Behavioural signs were most frequently referred to, with participants reporting 48 various behaviours they would associate with colic. Kicking or looking at the stomach or flank was the most recognised sign (89%, 1096/1238), with rolling, sweating and a reduction in appetite frequently mentioned (Table 4-2).

Table 4-2: The top ten most recognised signs of colic as reported by participants of an online survey exploring UK horse owners' knowledge and approach to colic.

Potential indicator of colic	Percentage of participants reporting sign (n = 1238)
'Kicking or looking at stomach or flank'	89%
'Rolling or attempting to roll	63%
'Sweating'	59%
'Reduced appetite'	33%
'Reduced droppings'	29%
'Digging / pawing the ground'	27%
'Increased respiratory / breathing rate'	24%
'Restlessness'	21%
'Increased heart rate'	15%
'Lying down or excessive lying down'	15%

4.4.5 Approach to equine colic

When presented with scenario one (impaction colic), veterinary assistance would be immediately sought by 23% (286/1218) of respondents, with 31% (378/1218) opting to observe the horse for a period of time before seeking assistance. Most (46%, 555/1206) participants would remove any remaining feed and walk the horse periodically in hand whilst waiting for the vet's arrival. Sixteen participants would not consult a veterinary professional in this situation. Seventy-six respondents provided details of an alternative approach whilst waiting, with many (31%, 24/76) suggesting they would ask the vet for specific advice on what they should do whilst waiting for their arrival.

Immediate veterinary assistance would be sought by 80% (981/1219) of participants if presented with scenario two (strangulating lesion). The removal of feed and periodic in hand walking whilst waiting for the vet was preferred by most (49%, 586/1203) participants. An alternative approach whilst waiting for the vet was described by 108 participants. Twenty-six percent (24/108) suggested that they would walk the horse continuously in hand until the vet's arrival to prevent rolling or further injury. Twenty-four respondents suggested environmental adjustments, such as the removal of 'hazards' or taking the horse to a sand school, to prevent further injury.

Three-hundred and thirty-six participants provided additional comments at the end of this survey section *('Section 2: Equine colic'*), with the majority (91%, 217/336) providing further details about their approach to the survey scenarios. Nineteen percent (66/336) of participants suggested that their approach to colic would depend on the severity of signs observed:

'I would regard the second scenario as the more serious of the two and would ask the vet to treat it as an emergency call. The first scenario could be something other than colic.' (Survey Participant 70)

'The first case is possibly discomfort through lack of exercise and if the leg wound allowed then gentle walking might help ease it. The second scenario is much more serious so I would take TPR in case it got worse and became too difficult, put more bedding down for safer rolling, preferably in a bigger stable.' (Survey Participant 417)

Previous colic experience (7%, 48/336) and current level of knowledge (14%, 48/336) were also suggested to be factors in participants' approach to colic management:

'Having seen colic a number of times, I would call the vet if I even suspected it.' (Survey Participant 20)

'Having had a horse with colic the vet's advice was to lunge them to get her moving which sometimes helps.' (Survey Participant 463)

'I would certainly always take advice from more experienced people at my yard and also what the vet said to do. I know I don't have enough knowledge on this.' (Survey Participant 873)

'I was always taught to walk them rather than leave to let them roll and risk twisted gut.' (Survey Participant 705)

4.4.6 Resource engagement

Thirty-seven percent (450/1205) of participants were aware of the 'REACT Now to Beat Colic' campaign at the time of the survey. Chi-squared testing indicated that campaign awareness was significantly associated with current BHS membership (p=<0.001).

Twenty-one percent (96/448) of participants had been made aware of the campaign via advertisement on BHS social media platforms (Twitter and Facebook). The quick reference guide (78%, 334/426) and owner information pack (72%, 317/438) were the most recognised resources. The online videos, *'REACT Now to Beat Colic'* and *'Are you prepared to REACT?'* received the lowest level of recognition. No statistical associations between participant demographics and resource recognition was found.

Engagement with campaign materials varied (Figure 4-6) with many participants who were aware of resources reporting that they had not read the information provided. Most participants (76%, 310/409) felt that all of the topics covered by the campaign were particularly useful, with 13% (54/409) highlighting 'recognising the signs of colic' as the single most useful topic.

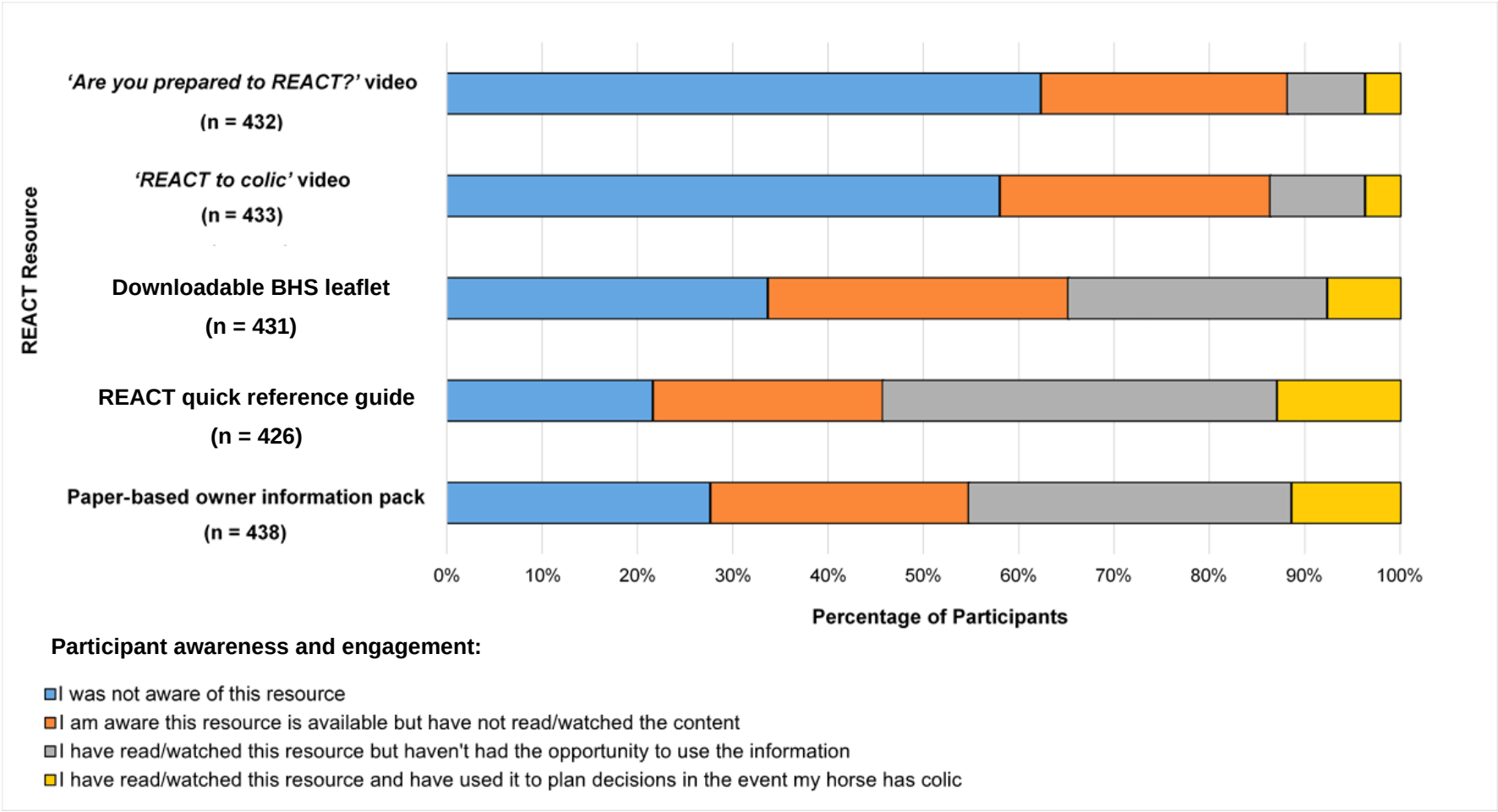


Figure 4-6: Stacked bar chart displaying participant awareness and use of REACT campaign materials taken from an online survey investigating UK horse owner awareness of an educational colic campaign.

When asked '*Is there any aspect of colic NOT included within the campaign resources that you would like to know more about?'* 9% (40/409) of participants provided further information on topics they'd like to know more about, with additional information relating to referral most frequently requested (n = 10).

4.4.7 Potential impact of resources

The overall campaign effect on horse owner approach and knowledge of equine colic (n=408) was reported as a median of 54% (range, 0 – 100%). The majority of 'REACT' aware participants (n=435) currently only measured and recorded rectal temperature, heart, and respiratory rate if their horse appeared unwell. When asked if the campaign had impacted upon their approach to monitoring their horses' health, 45% (194/427) of participants reported no change. Only 26.0% (113/427) indicated that they now intended to start monitoring these values on a regular basis.

Most 'REACT' aware participants (64%, 287/450) felt confident they could recognise most cases of colic. Immediately calling the vet (49%, 212/435) and a period of observation (36%, 156/435) were the most frequently chosen methods of managing a potential case of colic by those aware of the campaign. When asked if their approach to colic had been influenced by information provided by the campaign, the majority of participants (71%, 300/425) felt it had not had any impact.

When asked what impact the campaign had had upon awareness of potential tests a vet may use to assess a colic, 73% (304/415) of participants stated they already knew about these methods prior to the ‘REACT’ campaign. Of those who were not originally aware, 17% (72/415) now felt they knew which tests could be selected and why, with 5% (20/415) feeling more aware of potential tests but unsure as to why they would be performed.

Campaign effect on participants’ decision to refer their horse to a specialist equine hospital for further treatment was varied. Most (78%, 302/412) were already aware of referral options before the ‘REACT’ campaign with 39% (159/412) willing to have their horse referred, 10% (40/412) not considering this an option and 25% (103/412) unsure whether they would choose referral. Of those who were not aware of referral options before ‘REACT’ awareness, 6% (28/412) would now have their horse referred, 2% (10/412) would not choose referral and 5% (21/412) were still unsure of this decision. Twelve percent (51/412) of participants have never thought about the possibility of referral.

An emergency plan, in the event their horse had colic, was already held by 79% (330/420) of participants prior to hearing of the ‘REACT’ campaign. Of these, 14% (46/330) had modified their plan and 1% (3/330) had created a completely new strategy since being aware of the campaign. Of those that had no plan (90/420) 27% (24/90) had since generated an emergency proposal following campaign exposure.

4.5 **Discussion**

4.5.1 Overview of findings

This was the first study to evaluate horse owner awareness of the 'REACT Now to Beat Colic' campaign and engagement with associated resources. The results show that, one year post launch, 37% of survey participants were aware of the campaign, with British Horse Society (BHS) membership contributing significantly to campaign recognition. Engagement with educational resources was shown to be varied, with 20-30% of those aware of the campaign having not read the information provided. Consequently, very few participants felt that the campaign had impacted upon their knowledge and approach to colic. Further exploration of owner knowledge indicated that, although the majority felt confident measuring and interpreting equine health values, a large proportion of horse owners were still unsure of correct value ranges. Additionally, owner approach to colic management remained diverse with factors, such as perceived severity of signs, potentially affecting owner decision-making.

4.5.2 Study limitations

This study aimed to recruit as many participants, from a variety of equestrian backgrounds therefore, an online survey was chosen as the most appropriate method of data collection. The use of online surveys as a research tool has been widely debated (Barratt *et al*., 2015, Evans and Mathur, 2005, Hunter, 2012, Lefever *et al*., 2007, Sue and Ritter,

2012, Touvier *et al*., 2010, Wright, 2005), with many highlighting the low cost and time requirements of this approach as most advantageous (Evans and Mathur, 2005, Kwak and Radler, 2002, Lefever *et al*., 2007, Wright, 2005). Although the limitations of online surveys will be explored in more detail within the final chapter of this thesis (Chapter Nine), there are a number of limitations specific to this study which will be discussed.

The population in focus displayed similar demographics to those reported in previous owner studies (Bowden *et al*., 2020, Hotchkiss *et al*., 2007a, Ireland *et al*., 2011b, Ireland *et al*., 2013, Scantlebury *et al*., 2014, Wylie *et al*., 2013), with female owners being most represented. Although over 1,000 horse owners participated in this research study, the results cannot be considered representative of the UK horse owning population as they are likely subject to some degree of bias. Survey dissemination was facilitated largely by social media advertisement, an approach which may have favoured those with access to both the internet and the specific social media platforms utilised. The predominance of those with current BHS membership within the study population was likely to have been a consequence of BHS involvement during survey dissemination. This would have also led to a bias towards participants holding BHS qualifications, BHS registered yard owners and an awareness of the ‘REACT’ campaign. Self-selection, based on previous experience or concern, has been commonly reported as a potential source of study bias (Bowden *et al*., 2020, Ireland *et al*.,

2011a, Ireland *et al*., 2011b, Scantlebury *et al*., 2011, Scantlebury *et al*., 2014). Relative to this study, the topic of ‘colic’ was clearly discernible from the survey title and may have resulted in more frequent access or identification by those with a personal interest in this condition.

4.5.3 Key findings

A basic understanding of ‘normal’ equine health is essential in order to identify illness and maintain good levels of welfare (Bowden *et al*., 2020, Hemsworth *et al*., 2015). Changes in clinical parameters, such as an elevated heart (de Grauw and van Loon, 2016, Dujardin, 2011, Rietmann *et al*., 2004, Von Borell *et al*., 2007) or respiratory rate (Couëtil *et al*., 2016, Rettmer *et al*., 2015, Robinson *et al*., 2003), have been associated with early indicators of disease in the horse and should be cause for concern. However, owner knowledge of physiological values that can be regularly monitored and used to identify the early stages of illness was relatively low within this study population. Congruent with findings reported by Bowden *et al*., (2020), correct ranges for rectal temperature, heart and respiratory rate were associated with those holding a formal equestrian qualification. This result is not surprising given that many equine programmes require students to have a basic understanding of how to measure and interpret health values in order for a qualification to be awarded. Interestingly though, despite the majority feeling confident in measuring and understanding the specified values, 20-30% of participants were

unsure of correct value ranges, with a further 20-30% providing values that were outside of the acceptable range. These findings indicate that between 40% and 60% of owners may misinterpret or not recognise changes, which could compromise their horse's welfare. A particular cause for concern is the fact that the highest proportion of incorrect answers (32%), and lowest levels of owner confidence, was associated with heart rate. Colic is typically associated with violent behavioural signs, such as excessive rolling (Scantlebury *et al*., 2014, Yeoman *et al*., 2017), which can be easily recognised by an owner. However, not all horses will display overt signs that could convey the severity of their illness, with some showing a dull and depressed demeanour (Cook and Hassel, 2014, Pratt *et al*., 2003). Heart rate can be used as a predictor of colic severity, with studies frequently implicating an elevated heart rate with critical cases of abdominal pain (Orsini *et al*., 1988, Bowden *et al*., 2017, Curtis *et al*., 2015, Furr *et al*., 1995, Orsini, 2011, Reeves *et al*., 1989). Therefore, it is imperative that owners can assess both behavioural and physiological signs to ensure veterinary treatment is sought at the appropriate time.

Colic is multifactorial in nature, with signs varying in both severity and visual manifestation. Confidence in the recognition of colic was high amongst survey participants, with 63% reporting they could recognise most presentations. However, when asked which signs they'd most frequently attribute to colic, the majority referred to overt behavioural signs, such as kicking and/or looking at the stomach (88%), with very

few reporting subtle or less observable signs, such as an increase in heart rate (15%) or excessive lying down (14%). These findings agree with survey findings that participants were more likely to seek immediate veterinary assistance when presented with scenario two (strangulating lesion), which depicted a horse showing violent colic signs, whereas scenario one (impaction) was met with a more reserved approach, with some suggesting that it may not be colic at all. Additionally, though a high proportion of participants correctly associated colic with 'pain' (52%), mainly of the abdomen (30%), understanding of this term varied, with some referring to it colloquially and comparing it to human conditions, such as a 'tummy' or 'belly' ache. A misunderstanding of the pathophysiology of colic, coupled with a bias towards observable signs of a violent nature, contradicts participants' suggestion that they would be able to recognise most presentations. Furthermore, the attribution of anthropomorphic terms to colic could affect owners' interpretation of sign severity and consequently timing of veterinary assistance. This varied approach to both the recognition of 'good' health (Buckley *et al*., 2004) and interpretation of signs deemed 'abnormal' (Bowden *et al*., 2020, Ireland *et al*., 2012, Rettmer *et al*., 2015, Scantlebury *et al*., 2014) has been noted within the horse owning population before, with a number of factors identified as potential influences on owner decision-making. For instance, Ireland *et al*., (2012) found that owners' perception of the 'normal' ageing process has resulted in an under-reporting of disease in geriatric horses. Consistent with the findings of this study, colic

recognition has been previously linked to owners' interpretation of signs, with evidence suggesting that cases may go unreported (Tinker *et al*., 1997a) or veterinary treatment delayed (Bowden *et al*., 2020, Scantlebury *et al*., 2014) based upon an owner's personal assessment. Additionally, prior experience of colic, either through direct or indirect contact, has been found to be associated with both owner confidence in recognising symptoms (Bowden *et al*., 2020) and their approach to managing a horse with this condition (Scantlebury *et al*., 2014). Although not directly assessed in this study, participants frequently referred to their own experience of colic within free-text comments, which could suggest that prior experience had some degree of influence upon their approach to the survey scenarios. Whilst the application of scenarios, or 'vignettes', within social science research has become increasingly popular (Barter and Renold, 1999), many have implied that caution must be taken when interpreting participant responses (Hughes and Huby, 2012, Sampson and Johannessen, 2020, Spalding and Phillips, 2007, Spratt, 2000, Barter and Renold, 1999). This is due to the perceived notion that vignettes are not 'true reality' (Barter and Renold, 1999) and lack the emotional, environmental and time pressure influences that would be present in a real life decision-making situation (Sampson and Johannessen, 2020, Spalding and Phillips, 2007, Spratt, 2000). However, the fact that these findings coincide with those generated previously by both quantitative (Bowden *et al*., 2020) and qualitative (Scantlebury *et al*., 2014) studies, suggests that these responses do indeed reflect owners' true approach

to colic. Nevertheless, further exploration of owner decision-making is required in order to identify potential barriers to prompt veterinary treatment.

When asked what they would do whilst waiting for a vet to arrive, the majority of participants would choose to walk the horse in both scenario one (46%) and two (48%), which is similar to the findings published by Scantlebury *et al*., (2014). Walking a horse with colic is a common practice amongst the horse owning population, with the belief that allowing a horse to roll may cause the intestinal tract to 'twist' and potentially increase the need for surgery or euthanasia. Despite a lack of scientific evidence to support this claim, many owners will attempt to prevent a horse from rolling through continuous walking or lunging, which may have serious implications for both owner and horse safety. Although some presentations of colic warrant the application of controlled exercise in order to resolve symptoms (Abutarbush *et al*., 2005, Fultz *et al*., 2013, Hardy *et al*., 2000), this should only be performed if instructed to do so and under the direct supervision of a veterinary practitioner. Inappropriate exercise prior to veterinary diagnosis could put severe strain on an already compromised cardiovascular system (Proudman *et al*., 2006, Cook and Hassel, 2014) and potentially impact upon a horse's chances of survival or treatment options. Therefore, it is essential that owners are provided with appropriate advice from their veterinary practice. Additionally, it is widely acknowledged that owner knowledge is often formed in a social

context, such as livery yards, and frequently based on lay sources of information (Hockenhull *et al*., 2010, Visser and Van Wijk-Jansen, 2012, Buckley *et al*., 2004, Hockenhull and Creighton, 2013). Therefore, further research is required to identify beliefs that could have a negative impact on an owner's approach to colic.

The 'REACT' campaign targets knowledge gaps, particularly the understanding of 'normal' health values and early recognition of colic, originally identified in the study by Bowden *et al.* (2015), which was subsequently published in 2020 (Bowden *et al*., 2020). The results from the present study show that both owner knowledge of these areas and engagement / adoption of recommendations designed to improve understanding is still varied. This could potentially mean that the desired behavioural change, that being a proactive approach to colic through emergency preparedness, is not being elicited. These findings are similar to those reported by Dombrowski *et al*., (2015) when evaluating the impact of the 'Act FAST' campaign on recognition and response to stroke symptoms. Although the same population was examined both pre and post resources introduction, which is in contrast to this study, Dombrowski *et al.,* concluded that despite higher levels of campaign recall, those who had received campaign resources were no better at recognising or responding to stroke symptoms when compared to those with no knowledge of the campaign. A number of factors which could explain the lack of knowledge translation were considered by the authors and could be applied to the 'REACT' campaign. Firstly,

congruent with previous evidence exploring public health interventions (Bray *et al*., 2015, Hodgson *et al*., 2009, Lecouturier *et al*., 2010), it was suggested that campaign awareness alone is not sufficient to facilitate behavioural change. This could explain why those with awareness of the 'REACT' campaign reported both low levels of resource engagement and perceived personal impact of resource information. Dombrowski *et al*., (2015) also suggested that a poor understanding of the campaign message, coupled with many perceiving the information as not relevant to them, may have been a significant barrier to knowledge transfer. The 'REACT' campaign aims to encourage owners to plan for a potential colic emergency, thus reducing potential delays in decision-making if colic were to occur. It also strives to improve owner knowledge of colic in the hope that a sound understanding of this disease could assist in early recognition and help seeking behaviour. However, the results from the present study could indicate that the campaigns central message of emergency preparedness is not being understood by the target audience, perhaps due to the vast amount of information and varied topics covered. Additionally, it could be theorised that some horse owners may not perceive themselves as 'at-risk' of colic or in need of an emergency plan, which would explain the high number of participants who felt the campaign had not impacted upon their approach. Taking these factors into consideration, a more targeted message, tailored to owner experience and perceived risk of colic, could potentially enhance knowledge uptake. However, evidence has suggested that factors other than knowledge of a specific disease

can affect how an individual responds to symptoms. For example, lay knowledge, interpretation of signs and emotional response, have all been suggested as potential factors that could affect an individual's approach to disease recognition (Desai and Potter, 2013, Dombrowski *et al*., 2012, Hodgson *et al*., 2009). Therefore, it is recommended that potential barriers to knowledge transfer should be targeted alongside a campaigns key message. Considering this information, the present study has identified a variety of potential influences, such as qualification level and prior experience, which could affect interpretation of normal and abnormal equine health. Additionally, it could be theorised that these factors could have a significant bearing on campaign engagement as, for example, those who may have prior experience of colic or covered this topic within an equestrian qualification, may feel the campaign is not relevant to them. Therefore, further research investigating horse owners' intention to adopt 'REACT' recommendations, and the identification of potential barriers to this process, is warranted.

4.5.4 Recommendations for future work

Rapid decision-making is vital to ensure equine welfare is not compromised during episodes of colic. Yet, the results of this study have identified that owner knowledge and approach to colic is still varied, despite a nationwide campaign designed to enhance owner understanding of this topic. Though disappointing, this research study

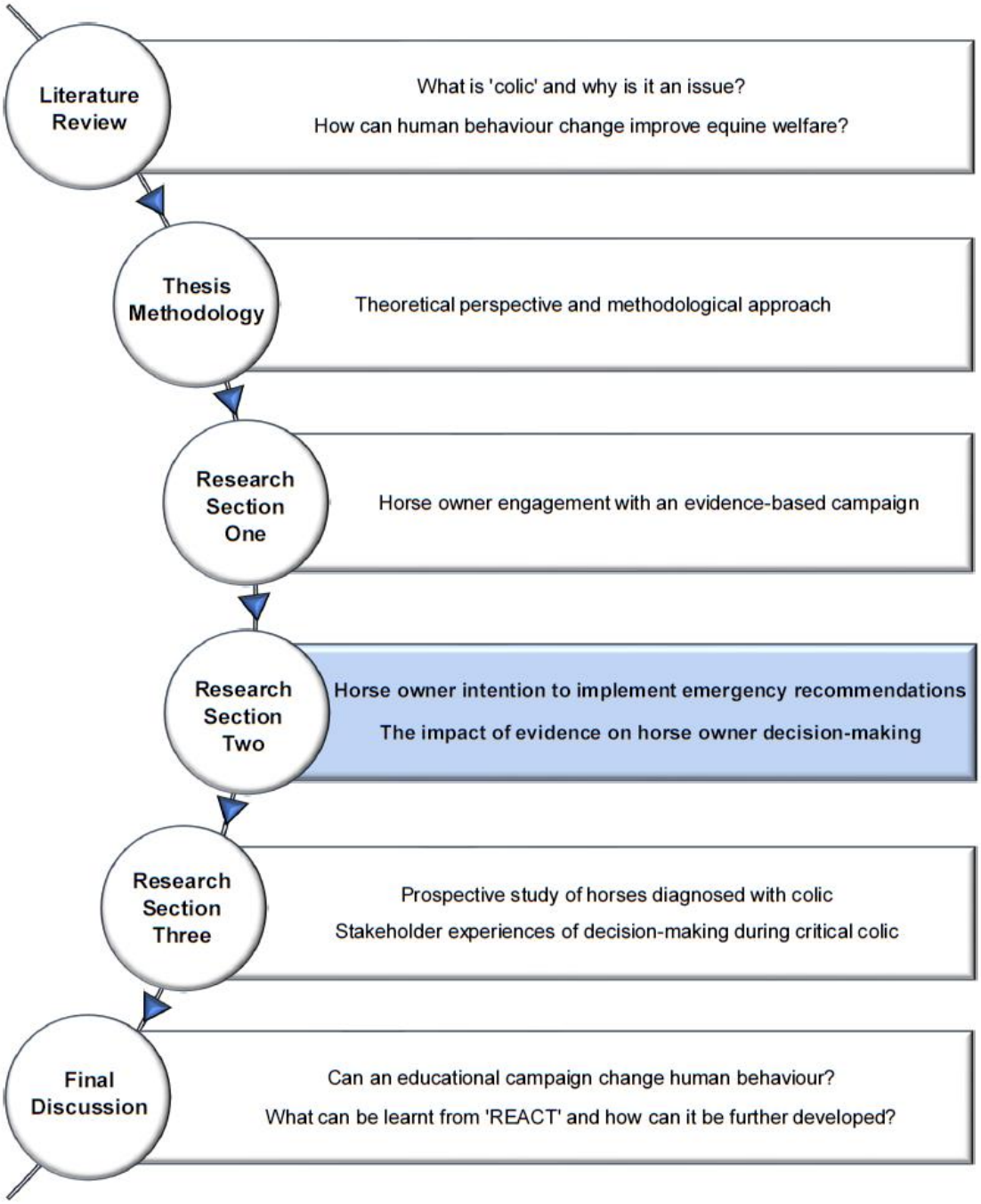
has identified areas in which this, and other campaigns, could be improved in order to elicit the desired behavioural change.

In line with current evidence on human behaviour, this study has shown that campaign awareness alone is not sufficient to facilitate behaviour change. Additionally, it has highlighted that the provision of evidence-based knowledge has done little to improve horse owners' understanding and subsequent approach to a potential colic emergency. Therefore, further investigation is required to identify the barriers which may be influencing the uptake of evidence within the equestrian community. Congruent with the aforementioned findings, low engagement with campaign resources, perhaps due to some horse owners perceiving the campaign as irrelevant to them, was a further concern raised by this study. To address this barrier to behaviour change, campaign messages should be stage-matched to owners' current beliefs, attitudes, and abilities. For example, owners who feel they are well prepared to react to colic should be prompted to review their current plans in line with current 'REACT' advice, whereas those who feel changing their behaviour would be too difficult should be directed to resources or educational events that will provide initial encouragement and support. However, further research focusing on ascertaining current horse owner beliefs and practices associated with colic and emergency preparation is required.

4.6 Conclusion

There is currently no published evidence on the success of existing educational campaigns within the veterinary industry. This is the first study to assess owner engagement with a campaign designed to improve horse owners' knowledge and approach to colic. Understanding of both normal equine health and signs indicative of colic remains varied amongst horse owners, with campaign awareness eliciting little change. The study findings indicate that awareness alone is not sufficient to change behaviour and highlights the need for regular campaign assessment and development. Strategies should focus on ensuring the relevance of a campaigns message is conveyed to all members of the target population. Further research is required to identify potential barriers to behaviour change associated with colic.

Research Section Two



Chapter 5: Use of human behaviour change models to investigate horse owner intention to adopt emergency recommendations

5.1 Introduction

Emergency events, though transient in nature, often occur unexpectedly with varying degrees of severity. A rapid and efficient response from those involved is required to minimise long-term effects (Alexander *et al*., 2003). To achieve this, those at risk must prepare to counteract potential threats in advance.

Medical emergencies are common in veterinary practice across all species. They can be defined as situations where immediate and appropriate medical attention is needed to avoid long term problems or death (Matthews, 2006). Although veterinary personnel are trained to manage cases of this nature, patient outcome will also rely on the owner's ability to recognise a potential emergency and respond accordingly (Williams *et al*., 2017).

Early recognition and rapid decision-making are essential during cases of colic in order to maximise survival (Proudman *et al*., 2002a); however, despite colic being a frequent equine emergency (Bowden *et al*., 2017), there are significant gaps in knowledge (Bowden *et al*., 2020) and a varied approach to management (Scantlebury *et al*., 2014) within the horse owning population. To address these issues, the

‘REACT Now to Beat Colic’ campaign was launched by industry stakeholders in 2016 (Burford *et al*., 2017). As previously described, this initiative aimed to enhance owner knowledge of colic and encourage them to adopt a proactive approach through the development of a provisional emergency plan. Yet, despite wide scale dissemination and promotion, the first study in this thesis (Chapter Four) suggests that owner engagement with campaign resources is low.

Currently there is limited evidence exploring horse owner intention to adopt emergency recommendations, with the majority of published literature focusing on evacuation planning in the event of a natural disaster (Thompson *et al*., 2018) or the implementation of biosecurity measures (Wiethoelter *et al*., 2017). In the health psychology sector, socio-cognitive models have been utilised to investigate decision-making processes and attitudes associated with behavioural intentions. For example, disaster preparedness (Mulilis, 1990), intention to seek support for eating-disorders (Akey *et al*., 2013) and condom use (Montanaro and Bryan, 2014) have all been explored through the application of various behavioural paradigms, such as the Protection Motivation Theory (Rogers, 1975) or the Health Behaviour Model (Janz and Becker, 1984). The Trans-Theoretical Model (TTM) (Figure 5-1) of behaviour change (Prochaska, 1982) is a framework that has often been employed by those developing health related campaigns (Alahuhta *et al*., 2011, Schultz, 2007, Wagner *et al*., 2004).

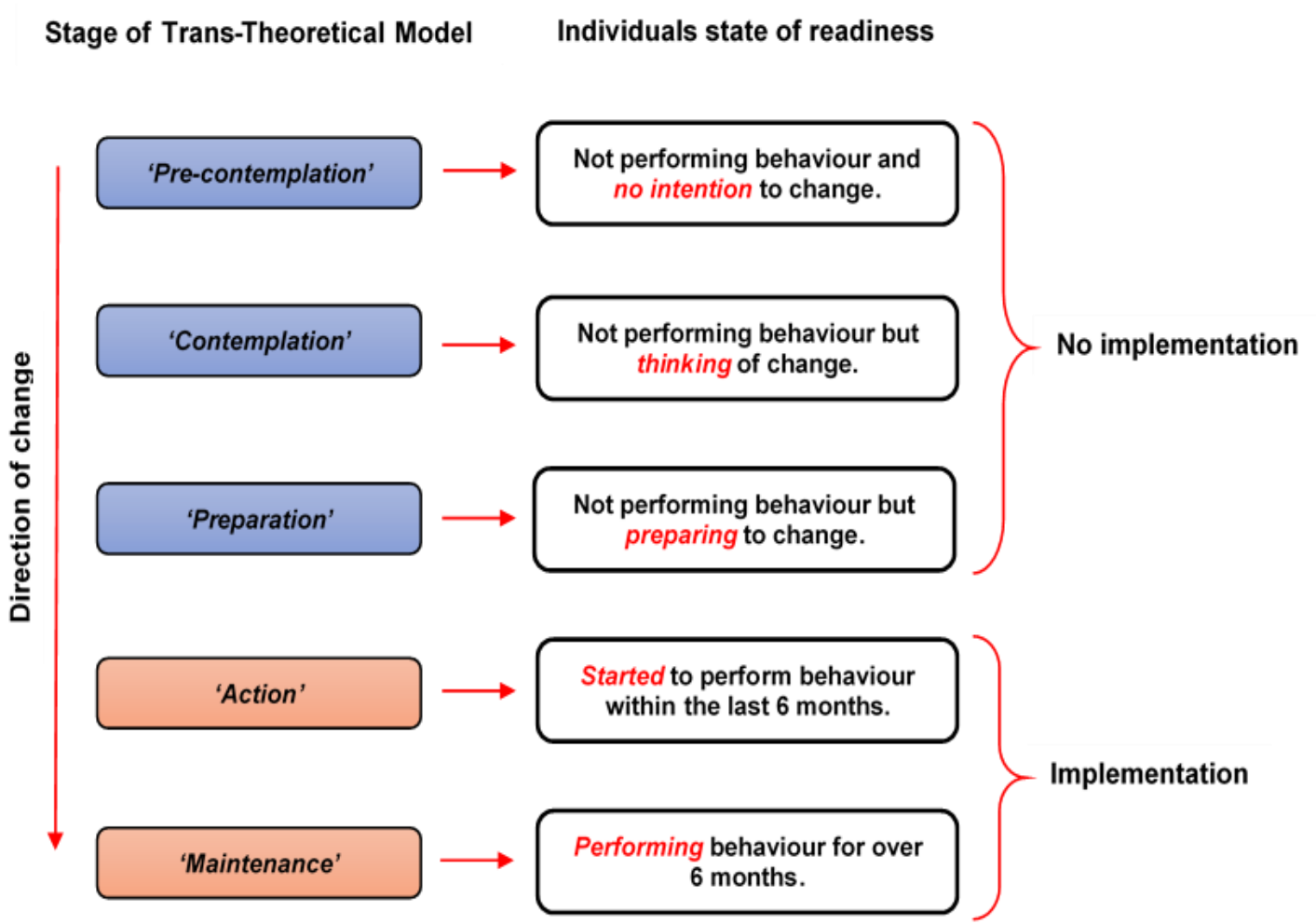


Figure 5-1: The five stages of the Trans-Theoretical Model (TTM) of behaviour change and corresponding states of individual readiness (adapted from Prochaska and DiClemente,1982).

The theory posits that change occurs in five stages and in order to elicit the desired behavioural change (e.g. implementation of campaign recommendations), interventions must stage-match guidance according to an individual's current state of readiness.

In order to successfully modify behaviour, potential barriers to change must first be identified. To achieve this, the TTM has often been paired with a second theoretical framework: The Theory of Planned Behaviour (TPB) (Ajzen, 1991a). This concept suggests that intention to carry out a specific behaviour can be influenced by three factors: attitude towards the behaviour (*behavioural beliefs*), social influences (*normative beliefs*) and a person's confidence in performing the behaviour (*control beliefs*).

5.2 Aim and objectives

The aim of this study was to investigate UK horse owners' attitudes and practices associated with planning for a potential colic emergency through the application of two behavioural models: The Trans-Theoretical Model of behaviour change and the Theory of Planned Behaviour.

The objectives of this study were:

- To describe horse owners' current attitudes and practices associated with emergency planning.
- To ascertain horse owners' experience of colic and concern about future episodes.
- To evaluate the importance of various factors on owner decision-making in the event of critical illness.
- To identify factors associated with owner intention to implement emergency planning recommendations suggested by the 'REACT' campaign.

5.3 Materials and methods

5.3.1 Sample population

The target population for the study were individuals who owned, or cared for, one or more equids. All horse owners/significant care givers, residing within the United Kingdom (UK) were included within the sampling frame. Owners of all equestrian discipline and ability were included. Owners/carers were required to be 18 years old or over in order to participate. Participants were recruited using a snowball sampling strategy, through regular promotion on social media sites frequented by horse owners and advertisement by equine veterinary professionals.

The number of individual horse owners within the UK is currently unknown however, figures published by the British Equestrian Trade Association (BETA) in 2015 suggest that there are an estimated 446, 000 horse owning households. Based on this information, a required sample size of 384 participants, 5% margin of error, 95% confidence and 50% response rate, was calculated (www.raosoft.com/samplesize.html).

5.3.2 Survey development

The questionnaire was developed using the 'Online Surveys' tool (Jisc, Bristol, UK). A study introduction and compulsory consent page, which complied with data protection requirements, were included at the start of the survey. A question on future study participation (Chapter Eight) was also present at the beginning and end of the survey. The main body of the questionnaire was divided into four sections: participant demographics, planning for a colic emergency, experience of colic and awareness of the 'REACT Now to Beat Colic' campaign (Table 5-1). Survey logic was applied to question nine to ensure only participants who currently owned, or cared for, an equid progressed onto section two. Those without horse ownership or involvement were directed to a 'thank you' page and then to the final survey page. Logic was also applied to question 17, in order to direct participants to a question set relevant to their experience of colic within section three, and questions 21, 29 and 38 to ensure questions within section four were relevant to participants' awareness of the 'REACT' campaign.

To investigate participants' intention to implement emergency recommendations, section two ('Preparing for a Colic Emergency') of the survey contained questions developed using the Trans-Theoretical Model (TTM) of behaviour change (Prochaska, 1982). Recommendations associated with three areas of emergency colic planning, prevention/early recognition of symptoms, involvement of others, and personal preparation, were selected from educational

resources produced by the ‘REACT Now to Beat Colic’ campaign (Burford *et al*., 2017). Chosen recommendations were required to be maintainable by participants over an extended period of time (e.g. weekly monitoring of heart rate vs. changing feed gradually when needed). Selected recommendations were incorporated into 15 Likert-type questions, based on those used by Richens *et al*., (2018), each accompanied by a single-choice tick box relating to one of five TTM statements, 1 = I do not do this and have no plans to start doing so, 2 = I do not do this, but I am thinking of doing this in the near future, 3 = I do not do this, but I am preparing to do so in the next month, 4 = I started doing this within the last 6 months, 5 = I already do this and have done so for over 6 months. Potential behavioural and social influences on participants’ intention to implement emergency recommendations were explored using the Theory of Planned Behaviour (TPB) (Ajzen, 1991a). Twenty-one statements associated with three components defined by the TPB, behavioural, control and normative beliefs, were created using previous evidence investigating horse owners’ views on colic recognition and approach (Bowden *et al*., 2020, Scantlebury *et al*., 2014, Yeoman *et al*., 2017), intention to implement biosecurity measures (Schemann *et al*., 2012, Wiethoelter *et al*., 2017) and equine welfare (Hemsworth *et al*., 2015, Ireland *et al*., 2012, Ireland *et al*., 2013, Pearson, 2003). A five-point Likert scale was used to measure participants agreement to each statement: 1 = strongly disagree, 2 = disagree, 3 = neither disagree nor agree, 4 = agree, 5 = strongly agree.

A short introduction to each section was provided, including a definition of emergency decision making: *'deciding what veterinary treatments the horse in their care should receive or if euthanasia is required'*; and emergency planning: '*any measure used to aid early recognition and rapid decision making in the event of a serious, unexpected episode of equine colic*'. The initial survey design was reviewed by three veterinary surgeons, two equine and one small animal, prior to being piloted.

5.3.3 Pilot survey

The survey was piloted by seven horse owners, two equine veterinary nurses and three veterinary surgeons (two equine and one small animal). Collection of pilot data was performed by E. Frost, a third year veterinary student studying at the School of Veterinary Medicine and Science. Corrections (Appendix VII) were performed and ethical approval for the final survey design (Table 5-1) was gained from the University of Nottingham's School of Veterinary Medicine and Science Ethics Committee prior to survey dissemination to the general public.

Table 5-1: Question types and topics included within the final version of a survey investigating horse owner intention to adopt emergency recommendations.

Survey Section	Question	Question Type
Participant Consent	**1) If you agree to participate within this survey, please complete the following consent questions.**	Closed with pre-defined, single choice answers
Future study participation	**2) Would you be interested in participating in a future telephone interview about your experience of colic?** ** Sub-question if previous answer 'Yes' – Please enter the best email address to contact you on below*	Closed with pre-defined, single choice answers
Section 1: *'Your Equestrian Involvement'*	**3) If you are happy to do so, please tell us your gender.**	Closed with pre-defined, single choice answers
	4) If you are happy to do so, please tell us your age.	Closed with free-text box
	5) Do you live within the United Kingdom? * ****** Sub-question if previous answer 'Yes' – Please provide the first part of your residential postcode.*	Closed with pre-defined, single choice answers Closed with free-text box
	6) How long have you been involved with the care of horses for?	Closed with free-text box

Section 1: *'Your Equestrian Involvement (Cont.)'*	**7) Do you hold any of the following formal UK equestrian qualifications?**	Closed with pre-defined, multiple choice answers
	8) Are you affiliated with, or a member of, any of the following equestrian associations / societies?	Closed with pre-defined, multiple choice answers
	9) Which of the following statements BEST describes your current horse ownership and role in emergency decision making? *	Closed with pre-defined, single choice answers
	***** *Various sub-questions relating to indicated level of horse ownership, including number of horses owned, regular equestrian activities undertaken and relationship to unowned horses in participants care*	Varied – Closed with pre-defined, multiple choice answers and open with free-text box.
	10) Is there anything else you would like us to know about your current horse ownership or role in emergency decision making?	Open with free-text box
	11) Did you hear about this survey through your local veterinary practice? *	Closed with pre-defined, single choice answers
	***** *Sub-question if previous answer 'Yes' – Please provide the name of your veterinary practice below*	Closed with free-text box

Section 2: *'Preparing for a colic emergency'*	**12) Which of the following health care measures do you currently perform for the horse/s you own/care for? *** ***** *Listed 'measures' relate to 'REACT' recommendations for prevention, or early recognition, of colic*	Likert-type scale with single choice tick boxes relating to five TTM statements
	13) If your horse developed colic and you needed to be contacted in an emergency, which of the following pieces of information have you shared with those in close contact with your horse? ***** *Listed 'information' relates to 'REACT' recommendations designed involve others*	
	14) Which of the following steps do you have in place to help you prepare for a potential colic emergency, in which the horse that you own/care for required further medical or surgical treatment at an equine hospital? ***** *Listed 'steps' relate to 'REACT' recommendations designed to aid personal preparation*	Likert-type scale with single choice tick boxes relating to five TTM statements
	The following statements * refer to…: **15) 'the recognition and management of colic'.** **16) 'the development and use of an emergency colic plan'.** **17) 'people who may be involved in emergency colic plans and preventative measures'.** **…Thinking about you and your horse, we would like to know to what extent you agree or disagree with each statement.** ***** *Listed 'statement' relate to three components as defined by the TPB*	Five point Likert scale with single choice tick boxes

Section 2: *'Preparing for a colic emergency (Cont.)'*	**18) Which of the following statements BEST describes your personal experience of equine colic?** ***** *Logic applied to answers to direct participants to relevant colic experience questions in Section 3*	Closed with pre-defined, single choice answers
Section 3: *'Your Experience of Colic'*	**19 / 26 / 36) Which of the following statements BEST describes where you currently keep the horse/s you own/care for?**	Closed with pre-defined, single choice answers
	20 / 27 / 37) Thinking about what you current know about colic, where did this knowledge come from?	Closed with pre-defined, multiple choice answers
	21 / 28 / 38) How interested are you in information about colic and the development of an emergency colic plan?	Closed with pre-defined, single choice answers
	22 / 29 / 39) How concerned are you that the horse/s you currently own/care for may develop colic in the future?	Closed with pre-defined, single choice answers
	23 / 30 / 40) If the horse/s you own/care for did develop colic in the future, how prepared to make emergency decisions do you feel you are?	Closed with pre-defined, single choice answers

Section 3: *'Your Experience of Colic' (Cont.)*	**24 / 34 / 44) If your horse was to become critically ill with colic in the future, how important, on a scale of 0 (not important) to 10 (very important), would each of the following factors be on your decision to pursue referral treatment?**	Closed with pre-defined answers using scale of 0-10
	**** Questions presented to participants who had either witnessed or personally managed a horse with colic only ****	
	31 / 41) How many times have you witnessed another horse owner / personally managed a horse with colic?	Open with free-text box
	32 / 42) How long ago was the most recent episode of colic you witnessed / personally managed?	Closed with pre-defined, single choice answers
	33 / 43) Which of the following BEST describes what happened to the / your horse during the most recent episode of colic you witnessed / personally managed?	Closed with pre-defined, single choice answers
	34 / 43) Which of the following BEST describes what happened to your / the horse during your / the most recent episode of colic?	Closed with pre-defined, single choice answers
	25 / 35 / 45) Have you heard of the 'REACT Now to Beat Colic' campaign?	Closed with pre-defined, single choice answers

	**** Question presented to participants with no knowledge of the 'REACT Now to Beat Colic' campaign only ****	
	46) If you wanted to know more about colic, where would you MAINLY go to seek advice?	Closed with pre-defined, single choice answers
	**** Question presented to participants with knowledge of the 'REACT Now to Beat Colic' campaign only ****	
Section 4: *'The 'REACT Now to Beat Colic' Campaign'*	**40) Have you read any of the information / resources provided by the 'REACT' campaign? ***	Closed with pre-defined, single choice answers
	** Sub-question if previous answer 'No' – Why do you think you have not read any of the information provided by the campaign?*	Open with free-text-box
	**Sub-questions if previous answer 'Yes' – Have you actively used any of the resources, or implemented any of the REACT recommendations, in regard to emergency planning in case your horse developed colic?*	Closed with pre-defined, single choice answers
	Further question if previous answer 'No' - Please tell us a little more about why you have NOT found this information useful.	Open with free-text-box
Future study participation	**48) Are you still interested in participating in a telephone interview?**	Closed with pre-defined, single choice answers

5.3.4 Survey dissemination

Data was collected over a four week time period, between 4th October and 2nd November 2018. Survey dissemination and promotion was conducted by the lead author (KL), with assistance from E. Frost. The survey was advertised twice weekly on social media platforms (Facebook and Twitter) using the research group profile the 'Nottingham Equine Colic Project'. The link was also posted on 38 other horse-related social media pages, including regional riding clubs and equine discussion forums. Additionally, members of the public who either shared or commented on research posts were personally thanked or responded to by the principle researcher, in order to encourage further study engagement. An email containing survey details was sent to 766 UK equine veterinary establishments, identified using the 'equine' filter on the RCVS 'Find a Vet' online tool, requesting them to distribute to clients. A follow-up email was sent two weeks post initial contact.

5.3.5 Data management

Data were imported directly from the 'Online Surveys' (Jisc, Bristol, UK) platform into an Excel spreadsheet (Microsoft Office 2013, Microsoft) for data cleaning. Results were updated and saved on a weekly basis. Data was stored on password encrypted software and accessed only by the principle researcher involved in the study.

5.3.6 Data analysis

5.3.6.1 Descriptive analysis

Exploratory descriptive analyses were performed on preliminary data. The mean, median and range were calculated for continuous data, such as participant age and number of horses owned. Normality of distribution was determined using histograms. Non-parametric data was reported as the median (range). Frequency percentages and mode values were calculated for categorical data, with optional free-text responses associated with the pre-defined answer of '*other*' being reviewed and grouped where appropriate into either existing or new answer categories. Answers which specifically requested a free-text answer were reviewed individually, categorised and ranked based on frequency of occurrence.

5.3.6.2 Statistical analysis

Statistical analysis was performed using Microsoft Office Excel (Microsoft, 2013) and SPSS Version 25 (IBM Corp. 2017). Following preliminary analysis, explanatory variables were grouped to create binary outcomes (Appendix VIII) and converted into the appropriate format to allow for statistical analysis. Correlations between explanatory variables were explored using Kendall's Tau for continuous variables and Chi-squared testing for categorical variables. Associations between categorical and continuous variables were investigated using Mann-Whitney U testing.

Statements relating to the TPB were grouped based on which model component (behavioural, control or normative belief) they reflected. To ensure internal reliability of questions was adequate, a Cronbach's Alpha Coefficient was calculated for each of the three TPB groups. An alpha score of 0.7 or above was considered to show acceptable reliability (Nunnally, 1994). If the alpha score has acceptable reliability, a mean score for each participant was calculated for each TPB group. If the score did not have acceptable reliability, each statement within the corresponding TPB group was considered individually throughout statistical analysis.

Preliminary analysis indicated that responses to TTM statements were not normally distributed. Therefore, based on the approach described by Richens *et al*. (2018), answers were dichotomised to represent TTM stages 1-3 (no implementation) and 4-5 (implementation). A modal participant score was then calculated for each emergency planning recommendation (prevention and recognition, involving others and personal preparation) to create a single outcome variable. Participants were assigned a score of either 1 (no implementation) or 2 (implementation) which reflected their intention to undertake each recommendation.

The association between explanatory variables and the dependent dichotomous variable (implemented vs. not implemented) was explored using logistic regression. Univariable analysis was conducted to identify covariates for inclusion and eliminate potential multi-collinearity within

the final models. In order to ensure meaningful predictor variables were not overlooked, a $p<0.25$ was used as the threshold to screen for evidence of association (Du and Tan, 2015). A final multivariable model was constructed in a backwards stepwise fashion. The Likelihood Ratio Test was assessed during each model iteration to determine the effect of variable removal with the variable excluded if the model was significantly improved. To validate the model's ability to differentiate between the binary outcomes when compared to the baseline model, the chi-square Omnibus goodness of fit test and Hosmer and Lemeshow analysis were used to assess the model fit. P-values less than 0.05 were considered statistically significantly.

5.4 **Results**

5.4.1 Survey engagement

The survey was accessed 3255 times between 4th October and 3rd November 2018. A large proportion of those engaging with the survey (63%, 2039 / 3255) progressed no further than the '*Welcome*' information page. One-thousand and eighty-two respondents provided consent to participate, however 33% (357 / 1082) did not reach the end of the survey in order to submit their responses. The majority (80%, 580 / 725) of completed responses were received during the first week of data collection. Following preliminary analysis, 24 respondents were excluded due to lack of current horse ownership (n = 7) or non-UK status (n=17). Subsequently, a total of 701 participants were eligible for inclusion within the final dataset (Figure 5-4). Eleven submissions were partially completed therefore, the total number of responses is reported for each question (n=).

5.4.2 Participant demographics

The majority of participants were females (98%, 684/700) and had a median age of 36 years old (range, 18-72; 697/701). A range of UK regions were represented (Figure 5-5), with the majority (23%, 160/698) of participants residing within the East of England. Length of equestrian involvement varied between respondents (median 20 years, range, 1-60), with most (38%, 260/694) having between 11 and 20 years equine experience. At least one formal UK equestrian qualification was held by 50% (346/690) of participants, with awards

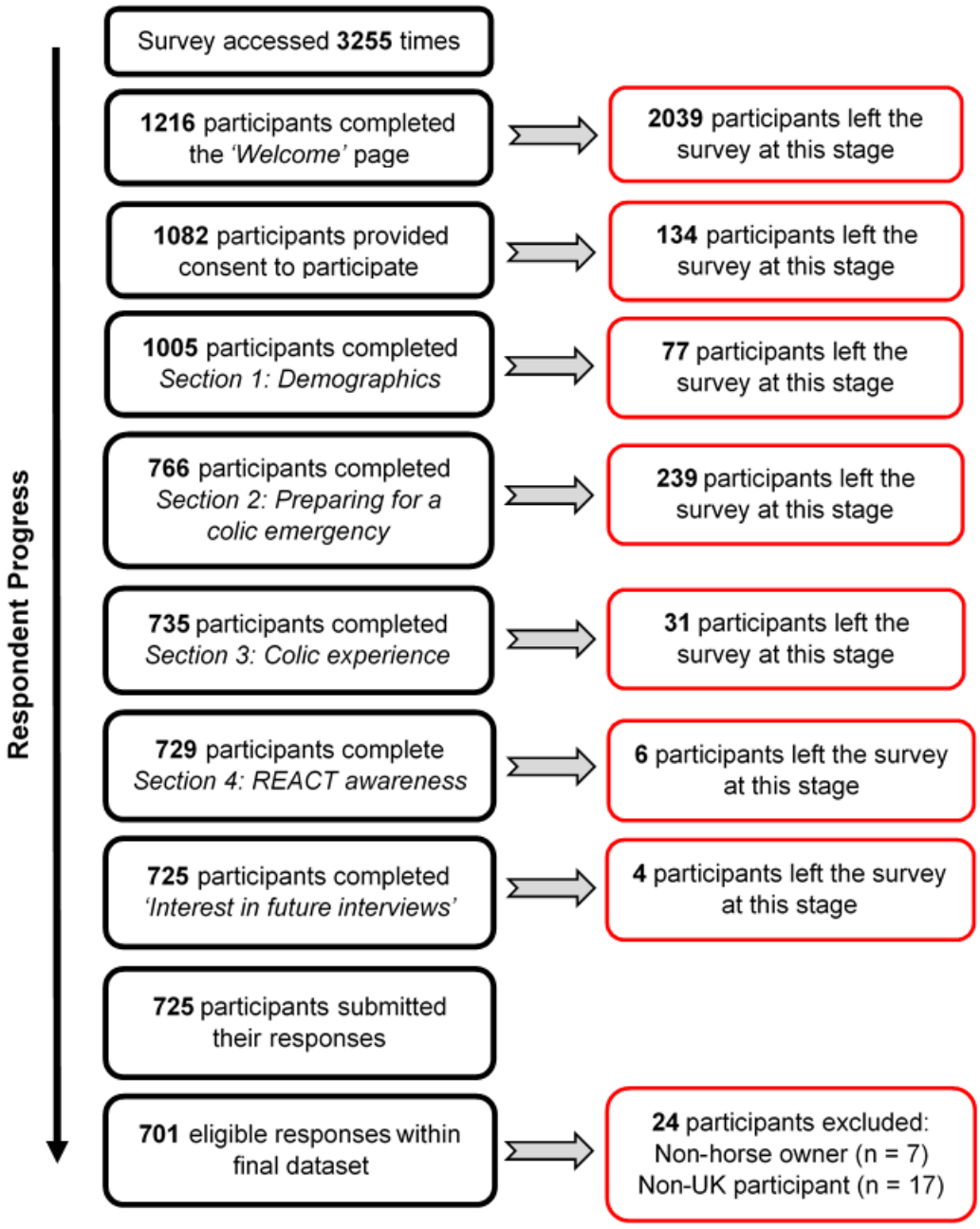


Figure 5-2: Flow-diagram illustrating respondent progress during online completion and preliminary data analysis of a survey investigating horse owner intention to adopt emergency recommendations.

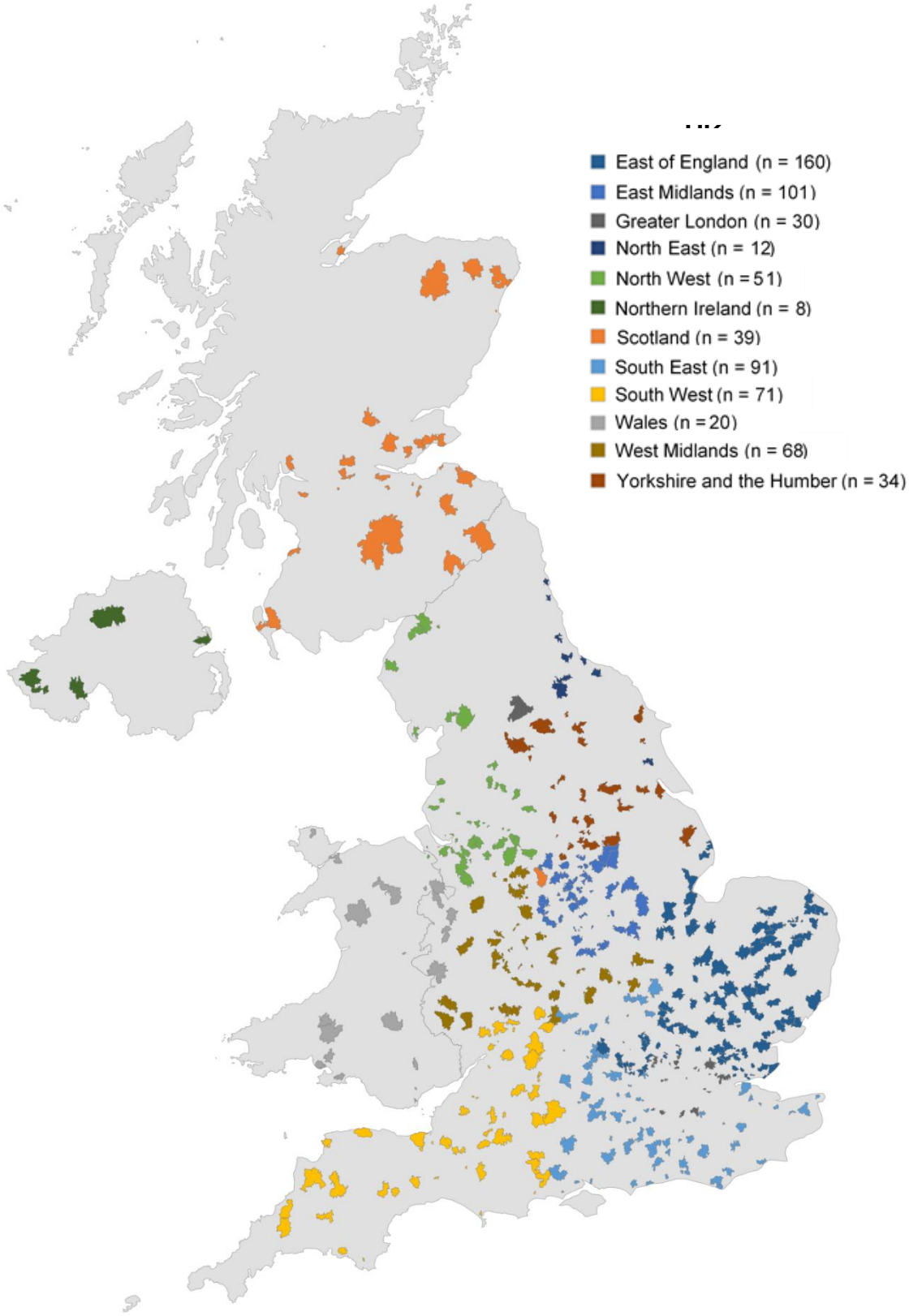


Figure 5-3: Map-chart displaying the range of UK locations represented by survey participants (n=698) completing an online survey investigating horse owner intention to adopt emergency recommendations.

provided by The British Horse Society (BHS) being most represented (63%, 217/346). Additionally, of those who were currently affiliated with a UK equestrian society or association (480/690), most (47%, 225/480) were BHS members.

Ninety-three percent (633/696) of participants currently owned a median of two horses (range, 1-30), with the majority (66%, 464/700) being managed at a commercial yard or on private land with other owners' horses. Of those who had responsibility for a horse they did not own (52/696), a large proportion cared for the horse as part of a loan (38%, 19/50) or share (26%, 13/50) agreement. Further information relating to horse ownership was provided by 166 participants, with the majority (71%, 118/166) of responses referring directly to decision making in the event of an emergency; 76% (90/118) either had a role in decision making for another owners' horse (n=45) or shared the responsibility of decision making with a family member or friend (n=45).

5.4.3 Colic experience and knowledge

The majority (78%, 543/701) of participants had direct personal experience of managing a median of two (range, 1–50) colic episodes involving a horse that they owned. Eighteen percent (128/701) of respondents had no personal experience but had witnessed another owner manage a horse with this condition. Four percent (30/701) of participants had no colic experience at all. The most recent episode of colic witnessed (48%, 61/128) or personally managed (59%, 317/539)

by participants had occurred over 12 months prior to survey completion. Resolution of clinical signs following veterinary treatment at the yard was reported for the majority of witnessed (52%, 66/126) and personally managed (48%, 247/510) colic episodes (Figure 5-6). Of those with direct experience, 25% (128/510) had pursued referral treatment, with 77% of horses surviving medical (n=47) or surgical (n=51) intervention. Euthanasia or death following referral to an equine hospital was reported by 23% (30/128) of participants. Seventeen percent of participants indicated that their horse was euthanised at the yard without further investigation or treatment. Cases in which horses owned by someone else required referral treatment or euthanasia had been witnessed by 27% (34/126) and 24% (30/126) of participants, respectively. Of those resulting in euthanasia, 63% (19/30) of cases were experienced at the owner's premises. Direct experience of colic (67%, 472 / 701) and information provided by veterinary professionals (63%, 442 / 701) were the main sources of participants' colic knowledge. Knowledge gained through the completion of equestrian qualifications (28%, 199/701) or information provided by equestrian associations / societies (13%, 91/701) were least reported. Awareness of the 'REACT Now to Beat Colic' campaign was indicated by 20% (140/701) of survey participants. Of these, 89% (124/140) of respondents had read resources provided by the project, with 44% (54/124) actively using them (Appendix IX). Of those who were not aware of this initiative (n=561), 58% would seek further information about colic from their veterinary surgeon.

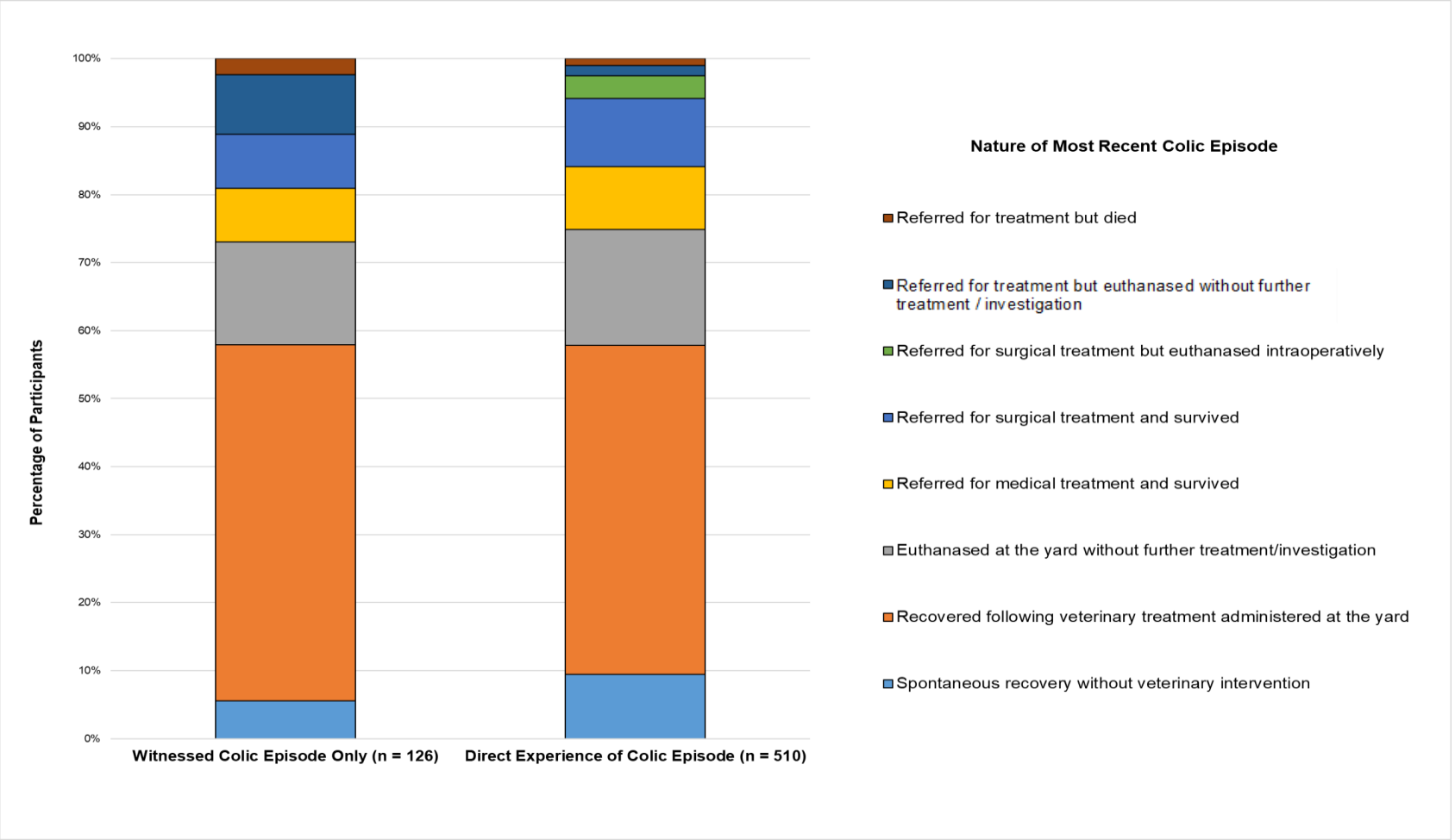


Figure 5-4: Stacked bar chart displaying the nature of participants most recently witnessed (n = 126) or personally managed (n = 510) colic episode in an online survey investigating horse owner intention to adopt emergency recommendations.

5.4.4 Planning for a colic emergency

Participants varied in how concerned they were about colic, with most (35%, 246/701) being ‘somewhat / a little’ concerned that their horse would develop colic in the future. When asked how prepared they felt to make emergency decisions if their horse developed a critical colic condition, 50% (352/701) of respondents felt ‘extremely / very’ prepared. A large proportion of the participants (98%; 681/697) would be interested in resources which helped them develop an emergency plan.

5.4.4.1 Implementation of ‘REACT’ recommendations

Implementation of ‘REACT’ recommendations varied between participants (Figure 5-7). The majority of respondents did not measure, and had no intention to start measuring, their horse’s temperature (72%, 503/695), heart (74%, 516/695) or respiratory rate (72%, 499/693) on a weekly basis. Annual dental examinations (97%, 678/699) and regular faecal worm egg counts (57%, 369/692) were already being performed by the majority of participants.

The majority of participants were already implementing recommendations on their personal preparation for a colic emergency prior to survey completion (Figure 5-8). Most (65%, 443/687) had had access to equine transport participants for at least 6 months. However, 36% (242 / 680) of respondents had no intention to identify a list of reputable equine transport companies in case of an emergency. A

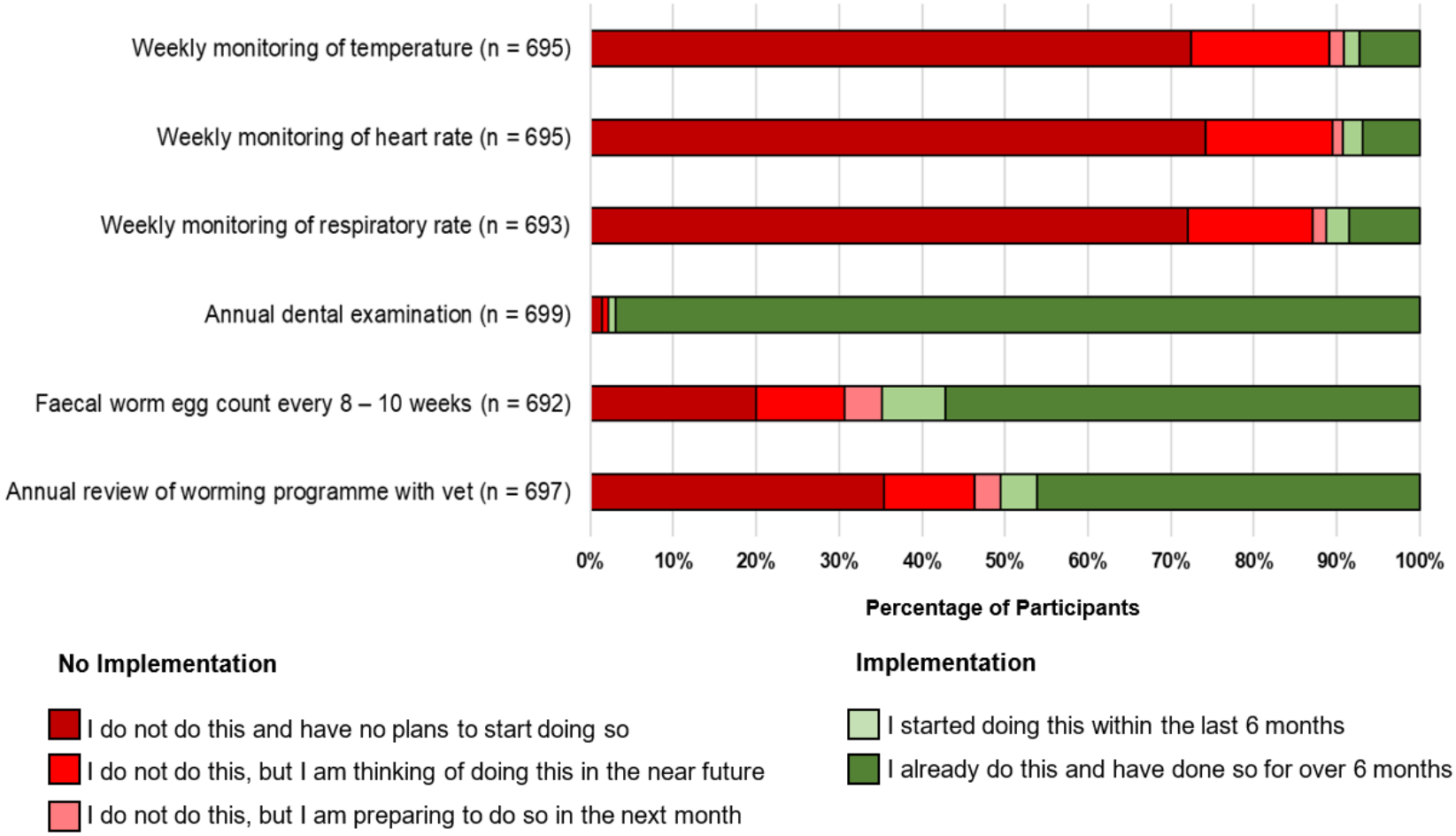


Figure 5-5: Stacked bar chart displaying participants' intention to implement measures designed to either prevent colic or aid in the recognition of early symptoms in an online survey investigating horse owner intention to adopt emergency recommendations.

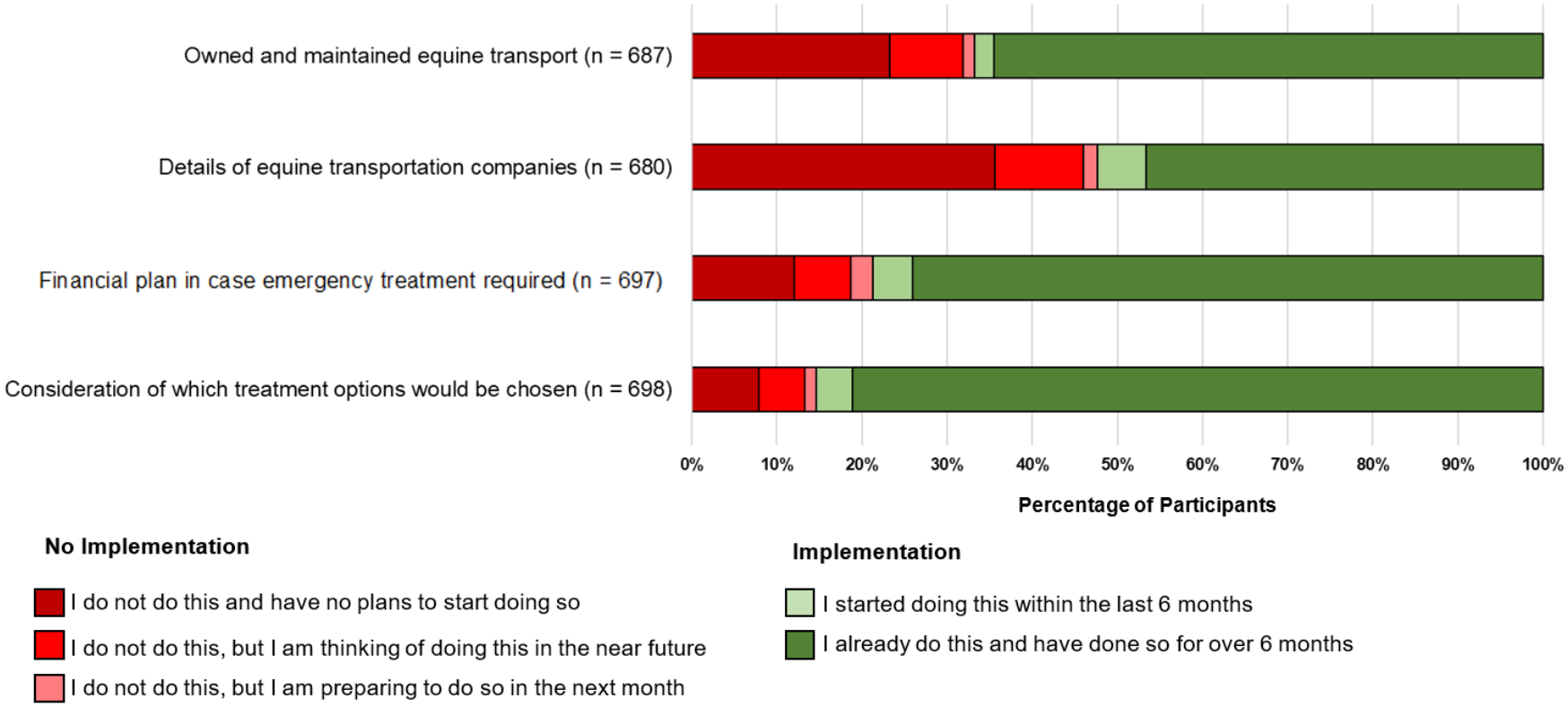


Figure 5-6: Stacked bar chart displaying participants' intention to implement measures designed to aid their personal preparation for a potential colic emergency, in an online survey investigating horse owner intention to adopt emergency recommendations.

financial plan, including insurance, was already held by 79% (549 / 697) of participants, with 81% (566 / 698) having already considered what treatment option they would choose for critical cases.

Recommendations designed to involve others, in order to minimise treatment delays, were being implemented by the majority of survey participants (Figure 5-9). These included sharing their emergency contact details (95%, 665/698), veterinary practice details (92%, 645/698) and an alternative contact person (88%, 609/694) with others involved in the care of their horse (i.e. yard manager) for over six months. Forty-two percent (289/695) of participants had not provided others with details of their preferred treatment or euthanasia options in the event they were unavailable during an emergency.

5.4.4.2 Beliefs associated with emergency planning

Sixty-six percent (460/701) of respondents disagreed with the statement *'it is inevitable that my horse will develop colic and require emergency veterinary treatment'* (Figure 5-10). The majority agreed a statement that they could rapidly recognise the signs of colic (94%, 656/701) and knew when to seek veterinary assistance (97.0%, 680/701). There were 485/700 (69%) participants who disagreed with a statement that treatment options available to their horse would not be within their control.

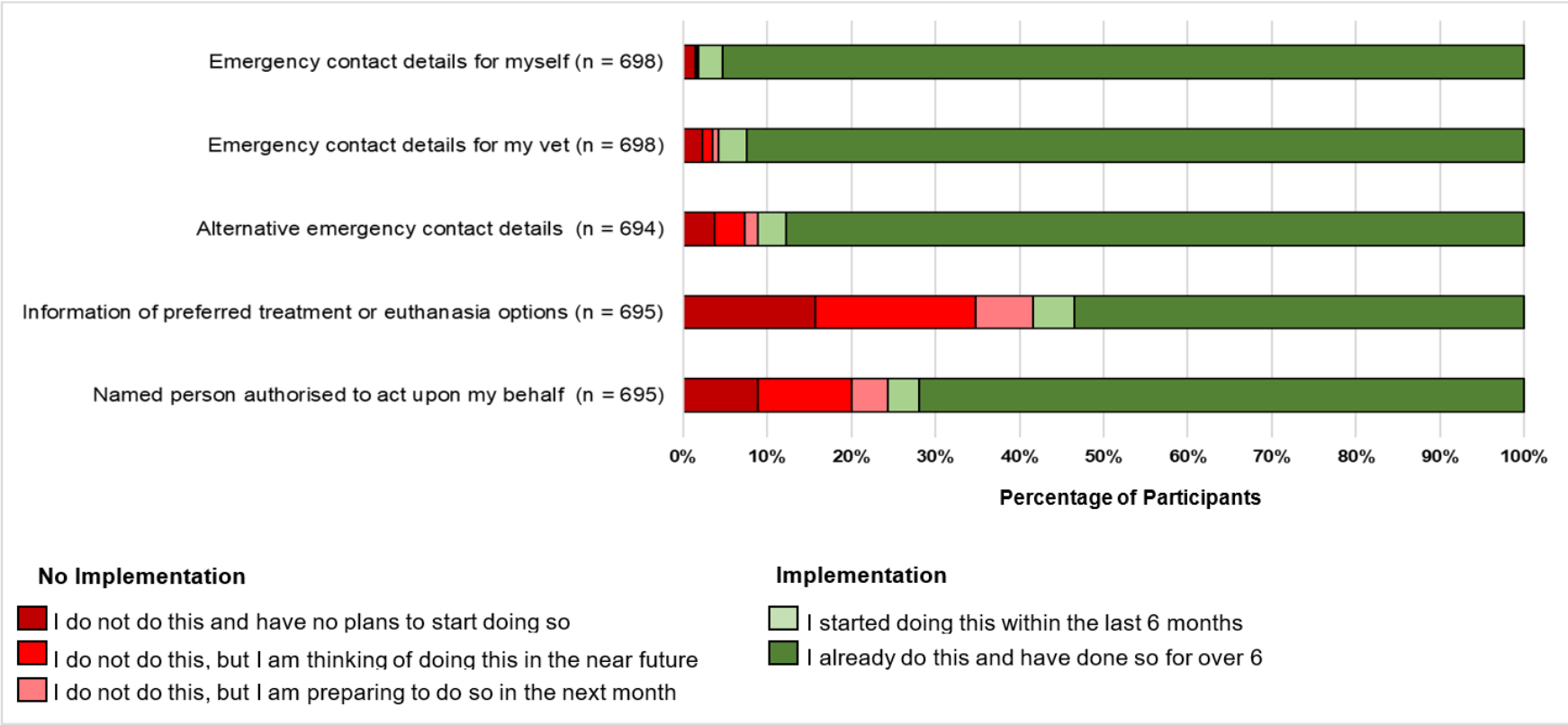


Figure 5-7: Stacked bar chart displaying participants' intention to implement measures designed to minimise delays in veterinary treatment by involving others in an online survey investigating horse owner intention to adopt emergency recommendations.

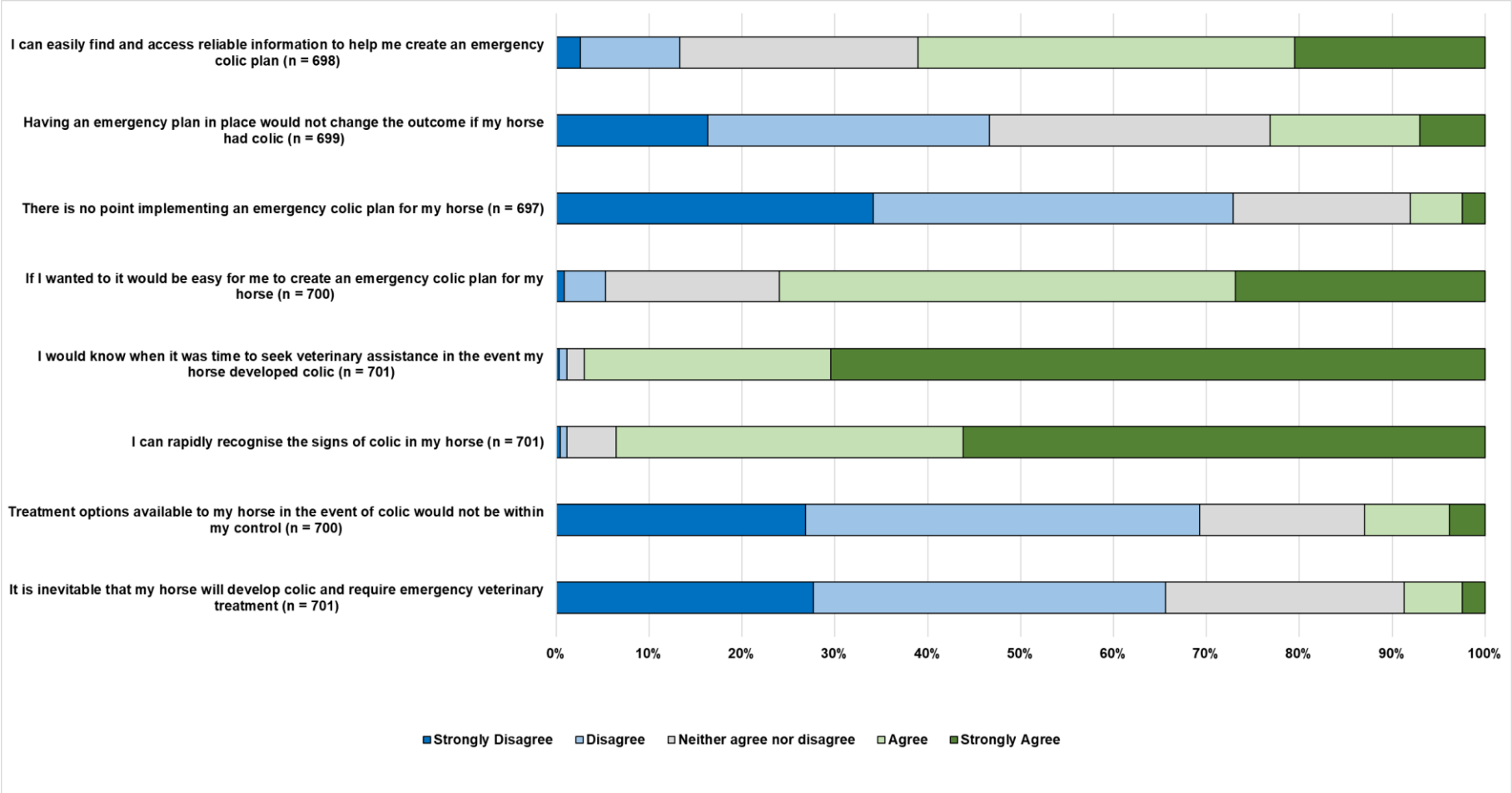


Figure 5-8: Participant agreement with statements reflecting control beliefs associated with colic and the use of emergency plans, in an online survey investigating horse owner intention to adopt emergency recommendations.

Implementing an emergency colic plan was seen positively by most participants (Figure 5-11). Most agreed that having an emergency colic plan would improve their horse's welfare (68%, 474/701) and help them to make informed decisions (78%, 546/701). Additionally, regular monitoring of equine health (85%, 600/701) and involving others in emergency arrangements (77%, 536/701) were seen to minimise treatment delays and improve recognition of clinical signs. Implementing a colic plan was not considered to be impractical (72%, 501/697) or time consuming (59%, 415/701) by most participants.

Most participants (85%, 597/699) did not feel pressure from others to implement an emergency colic plan (Figure 5-12). Most participants stated that the opinions of veterinary professionals were important for emergency planning (93%, 649/701), but those of equestrian associations or societies were not important to many participants (51%, 360/700).

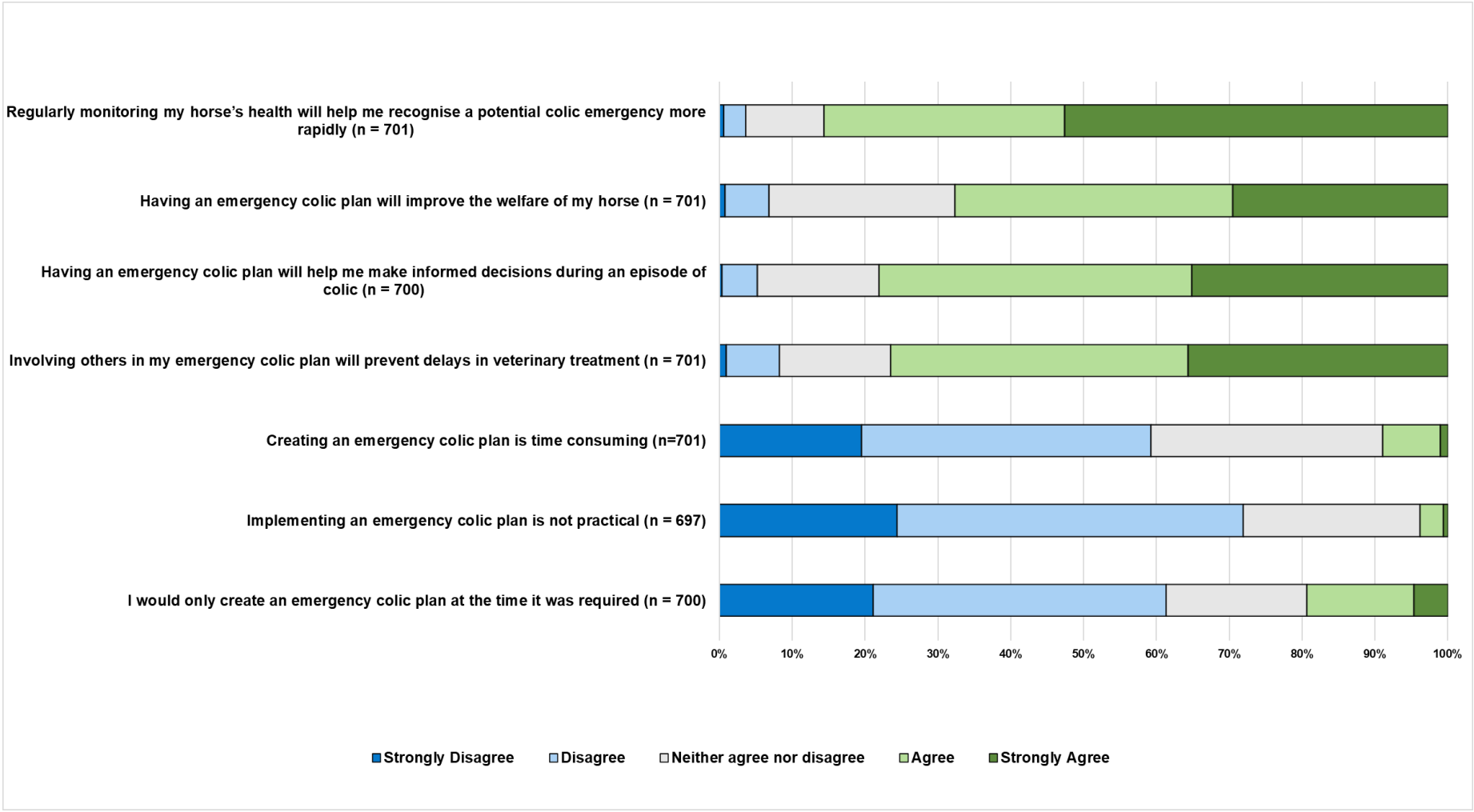


Figure 5-9: Participant agreement with statements reflecting behavioural beliefs associated with emergency plans, in an online survey investigating horse owner intention to adopt emergency recommendations.

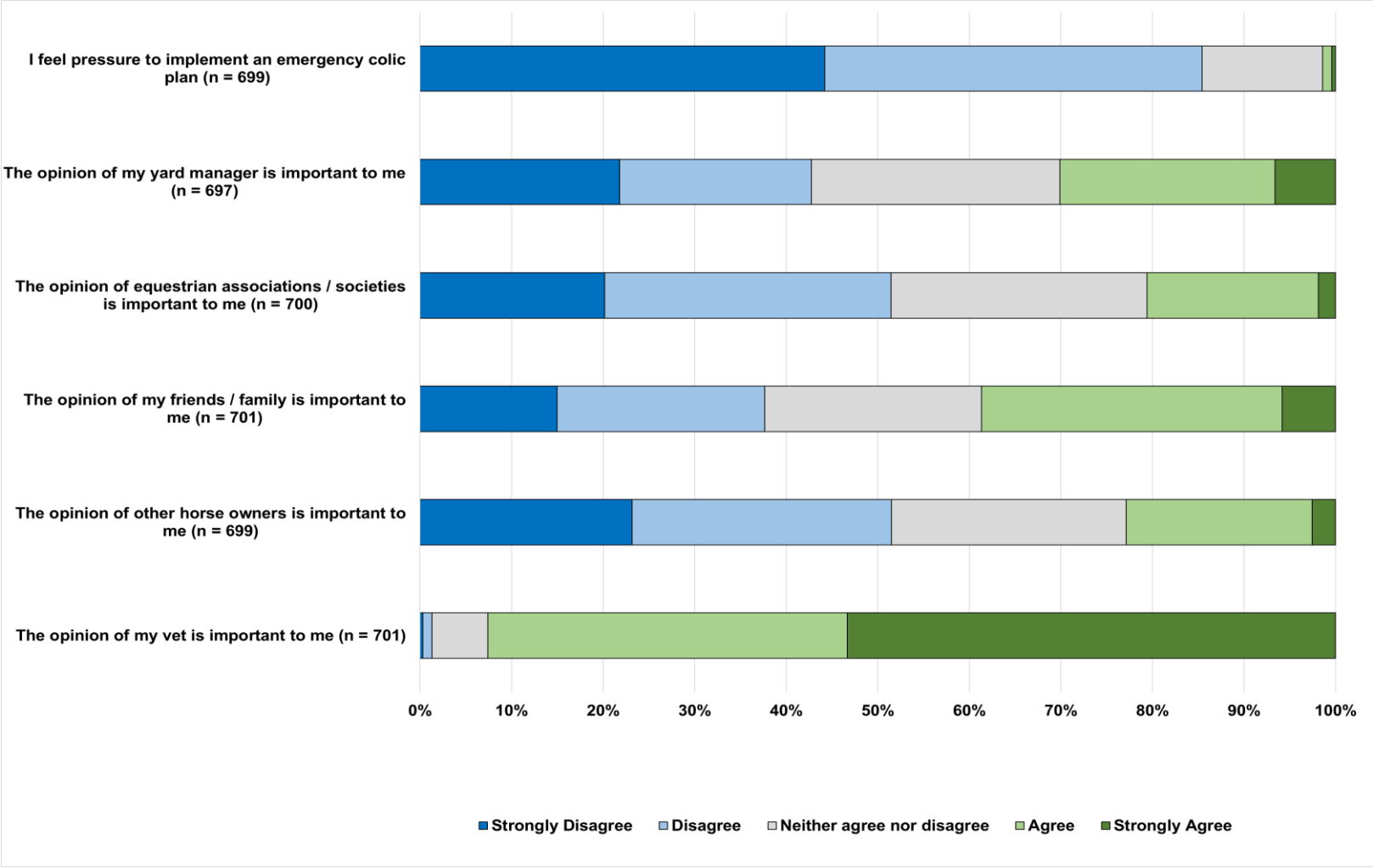


Figure 5-10: Participant agreement with statements reflecting normative beliefs associated with the influence of others on their intention to implement an emergency colic plan, in an online survey investigating horse owner intention to adopt emergency recommendations.

5.4.4.3 Influencing factors

When asked to indicate how important various factors would be on their decision to pursue referral treatment for their horse (0 = not at all important, 10 = very important), aspects associated with financial considerations (immediate costs, long term costs/care and value of horse) had a low median score (n=701) (Figure 5-13). Of the owner related factors, both their relationship and veterinary advice given at the time of diagnosis were considered highly important (median score 10, range 0 -10). Factors directly associated with horse health or management were also identified, with a median score of 10 (range, 0-10) for poor prognosis, level of pain and expected quality of life.

Additional factors considered important during decision making were provided by 202 participants (Appendix IX). Of these, 45% (90 / 202) of comments referred to the age of the horse concerned:

"…I would consider the age of the horse, as I have two veterans, and my reaction would be to consider euthanasia in the first instance rather than refer to surgery…" (Survey Participant 72)

"…Horses age - I have an old horse I wouldn't put through invasive treatment, but a younger one I would…" (Survey Participant 167)

"…The age of the horse. I have witnessed a number of horses with "terminal colic" in their late twenties… the pain is especially acute, and they have a greater risk from surgery with dubious quality/length of life afterwards…" (Survey Participant 172)

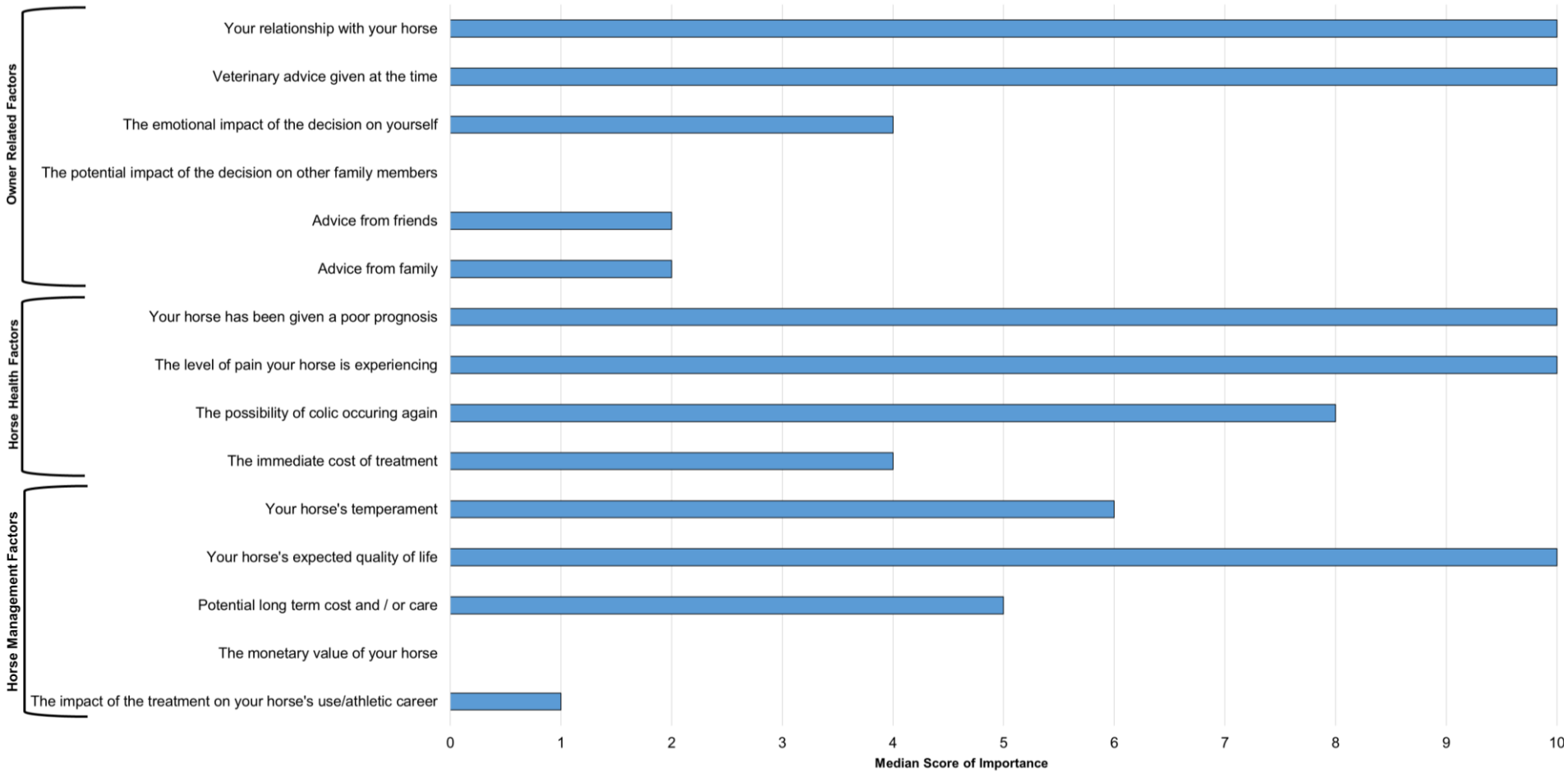


Figure 5-11: Bar chart displaying the median importance score (0 = not at all important, 10 = very important) of owner, horse health and horse management factors in the decision to pursue referral treatment for colic, as indicated by survey participants (n = 701) in an online survey investigating horse owner intention to adopt emergency recommendations.

Other factors included current or on-going health concerns (13%, 26 / 202) and post-operative management (12%, 24 / 202). Eleven participants stated they would never consider referral or surgical intervention an option for their horse and eight respondents with prior experience of surgery would never make this decision again:

"…I generally would PTS rather than surgery as I've witnessed and dealt with horses after colic surgery and only 1 has survived and led a normal life afterwards..." (Survey Participant 237)

"…Personally, I would not opt to put a horse through colic surgery, having known many horses who have gone for surgery, most of whom never returned home and only one survived more than 2 years post-operative…" (Survey Participant 346)

5.4.5 Statistical analysis

5.4.5.1 Theory of Planned Behaviour (TPB) question reliability

A reliable Cronbach's Alpha Coefficient was calculated for the TPB group relating to behavioural beliefs (0.78). Therefore, a mean score for each participant was generated. Due to an unreliable Cronbach's Alpha scores for both the control (0.49) and normative (0.69) beliefs, each statement was analysed separately.

5.4.5.2 Univariable Regression

A number of explanatory variables, such as participant age and number of equestrian qualifications / memberships, were significantly associated. These were subsequently removed from analysis meaning a total of 14 explanatory variables were taken forward to univariable regression.

Sixteen variables were identified for both the model investigating owner intention to implement recommendations to aid colic recognition / prevention and the personal preparation model. Fifteen variables were eligible for inclusion within the model exploring the involvement of others (Appendix X).

5.4.5.3 Multivariable Regression

Aspects of each of the three TPB components were associated with each of the models (Table 5-3), with control beliefs being most frequently associated with participant intention to implement recommendations. Hosmer and Lemeshow analysis indicated that all three models displayed adequate fit.

The model investigating recommendations designed to aid colic recognition and prevention was found to be statistically significant (X^2 = 37.49, p=<0.001) with three variables. It appeared that participants were more likely to implement these recommendations if they were aware of the 'REACT' campaign, felt there was a 'point' in creating an

emergency plan for their horse (control belief) and felt they knew when to seek veterinary assistance (control belief) (Table 4-3; TTM Model A).

The model investigating recommendations designed to involve others was found to be statistically significant ($X^2 = 32.302$, p=<0.001) with two variables. Participants' who felt they would know when to seek veterinary assistance were more likely to implement recommendations. In contrast to the other models, positive behavioural beliefs towards the use of emergency plans appeared to influence participants' intention to involve others (Table 5-3; TTM Model B).

The model exploring recommendations designed to assist personal preparation for an emergency was found to be statistically significant ($X^2 = 77.588$, p=<0.001) with five variables. The model suggested that those currently holding an equestrian society membership and who had a greater number of years involved with horses, were more likely to implement these recommendations. Additionally, participants were found to be less likely to implement recommendations if they felt pressured to do so (Table 5-3; TTM Model C).

Table 5-2: Results of multivariable logistic regression with outcome variables (no intention vs. already implementing) associated with uptake of recommendations designed to: aid recognition and prevention of colic, involve others in emergency planning and personal preparation for an emergency.

Variable	Significance (p value)	Odds Ratio	95% Confidence Interval (CI)	
			Lower	Upper
TTM Model A – Recommendations designed to assist colic recognition and prevention				
Awareness of the 'REACT Now to Beat Colic' Campaign	0.001	2.356	1.400	3.966
There is a point to creating an emergency plan for my horse (control belief)	0.007	2.332	1.266	4.297
I would know when to seek veterinary assistance (control belief)	0.001	1.702	1.255	2.308
Hosmer and Lemeshow analysis: $X^2 = 4.691$; $p = 0.58$				
TTM Model B – Recommendations designed to involve others in emergency plans				
Mean Behaviour Beliefs score	< 0.001	2.928	1.781	4.812
I would know when to seek veterinary assistance (control belief)	0.034	1.546	1.033	2.312
Hosmer and Lemeshow analysis: $X^2 = 9.267$; $p = 0.32$				
TTM Model C – Recommendations designed to assist personal preparation				
Number of years involved with horses	0.006	1.026	1.007	1.045
Current member / affiliation with equestrian society or association	< 0.001	2.567	1.691	3.899
I feel pressure from others to implement an emergency plan (normative belief)	0.015	0.685	0.506	0.928
I can rapidly recognise the signs of colic (control belief)	< 0.001	2.131	1.519	2.991
There is a point to creating an emergency plan for my horse (control belief)	< 0.001	1.609	1.314	1.969
Hosmer and Lemeshow analysis: $X^2 = 10.527$; $p = 0.23$				

5.5 **Discussion**

5.5.1 Overview of findings

This was the first study to utilise a combination of theoretical frameworks to investigate horse owner attitudes and practices associated with planning for a potential colic emergency. The findings were that horse owners generally fall into one of two categories: no intention to adopt or already implementing emergency recommendations. Beliefs surrounding the completion of emergency preparation, such as perceived personal relevance and benefit, were significantly linked to horse owners' intention to adopt emergency advice. Lower levels of intention were associated with perceived social pressure to undertake personal preparation. The findings of this study also demonstrate that horse owners consider individual factors, such as the horse-human relationship, more important than financial aspects in their decision to pursue referral treatment. Furthermore, 'old' age and the need for surgery were frequently associated with poor survival, beliefs that could potentially have severe implications for informed decision making.

5.5.2 Study limitations

Due to intended large scale distribution, an online survey was chosen as the most appropriate method of data collection for this study. As previously mentioned, the advantages and disadvantages of using web-based surveys will be considered in more detail in Chapter Nine however, limitations exclusive to this study will be discussed in the following section.

This study aimed to gather opinions from as many participants as possible. Despite over 700 horse owners participating in this survey, caution must be taken when interpreting these results as some degree of bias may be present. As noted in Chapter Four of this thesis, the use of online platforms as a method of dissemination can result in a bias towards a computer literate population. A diverse range of equestrian backgrounds were included, and participants had demographical traits similar to those reported in previous research (Bowden *et al*., 2020, Hotchkiss *et al*., 2007a, Ireland *et al*., 2012, Scantlebury *et al*., 2014, Wylie *et al*., 2013). Yet, despite the survey being extensively piloted and questions carefully worded there were still a number of potential biases. Owners with previous colic experience or positive views on emergency planning may have been more likely to complete and share the survey. However, the high level of colic experience within this study does coincide with that of previous colic research (Bowden *et al*., 2020). Social desirability, or the need for social acceptance (King and Bruner, 2000, Krumpal, 2013), may result in owners responding to questions,

such as the TPB statements, based on what they perceive as the most socially acceptable answer. Yet, positive intentions to adopt recommendations were not shared by all participants, suggesting that potential survey bias was not exacerbated through the choice of sampling method or question design.

Research has suggested that a completion time of under 13 minutes is required to maximise response submissions during surveys (Asiu *et al*., 1998, Fan and Yan, 2010, Handwerk *et al*., 2000, Porter and Whitcomb, 2003). Despite the use of techniques such as skip sequencing, commonly referred to as 'logic', participants' took on average 15 minutes to reach the end of the survey, with only 20% of those who accessed the questionnaire submitting completed responses. The majority (63%) of participants left following the 'welcome' page and therefore, survey length was unlikely to be the main source of poor engagement.

Finally, a multi-theory approach was deemed the most appropriate method to assess current attitudes and practices associated with emergency planning, based on findings reported by Richens *et al*. (2018), who investigated similar constructs within farm biosecurity. The use of a theoretical framework enabled the identification of several factors associated with owner intention to adopt emergency advice. However, the observational nature of this study, which resulted in the collection of owner perceptions rather than evidence of actions, may be considered a limitation. In the human medical field, interventional,

rather than observational, studies have frequently been used to explore and validate health behaviour change interventions related to weight loss (Alahuhta *et al*., 2011), condom use (Arden and Armitage, 2008) and sun safety (Houdmont *et al*., 2016). This methodology allows for the comparison of interventions pre and post implementation. As a result, factors which can affect intention to adopt recommendations, stage transition and progress can be identified. The purpose of the study within this thesis was to establish current attitudes and beliefs associated with emergency planning rather than evaluate the effectiveness of a behavioural intervention. Nevertheless, it did highlight several factors that may be important to consider when developing campaigns aiming to change owner behaviour and improve animal welfare.

5.5.3 Key findings

5.5.3.1 Horse owner experience, knowledge, and concern

With a yearly frequency of four to ten cases per 100 horses (Kaneene *et al*., 1997, Tinker *et al*., 1997a), it is not surprising that over 70% of participants within this study had direct, personal experience of managing a horse with colic. Yet, this figure is slightly lower than that reported by Bowden *et al*., (2020), who found that 96% of owners responding to an online survey exploring colic knowledge had experience of this condition. However, unlike the study detailed within this thesis, the authors did not ascertain whether or not reported experience was through direct or indirect involvement. When asked

about their most recent colic experience, 57% of owners reported spontaneous recovery or resolution of symptoms following a single veterinary treatment. This is consistent with existing research which suggests that 80% of colic cases will require no treatment or a single veterinary visit (Kaneene *et al*., 1997, Curtis *et al*., 2015, Hillyer *et al*., 2001, Tinker *et al*., 1997b, Traub-Dargatz *et al*., 2001, Uhlinger, 1992).

Despite the fact that many participants had experience of colic and were concerned about future occurrences, neither of these factors were found to be significantly associated with intention to adopt emergency recommendations. Furthermore, though the majority of participants reported high levels of interest and positive behavioural beliefs in relation to emergency plans, only 20% were aware of the 'REACT' campaign at the time of the survey. In contrast to these finding, Schemann *et al*., (2013) found that those with previous experience of Equine Influenza (EI) displayed increased levels of both help seeking behaviour and implementation of preventative measures due to higher levels of perceived personal risk. However, most owners were more likely to adopt recommendations aimed at improving colic prevention and recognition if they felt there was a 'point' to creating an emergency plan (control belief). Additionally, the belief that they knew when to seek veterinary assistance was significantly associated with intent to adopt advice. These findings could be explained by the Protection Motivation Theory (PMT) (Prentice-Dunn and Rogers, 1986, Rogers and Prentice-Dunn, 1997), which has frequently been applied to explain or explore

attitudes associated with intent to implement preventative behaviours. The theory postulates that motivation (or intent) to adopt suggested recommendations arises based on the target populations' cognitive appraisal of three main elements: perceived risk, likelihood of the event occurring and effectiveness of proposed recommendations. Therefore, if an event or behaviour is perceived to be potentially noxious and likely to occur, and suggested actions are believed to be effective in reducing risk, intention to adopt precautionary advice will be greater. For example, Mulilis and Lippa (1990) utilised this theory to explore behaviour change associated with earthquake preparedness and the use of negative threat appeals in at risk areas within California. Using a multiact earthquake preparedness scale (MLEPS), the authors compared participants' attitudes and intent to adopt emergency recommendations before and after the introduction of 'threat' inducing communications, which detailed the likelihood of future earthquakes within the area and negative outcomes associated with a lack of emergency preparedness. The authors concluded that the use of negative threat appeals significantly increased participants' motivation to adopt emergency recommendations, which is in line with the elements described by the PMT. However, many studies suggest the use of this method produces limited or detrimental effects (Peters *et al*., 2013, Ruiter *et al*., 2001, Witte and Allen, 2000). In light of these findings, those planning and developing campaigns must ensure focus is upon the desired behavioural change, i.e. calling emergency services, rather than the consequences of a disease or issue. Taking

the PMT into account, it could be postulated that previous experience of colic and reported level of concern were insignificant in this study, due to participants' low perception of personal risk and the belief that their current approach to emergency planning is sufficient. This would coincide with the fact that, not only did the majority (> 90%) of owners already feel prepared to make emergency decisions, but most (66%) did not perceive emergency veterinary treatment for colic an inevitability, despite colic being a common equine emergency (Bowden *et al*., 2017). However, very few (< 30%) owners within this study had personal experience of emergency decision making (e.g. referral or euthanasia) as a direct result of colic, suggesting that their current state of preparedness may actually relate to their response to and management of mild, rather than critical, episodes of colic. Though evidence is currently lacking, an over-estimation of personal capabilities has been previously reported in horse owners (Bowden *et al*., 2020). Additionally, being ignorant of one's own ignorance has been widely studied within human psychology (Dunning, 2011). Therefore, it could be suggested that the polarisation of respondents in respect to the TTM framework (indicating that horse owners either feel that they are already performing recommended behaviours or have no intention to start doing so) is actually the result of over-confidence and not a true representation of performed behaviour. A lack of perceived risk and high levels of self-efficacy could have serious implications for both the 'REACT' campaign and similar initiatives aiming to enhance animal welfare through the improvement of owner emergency preparedness:

owners may simply feel that they do not need to implement suggested recommendations. Strategies to increase uptake of emergency recommendations for owners who are currently within TTM stages 1-3 (no implementation) should be sought. For example, regular exposure to information describing why behaviour should be altered could engage those with little or no intention to change. Alternatively, those within TTM stages 2 or 3 may have every intention to change but lack the skills to do so. Therefore, step by step guidance or practical workshops aimed at developing the skills needed to perform the recommended behaviour are warranted. Additionally, further investigation into the impact of a colic experience on owner knowledge and future response is warranted. Research should be qualitative in nature in order to capture personal and time-dependent factors associated with decision-making. Additionally, studies should investigate both immediate and long term effects of such an experience, including subsequent help-seeking and future decisions.

Up to 20% of colic cases will be critical in nature (Mair and Smith, 2005a, Bowden *et al*., 2017, Curtis *et al*., 2015), with patient outcome relying to some extent on an owner or care givers response to clinical signs. For instance, in a retrospective study of 896 Thoroughbred mares admitted for surgical correction of large colon volvulus, Hackett *et al*., (2014) found that irreversible colon damage is sustained within 3-4 hours of the obstruction occurring. It was encouraging that personal preparation and steps to involve others in order to minimise treatment

delays had already been undertaken by the majority of survey participants. However, despite majority agreement (> 70%) that the involvement of others would prevent delays in veterinary treatment (behavioural belief), over 40% of owners indicated that they had not, and had no intention to, provide details of preferred treatment or euthanasia options to be followed if they could not be contacted. Furthermore, although awareness of the campaign was significantly associated with implementation of this advice, it was disappointing to note that over 80% of survey participants were not actively monitoring their horses' temperature, pulse or respiration on a weekly basis, with many within the pre-contemplation stage of behaviour change. Although these results are consistent with those reported in Chapter Four, they contradict survey participants agreement that regular monitoring of equine health (behavioural belief) would improve symptom recognition and minimise delays. Though concerning, the apparent mismatch between owner belief ('involving others is beneficial') and observable behaviour is most likely the result of the so called 'value-action gap' (Maio, 2011, Weigel and Newman, 1976). This theory posits that, despite holding positive beliefs, a person may be unable to perform recommended behaviours due to a variety of personal and environmental factors. For example, (Chaplin and Wyton, 2014) reported that a lack of accessible recycling facilities was a significant barrier to the sustainable living of university students, despite the majority holding positive views on recycling. Taking this into account, it may be that owners genuinely believe that involving others

will prevent delays in veterinary treatment however, they may not know a suitable individual who could act on their behalf during an emergency. Therefore, prior to providing recommendations, campaigns should strive to understand potential barriers associated with the desired behaviour. The use of qualitative interviews or focus groups would provide an in-depth insight into challenges faced by the target population. Stakeholder involvement would also assist in the development of context specific recommendations and the identification of barriers to implementation.

5.5.3.2 The horse-human relationship

Horse owners generally seek health (Hockenhull and Creighton, 2013) and treatment advice (Scantlebury *et al*., 2014) from veterinary professionals, although books, websites and other horse enthusiasts are frequently used (Bowden *et al*., 2020, Hockenhull and Creighton, 2013, Visser and Van Wijk-Jansen, 2012). Congruent with these findings, clinical aspects, such as veterinary advice, prognosis and expected quality of life, were deemed most important to participants when making critical decisions relating to colic. However, the relationship an owner has with their horse, and the level of pain they perceive their horse to be in, were also ranked as highly important. The human-animal bond is a powerful concept that can influence a range of decisions, from owner compliance with veterinary treatment to the pursuit of medical or surgical treatment for a beloved pet (Gray and Moffett, 2013). It has been acknowledged that owners frequently regard

companion animals as valued family members (Barton Ross and Baron-Sorensen, 2007, Cohen, 2002, Dawson, 2007a, Dawson, 2007b), with a similar paradigm shift in the horse-human relationship being noted within the equestrian sphere (Hausberger *et al*., 2008, Hemsworth *et al*., 2015). Although not explored explicitly within this study, the influence of the horse-human relationship on the decision to pursue referral treatment may have serious implications for both informed decision-making and campaign engagement. Therefore, further in-depth research is required to identify how this phenomenon can influence owner decision-making during an emergency event. Given the uniqueness of the horse-human relationship, studies should be qualitative in design in order to capture an array of perspectives and contexts in which emergency decisions are made.

5.5.3.3 The role of others

Research has identified that a negative impact on animal welfare can occur if an individual's attitudes and beliefs are based upon misinformation or a low knowledge-based background (Waiblinger *et al*., 2006, Hemsworth *et al*., 2015). Consequently, this study found that a large proportion of participants referred to 'witnessed' episodes of colic when suggesting that age would be a significant barrier to intensive treatment, despite there being no conclusive evidence to suggest age is a major risk factor for colic surgery survival (Mair and Smith, 2005b, Proudman *et al*., 2005b, Southwood *et al*., 2010). The effect of normative social influences (those being witnessed actions or

behaviours of others which can significantly influence an individual's current or future behaviour) (Nolan *et al*., 2008), has been explored in several areas of human behaviour. Lying (Asch, 1956), illicit drug use (Maxwell, 2002) and cyberbullying (Bastiaensens *et al*., 2016) have all been associated with normative social influence, with several studies suggesting that both direct observation and written communication of a descriptive norm can induce desired or undesired behaviour (Parks *et al*., 2001, Von Borgstede *et al*., 1999). Based on these findings, misconceptions relating to colic treatment and outcome could not only be attributed to personal experience, but also to the experience and opinions of other horse owners. However, the majority of owners responded that the opinion of others (*normative beliefs*), with the exception of their veterinary surgeon, were not important to them in relation to the development of an emergency plan. Additionally, participants were less likely to personally prepare for a potential colic emergency if they felt pressured to do so. More surprising was the fact that most owners within this survey did not view the opinion of equestrian societies or associations important to them in terms of emergency planning, which is concerning given that the 'REACT' campaign is predominantly disseminated by the BHS. These findings could have serious implications for both campaign development and informed decision-making if appropriate veterinary assistance is not sought based on skewed beliefs. Therefore, an investigation into misconceptions surrounding colic treatment is needed to ensure owners

are utilising evidence-based recommendations to aid in decision-making.

5.5.4 Recommendations for future work

Preparing for a potential colic emergency in advance can maximise a horse's chances of survival by helping owners make rapid and informed decisions. The findings of this study indicate that many horse owners are currently unwilling to adopt emergency recommendations or feel their current approach is already sufficient. Additionally, it has highlighted that prior experience of colic may have a significant bearing on owner decision-making, which warrants further investigation. The role of other people's opinions and experiences was also identified as a potential barrier to information dissemination and informed decision-making. Furthermore, the context in which an emergency judgment is made was also found to be an important factor in owner decision-making. Aspects such as a horse's age, perceived level of pain and strength of human-animal bond were ranked highly in terms of importance when deciding if referral treatment would be an option. However, although not directly assessed in this study, it appears that many decisions may be based on misinformation or the coercion of others. Misconceptions regarding colic survival and management approaches are often fuelled by traditional beliefs within the equestrian community and can be deeply ingrained. If true, this could have a detrimental impact on knowledge transfer and the success of educational campaigns. Therefore, further research into potential

misconceptions about colic and peer pressure amongst the horse owning population is needed.

5.6 Conclusions

This was the first study to use a theoretical framework to assess horse owners' current approach to emergency colic planning. As a result, this study has identified current attitudes and beliefs within the UK equestrian community, with the majority of owners either unwilling to adopt suggested recommendations or believing that their approach is currently sufficient. Most owners perceived veterinary professionals as highly influential on their decision to plan for a colic emergency, which highlights their importance in any educational health campaign. This research highlighted potential barriers to knowledge transfer, including negative impact of misconceptions about colic and the influence of others on owner decision-making. Given the detrimental effect these factors could have on the success of educational campaigns, further investigation is warranted.

Chapter 6: *Challenging the norm*: Impact of evidence-based knowledge on horse owner decision-making

6.1 Introduction

The nature of 'information' has long been debated, with behavioural science striving to understand how humans select, interpret and apply available evidence (Karlova and Fisher, 2013). During the late 1940's, information was first described mathematically as being a 'signal' transmitted between a 'sender' and a 'receiver' (Shannon, 1948). Though highly praised, this theory failed to acknowledge three fundamental aspects of human communication: the exchange of meaning, message importance and the degree to which information is successfully received (Tuominen and Savolainen, 1997, Taylor, 1962, Klüver, 2011, Dervin and Nilan, 1986, Belkin and Robertson, 1976). Additionally, the concept of 'misinformation' and its influence on knowledge creation was largely ignored (Karlova and Fisher, 2013). Misinformation is a term commonly used to describe 'false, or misleading information' (Oxford English Dictionary). However, some have argued that despite its falsity, misinformation can still be informative (Fox, 1983), with those choosing to believe this information often developing misconceptions about the associated topic (Karlova and Fisher, 2013).

'Misconceptions' can be defined in many ways, from 'false, persistent beliefs' (DiSessa, 2014) to a person holding 'inaccurate, prior

knowledge' of a particular concept (Taylor and Kowalski, 2014). Although prior understanding of a subject can help to facilitate further learning (Hambrick and Engle, 2002, Chiesi *et al*., 1979, Beier and Ackerman, 2005), a foundation built on inaccurate information can hinder educational development (Lipson, 1982). Misconceptions often cause individuals to misinterpret, distort or ignore new information, resulting in permanent retention or strengthening of inaccurate beliefs (Taylor and Kowalski, 2014, Karlova and Fisher, 2013). Consequently, changing the behaviour of those holding false beliefs can be difficult, due to a tendency to mistrust information that does not align with their views. This can have important implications for those designing complex interventions in the hope of eliciting positive changes in behaviour (Vosniadou, 2001, Karlova and Fisher, 2013, Hacker *et al*., 1998).

The study detailed in Chapter Four of this thesis indicated that a high proportion of horse owners have a poor understanding of 'normal' equine health. Additionally, a varied approach to colic recognition and response was noted, with many owners basing their decisions on prior, often incorrect, knowledge. Therefore, further investigation is required to establish which misconceptions around colic are currently present within the horse owning population and how these might be overcome.

6.2 Study aims and objectives

The aim of this study was to investigate the impact of evidence-based information on UK horse owners' recognition and response to equine colic.

The objectives of this study were:

- To describe horse owners' current views on colic education within the equestrian community.
- To identify factors associated with the decision to refer a horse for intensive medical or surgical treatment at an equine hospital.
- To ascertain horse owners' current knowledge and understanding of colic recognition, response and treatment options and identify any areas where misconceptions exist.
- To evaluate the impact of evidence-based information on owner decision-making and determine whether they can change misconceptions.

6.3 Methods

6.3.1 Sample population

6.3.1.1 Participant recruitment and selection

Participants were recruited using a snowball sampling strategy, through regular promotion on social media sites frequented by horse owners and advertisement by equine veterinary professionals. Participation in this study was entirely voluntary and no financial incentive was offered. Inclusion criteria were individuals with experience of horse ownership or care. Varying levels of equestrian affiliation and ability were permissible however, participants were required to be 18 years old or over and currently living within the United Kingdom (UK).

6.3.2 Data collection

6.3.2.1 Survey development

A questionnaire was developed using the 'Online Surveys' tool (Jisc, Bristol, UK). A study overview and compulsory consent page was presented at the start of the survey. The main body of the questionnaire was divided into four sections:

1. Owner demographics and views on current colic education
2. Information on horses currently owned and views on referral
3. Current owner knowledge and approach to colic
4. Impact of evidence-based information on owner decision-making

A brief introduction describing the purpose of each survey section was provided. Survey logic was applied to question eight (Table 6-2) to allow those who did not currently own or care for an equid to progress straight onto section three. Logic was also applied to question 21 to give those with multiple horses the option to provide additional details.

The final section of the survey explored the impact of evidence-based information on horse owner decision-making. Information presented in the survey was based on peer-reviewed research and current expert opinion, as detailed in Table 6-1.

6.3.2.2 Survey pilot

The survey was piloted by two non-veterinary horse owners, four undergraduate veterinary students and one equine veterinary surgeon. Collection of pilot data was performed by J. Heale, a third year undergraduate veterinary student studying at the School of Veterinary Medicine and Science. Corrections (Appendix XI) were performed and ethical approval for the final survey design (Table 6-2) was gained prior to survey dissemination to the general public.

Table 6-1: Scientific evidence and expert opinion presented to owners in Section 4 of a survey investigating the impact of evidence on owner decsion-making.

Information provided in section three of survey	Source of information
Did you know that the classic signs of colic, such as rolling and flank watching, will not be shown by every horse and are often seen much later in the disease process?	Cook and Hassel (2014) Pratt (2003) Wild et al., (2017) Yeoman et al., (2017)
Did you know that the normal heart rate range for a horse at rest is 28 – 44 beats per minute (bpm), with an unexplained increase in normal resting heart rate, e.g. over 44 bpm, potentially being an indication of pain, distress or disease?	Bowden et al., (2017) Curtis et al., (2015) Furr et al., (1995) Orsini et al., (1988)
Did you know that there is currently no scientific evidence to suggest that allowing a horse with colic to roll will cause a twist or increase the need for surgery?	*** Expert veterinary opinion *****
Did you know that scientific research has shown that horse's intestines can become irreversibly damaged within 3-4 hours of an obstruction / strangulation occurring?	Hackett et al., (2014)
Did you know that the term 'referral' does not always mean surgery is needed?	*** Expert veterinary opinion *****

Did you know that a recent study has shown that the average cost of colic surgery in the UK is just under £6500, with many insurance companies offering an average of £5000 to cover colic treatment costs?	Barker and Freeman (2019)
Did you know research has shown that horses who survive colic surgery and are successfully discharged from hospital have about an 85% chance of being alive 12 months after treatment?	Christopherson et al., (2011) Mair and Smith (2005) Van der Boom and Van der Velden (2001)
Did you know that a recent scientific study showed that geriatric horses (those over 16 years of age) were just as likely as mature horses (those aged between 4 and 15 years of age) to be successfully discharged from hospital following colic surgery for strangulated intestines?	Southwood et al., (2010)
Did you know research has shown that up to 70-90% of horses who survive colic surgery and are successfully discharged from hospital will be performing at their previous level of activity / work after 12 months?	Christopherson et al., (2011) Davis et al., (2013) Hart et al., (2014) Tomlinson et al., (2013)

Table 6-2*:* Question types and topics included within the final version of a survey investigating the impact of evidence on owner decision-making.

Survey Section	Question	Question Type
Participant consent	**1. If you agree to participate within this survey, please complete the following consent questions:**	Closed with pre-defined, single choice answers
Section 1: 'About You'	**2. If you are happy to do so, please tell us your gender**	Closed with pre-defined, single choice answers
	3. Do you live within the United Kingdom? * **Sub-question if previous answer 'Yes' – Please could you tell us where in the UK you currently live?* **Sub-question if previous answer 'No' – Please could you tell us which country you live in?*	Closed with pre-defined, single choice answers Closed with pre-defined, single choice answers Closed with free-text box
	4. How long have you been involved with the care of horses for?	Closed with free-text box
	5. Do you hold any of the following formal UK EQUESTRIAN qualifications?* **Sub-questions if equestrian qualification held –* *Thinking about the equine qualifications you have told us about, which of the following statements best describes how the topic of colic was covered during your equine course/s?*	Closed with pre-defined, multiple choice answers Closed with pre-defined, single choice answers

Section 1: 'About You' (Cont.)	*In order to identify where further support can be provided, please could you tell us a little more about how well you thought the topic of colic was covered during your equine course/s*	Open with free-text box
	6. In your opinion, how well do you think the term colic, and how to manage a horse with this condition, is understood by those within the equestrian community? `	Open with free-text box
	7. When and where was the last time you read anything related to colic in the horse?	Open with free-text box
	8. Which of the following statements BEST describes your current horse ownership and role in emergency decision making?	Closed with pre-defined, single choice answers
Section 2: 'Your Horse'	**9. How long have you owned your horse for?**	Open with free-text box
	10. How old is your horse?	Open with free-text box
	11. Is your horse currently insured? * ** Sub-questions if previous answer 'Yes' - How much is your horse currently insured for?*	Closed with pre-defined, single choice answers Open with free-text box

Section 2: 'Your Horse'	**12. What activity is your horse MAINLY used for?**	Closed with pre-defined, single choice answers
	13. Does your horse have any ongoing health issues? * **Sub-question if previous answer 'Yes' - Please could you tell us a little more about your horse's ongoing health issues?*	Closed with pre-defined, single choice answers Open with free-text box
	14. Does your horse have any significant behavioural issues that affects their athletic performance, ability to be ridden or day to day management? * ** Sub-question if previous answer 'Yes' - Please could you tell us a little more about your horse's behavioural issues?*	Closed with pre-defined, single choice answers Open with free-text box
	15. Does your horse have a history of colic? * **Sub-question if previous answer 'Yes' - How many episodes of colic has your horse had during the time you have owned them?*	Closed with pre-defined, single choice answers Open with free-text box

Section 2: 'Your Horse' (Cont.)	**16. The following statements refer to the owner-horse relationship. Thinking about you and your horse, we would like to know to what extent you agree or disagree with each statement.** *Optional sub-question - Is there anything else you would like to tell us about the relationship you have with your horse?*	Six point Likert scale with single choice tick boxes Open with free-text box
	17. Please use this box to tell us anything else you feel is important about the relationship you have with your horse.	Open with free-text box
	18. In your opinion, if a horse develops colic and immediate referral for specialist treatment is needed, do you think there is pressure on owners to agree to referral, rather than try treatment at the yard? * **Sub-question if previous answer 'Yes' - Where do you think the pressure to choose referral for specialist colic treatment is coming from?*	Closed with pre-defined, single choice answers Open with free-text box

Section 2: 'Your Horse'	**19. Thinking about the horse you have just told us about, would you choose referral to an equine hospital if they developed a severe case of colic which couldn't be treated at your home / yard? ***	Closed with pre-defined, single choice answers
	**Sub-question if previous answer 'I would never...' - Why would you be unsure whether to have your horse referred?*	Open with free-text box
	**Sub-question if previous answer 'I'm not sure...' - Why would you be unsure whether to have your horse referred?*	Open with free-text box
	20. If you would like to provide us with any additional information about your horse or your decision regarding referral for colic, please use the space below.	Free-text box
	21. Would you like to tell us about another horse you own / are primary carer for?	Closed with pre-defined, single choice answers
Section 2 repeated for those who wish to add details for an additional horse (questions 20 – 33)		
Section 3: 'What do you think?'	**34. How often do / would you check your horse's heart rate?**	Closed with pre-defined, single choice answers
	35. True or False - Signs such as rolling, flank watching and pawing the ground will be shown by all horses with severe conditions causing colic.	Closed with pre-defined, single choice answers

Section 3: 'What do you think?' (Cont.)	**36. If your horse developed colic and was continuously rolling, would you walk them around to try and stop them?*** **Sub-question if previous answer 'Yes' - Why would you walk your horse around?* **Sub-question if previous answer 'No' - Why would you NOT walk your horse around?*	Closed with pre-defined, single choice answers Open with free-text box
	37. In a severe case of colic where the blood supply to the intestines has become damaged, how long do you think it would be before the intestines became irreversibly damaged?	Open with free-text box
	38. Thinking of colic treatment, what does the term 'referral' mean to you?	Open with free-text box
	39. At what age would you consider a horse to be 'old' and / or 'geriatric'?	Open with free-text box
	40. Would you consider referral for intensive medical or surgical colic treatment for a horse over the age of 16? * **Sub-question if previous answer 'No' - Why would you NOT consider referral for intensive medical or surgical colic treatment for a horse of this age?*	Closed with pre-defined, single choice answers Open with free-text box
	41. How much do you think colic surgery costs on average (including VAT, livery and hospital treatment)?	Open with free-text box
	42. On average, what do you think is the <u>maximum</u> financial amount UK equine insurance companies currently offer for colic treatment?	Open with free-text box

Section 3: 'What do you think?' (Cont.)	**43. Thinking about horses who have undergone surgical treatment for colic and been successfully discharged from hospital, what percentage would you expect to still be alive 12 months after surgery?**	Open with free-text box
	44. Thinking about horses who have undergone surgical treatment for colic and been successfully discharged from hospital, what percentage would you expect to be in full work 12 months after surgery?	Open with free-text box
Section 4: 'Did you know?	**Each question in Section 4 was followed by:** **Sub-question if main answer was 'I might' or 'I probably won't' …:** *Why would you be unsure about changing your approach to colic after reading the information above?* **Sub-question if main answer was 'I will continue [previous approach] or 'I have no intention to' …:** *Why would your approach to colic not change after reading the information?*	Open with free-text box Open with free-text box
	Did you know that the classic signs of colic, such as rolling and flank watching, will not be shown by every horse and are often seen much later in the disease process? **45. Thinking about the information you have just read, which of the following statements BEST describes what you would do if you thought your horse had colic?**	Closed with pre-defined, single choice answers

Section 4: 'Did you know?' (Cont.)	***Did you know that the normal heart rate range for a horse at rest is 28 – 44 beats per minute (bpm), with an unexplained increase in normal resting heart rate, e.g. over 44 bpm, potentially being an indication of pain, distress or disease?*** **46. Thinking about the information you have just read, which of the following statements BEST describes your intention to monitor your horse's heart rate?**	Closed with pre-defined, single choice answers
	Did you know that there is currently no scientific evidence to suggest that allowing a horse with colic to roll will cause a twist or increase the need for surgery? **47. Thinking about the information you have just read, which of the following statements BEST describes what you would do if your horse developed colic and started to roll?**	Closed with pre-defined, single choice answers
	Did you know that scientific research has shown that horses intestines can become irreversibly damaged within 3-4 hours of an obstruction / strangulation occurring? **48. Thinking about the information you have just read, which of the following statements BEST describes what you would do if you thought your horse had colic?**	Closed with pre-defined, single choice answers

Section 4: 'Did you know?' (Cont.)	***Did you know that the term 'referral' does not always mean surgery is needed?*** **49. Thinking about the information you have just read, which of the following statements BEST describes what you would do if your vet suggested referral as a treatment option?**	Closed with pre-defined, single choice answers
	Did you know that a recent study has shown that the average cost of colic surgery in the UK is just under £6500, with many insurance companies offering an average of £5000 to cover colic treatment costs? **50. Thinking about the information you have just read, which of the following statements BEST describes what you would do if your vet suggested colic surgery as a treatment option?**	Closed with pre-defined, single choice answers
	Did you know research has shown that horses who survive colic surgery and are successfully discharged from hospital have about an 85% chance of being alive 12 months after treatment? **51. Thinking about the information you have just read, do you think you will now consider colic surgery an option for your horse?**	Closed with pre-defined, single choice answers
	Did you know that a recent scientific study showed that geriatric horses (those over 16 years of age) were just as likely as mature horses (those aged between 4 and 15 years of age) to be successfully discharged from hospital following colic surgery for strangulated intestines? **52. After reading the information above, do you think you would now consider colic surgery an option for a horse over the age of 16?**	Closed with pre-defined, single choice answers

Section 4: 'Did you know?' (Cont.)	***Did you know research has shown that up to 70-90% of horses who survive colic surgery and are successfully discharged from hospital will be performing at their previous level of activity / work after 12 months?*** **53. Thinking about the information you have just read, which of the following statements BEST describes what you would do if your vet suggested colic surgery as a treatment option?**	Closed with pre-defined, single choice answers

6.3.2.3 Survey dissemination

Data collection began on the 25th July 2019 and the survey remained open until the 2nd September 2019. Survey dissemination and promotion was conducted by the lead author (KL), with assistance from J. Heale. The survey was advertised on social media platforms (Facebook and Twitter) using the research group profile the 'Nottingham Equine Colic Project'. The survey link, accompanied by a short study overview, was also posted on 38 separate social media pages frequented by horse owners, including regional riding clubs and equine discussion forums. Social media advertisement was performed on a twice weekly basis.

An email containing survey details was sent to 762 UK equine veterinary establishments, identified using the 'equine' filter on the RCVS 'Find a Vet' online tool, for client distribution. The survey link was also shared on social media by equine charities The British Horse Society and World Horse Welfare. During the final week of the survey, social media posts informed participants that the survey would close at midnight on 2nd September 2019.

6.3.3 Data analysis

Data was imported directly from the ‘Online Surveys’ (Jisc, Bristol, UK) platform into an Excel spreadsheet (Microsoft Office 2016, Version 16.0) for data cleaning. Results were updated and saved on a weekly basis. Data were stored on password encrypted software at all times and accessed only by the principle researcher involved in the study.

6.3.3.1 Descriptive analysis

Exploratory descriptive analyses were performed on preliminary data. The mean, median and range were computed for continuous data, such as financial cost of surgery and number of horses owned. Normality of distribution was determined using histograms and Kolmogorov Smirnov testing. Non-parametric data was reported as the median (range), whereas mean values were used when parametric distribution was indicated. Frequency percentages and mode values were calculated for categorical data, with optional free-text responses associated with the pre-defined answer of ‘*other*’ being reviewed and grouped where appropriate into either existing or new answer categories. Answers which specifically requested a free-text answer were reviewed individually before being categorised, using a content analysis approach, and ranked based on frequency of occurrence.

6.3.3.2 Statistical analysis

Statistical analysis was performed using Microsoft Office Excel (Microsoft, 2013) and SPSS Version 25 (IBM Corp. 2017). Following preliminary analysis, explanatory variables, such as insurance status and perceived pressure to refer, were grouped to create binary outcomes. Data was then converted into the appropriate format to allow for statistical analysis. Correlations between explanatory variables were explored using Kendall's Tau for continuous variables and Chi-squared testing for categorical variables. Associations between categorical and continuous variables were investigated using Mann-Whitney U testing.

A generalised linear model, constructed as an ordinal logistic regression, was performed. Initially univariable regression was conducted to identify variables for inclusion and eliminate potential variable multi-collinearity within the final model. In order to ensure meaningful predictor variables were not overlooked, a p-value of 0.25 was chosen to identify variables for inclusion (Du and Tan, 2015). A backwards stepwise model was built using all variables which had evidence of association. The -2 log-likelihood value for each model iteration was used to determine the effect of variable removal. Variables with a Chi-square statistic of >3.842, corresponding to a p-value of 0.05 with one degree of freedom, were sequentially removed from the initial model. Model fit was assessed using Akaike's Information Criterion.

6.4 Results

6.4.1 Survey engagement

The survey was accessed 4596 times between July 25th and September 2nd, 2019. A large proportion of those accessing the survey (37%, 1711/4596) progressed no further than the introductory or consent page. Two-thousand eight hundred and eighty five respondents provided consent to participate however, 42% (1214/2885) did not reach the end of the survey in order to submit their responses. The majority of submissions (66%, 1096/1671) were received in the first week of data collection. Following preliminary analysis, 127 respondents were from outside of the UK and were therefore excluded from data analysis (Figure 6-1). Subsequently, a total of 1544 participants were eligible for inclusion within the final dataset. A number of submissions were partially completed therefore, the total number of responses is reported for each question.

6.4.2 Participant demographics

Survey respondents were mainly female (98%, 1517/1544) and had been involved in the care of horses for an average of 26 years (range, 1 – 70 years). A range of UK regions were represented, with most participants residing in either the South East (17%, 257/1544) or South West (234/1544) of England.

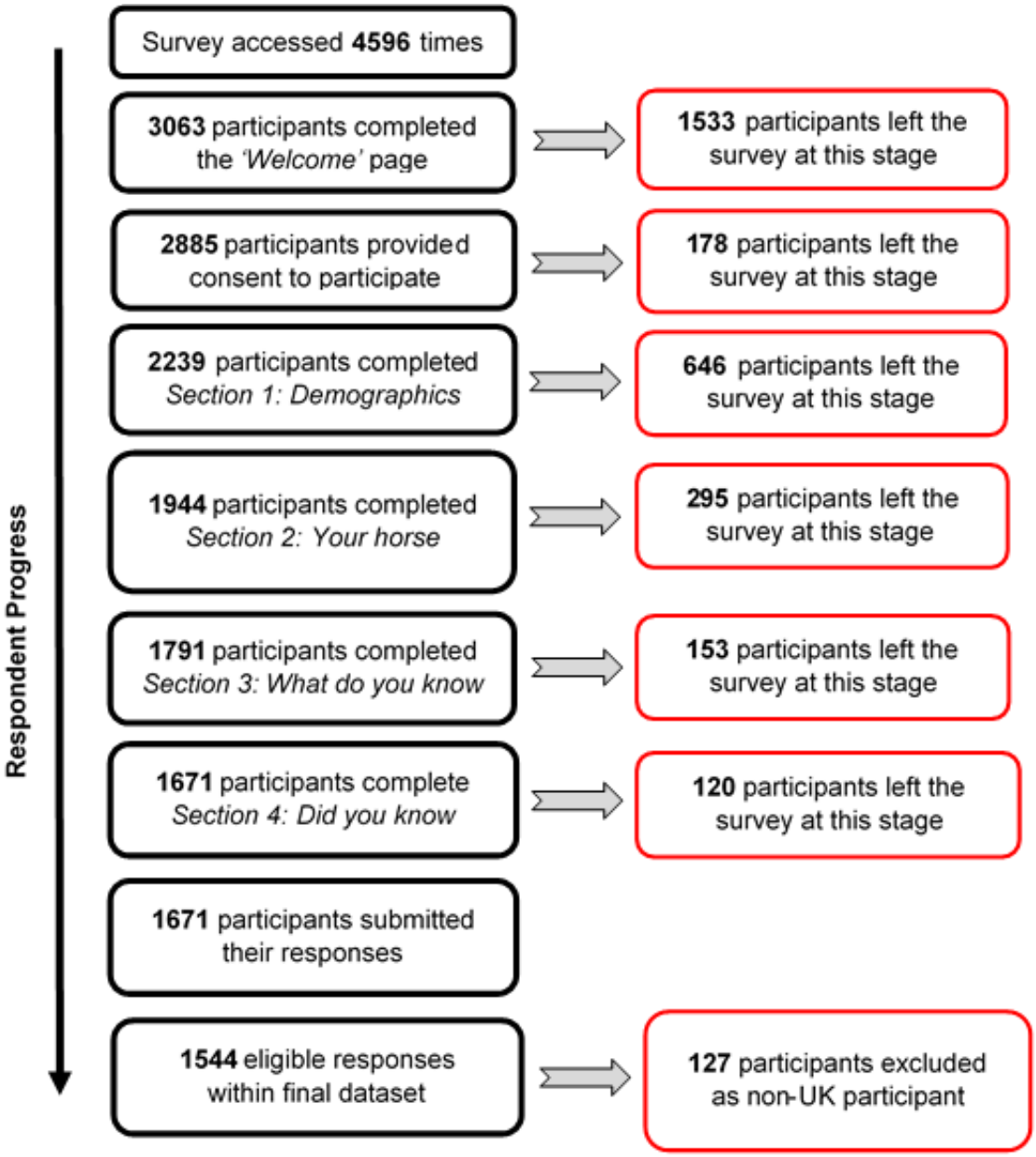


Figure 6-1: Flow-diagram illustrating respondent progress during online completion and preliminary data analysis of a survey investigating the impact of evidence on owner decision-making.

6.4.3 Colic education

At least one formal UK equestrian qualification was held by 32% (498/1544) of participants, with awards provided by The British Horse Society (BHS) being most frequently reported. When coverage of colic within their equestrian qualification was queried, 57% (373/659) of respondents felt that this topic was poorly covered, although 43% (286/659) were satisfied with their colic education. When asked to expand on their answer, 547 (83%) of respondents provided additional information.

Of these, 54% (296/547) of participants felt that their training had provided them with only a basic overview of colic:

'Colic was covered but the basics of it, I feel having seen many cases of colic, people need to be taught more on what to do when you suspect colic' (Survey participant 108)

' . . . We studied a variety of different illnesses over a couple of months. I don't think colic was very well explained considering how big the term "colic" is and the wide variety it covers.' (Survey participant 230)

'Having an hour lecture on a potentially life threatening condition is very insufficient in learning about all the symptoms and actions to take.' (Survey participant 1533)

Additionally, 19% (102/547) of comments referred to the relevance of taught knowledge, with many deeming their training 'out-of-date':

'Compared to what I know now, the level of information taught to us was so basic e.g. ten golden rules of feeding. This is going back quite a good number of years so things may be very different now.' (Survey participant 264)

'It was a very long time ago and I think the advice has changed. I remember having a book suggesting 10 aspirin in fizzy pop...' (Survey participant 272)

*'. . . exams were/are based on fairly old fashioned understandings and new research/understandings do take time to be encouraged into exams.' (*Survey participant 1348)

When asked when they had last read any information on colic, the majority (38%, 619/1525) of respondents had done within the last six months, 28% (427/1525) had done this between six months and one year prior to participation. Twenty four percent (365/1525) stated that they could not remember the last time they learned about colic. When asked where they had obtained their most recent colic information, the most common sources were social media (24%, 195/819) and articles within equestrian publications (183/819); only 6% (51 / 819) of participants stated that their recent colic knowledge had come from the 'REACT' campaign.

When asked what they thought about the equestrian communities understanding of colic, 1504 participants provided a free-text answer. Of these, 26% (395 / 1504) felt that colic is reasonably understood, but

knowledge could always be improved. However, 18% (274 / 1504) felt that owners had a poor understanding of colic, with a further 15% (227 / 1504) suggesting that colic knowledge was owner dependent:

'Not understood very well as many think colic is purely down to feeding and don't realise colic is a blanket term for most gastric issues and pain.' (Survey participant 598)

'I think many people are too casual about it and don't seek veterinary help fast enough. Also, they don't always recognise it if symptoms are subtle.' (Survey participant 628)

'I think the majority of people know and understand however there is scarily a lot of people still just haven't given it any thought or don't know what to do if a horse is showing signs OR what can even cause colic.' (Survey participant 359)

'There's a severe lack of knowledge amongst 'everyday' horse owners who run their horses on a shoestring which is frightening to see.' (Survey participant 417)

'I think the majority of people who have been brought up with PC or BHS qualifications are great however, since running a livery yard it has become apparent that a lot of horse owners are not even sure what colic is.' (Survey participant 1570)

Additionally, 12% (184 / 1504) of comments referred to knowledge within the equestrian community being 'out-of-date' or conflicting:

'I think understanding is mixed and there are a lot of old wives tales going around, like working the horse and not allowing it to roll.'(Survey participant 49)

'I think the majority of horse owners know the word colic. I think the biggest problem is the amount of myths out there and livery yards giving out the wrong advice. People are more willing to take advice from non-qualified people rather than calling their vet for advice!' (Survey participant 264)

6.4.4 Current horse ownership

The majority (91%, 1407/1544) of participants owned their own horse, with a further 7% (107/1544) having a major role in emergency decision-making for a horse they routinely cared for. Therefore, data for a total of 1514 horses is reported. Data associated with a second horse was provided by 398 participants however, this data was not included in the analysis for this study.

6.4.4.1 Current horse details

Demographics

Horses (1397/1514) had been owned for an average of 8.6 years (range, 0.08 – 37 years) and had a median age (1456/1514) of 14 years (range, 0.91 – 37 years). Most (51%, 765/1514) horses were

currently used for leisure or hacking, with 15% (224/1514) being either retired or a companion.

Insurance status

Over half (56%, 846/1514) were currently insured, with 68% of these (568/838) covered for mortality and vets fees only. Horses (n=658) were reportedly insured for a median of £2500 (range, £100 - £25000), with 43% (311/731) having current policy exclusions. Of these, most (25%, 77 / 311) had colic or colic related illnesses excluded from their policy.

Health status

A total of 554 (37%) horses reportedly had ongoing health issues, with some form of arthritic complaint (22%, 120/554) or a diagnosis (presumed or definitive) of Pituitary Pars Intermediate Dysfunction (PPID) (16%; 90/554) most frequently reported. Twenty-seven percent (412/1514) of owners indicated that their horse had suffered from colic during the time that they had owned them, with an average of three (range, 1 – 30 episodes) colic episodes reported. Finally, 5% (75/1514) of horses were stated to have behavioural issues severe enough to interfere with day to day management, with anxious or nervous behaviour most frequently reported (29%, 20 / 75).

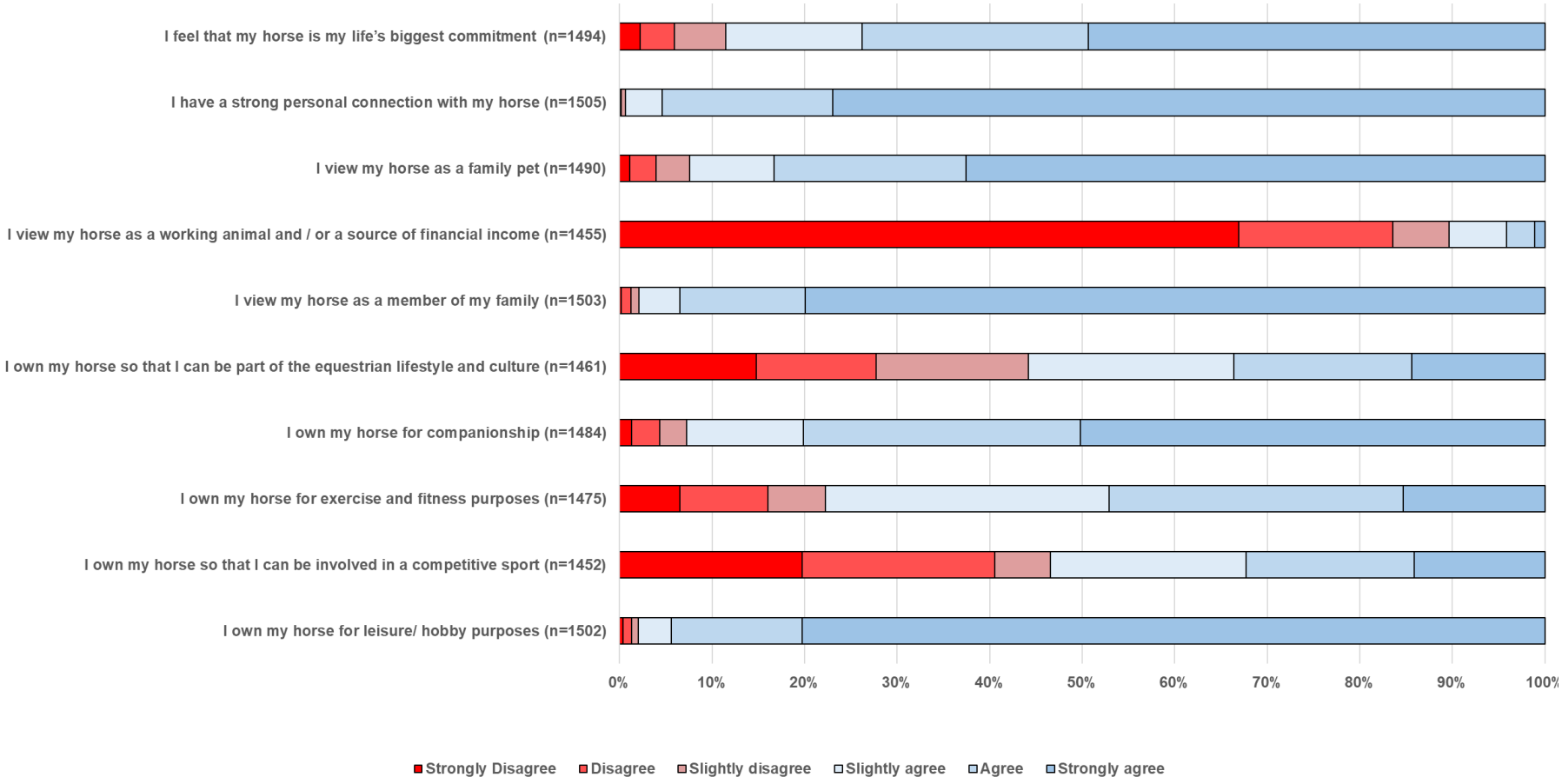


Figure 6-2: Stacked bar chart illustrating participants responses to statements associated with the horse-human relationship

6.4.4.2 Horse-human relationship

Participants were generally polarised in their response to statements associated with the horse-human relationship (Figure 6-2). The majority (80%, 1206/1502) strongly agreed that they owned their horse for leisure or hobby purposes. Horse ownership was seen as a means of staying fit by 78% (1147/1475) of participants however, only 53% (776/1452) of respondents agreed that they owned their horse to be involved in competitive sport. A large proportion (44%, 815/1461) of owners agreed, to some extent, that they owned a horse to be part of the equestrian lifestyle or culture, the majority (93%, 1376/1484) agreed that horses provide them with a source of companionship.

Most survey participants saw their horse as a pet (92%, 1377/1490) and member of their family (98%, 1472/1503), with the majority (90%, 1304/1455) disagreeing that their horse was a working animal or source of financial income. Finally, although 89% (1323/1494) of owners agreed that their horse was their biggest commitment in life; nearly all (99%, 1495/1505) agreed that they had a strong personal connection to the animal they owned.

Five-hundred and fifty-four participants provided additional comments about their horse. Forty0six percent (253/554) provided further insight into the relationship they have built with their horse:

'He is definitely a pet/friend rather than a working horse. I enjoy hunting and try to do that, but mainly just enjoy riding / spending time with / caring for (most of the time) horses' (Survey participant 465)

'I take a pragmatic view to horse ownership, despite the fact I totally adore my horses at the end of the day they are animals and are treated as such.' (Survey participant 556)

'My horses are my children. They come above and before anything else. They are more than pets. I have had my 15 year old since he was 1 and my 6 year old since she was 4 months old and they have both been through illnesses and injuries that could have seen them put to sleep and having nursed them through these I feel like we have a very special bond.' (Survey participant 1301)

Responsibilities of horse ownership, such as maintaining welfare and financial commitment, were also commented on by participants (28%, 154/554). Additionally, 23% (125/554) of respondents reported the physical and emotional benefits of horse ownership:

'Horses of which I have six are a huge part of my life - I am much happier and healthier due to my lifestyle with them - beats working in the city which I have also done' (Survey participant 89)

'I was at great risk of suicide . . . Fear that he would have no one to care for him properly has kept me from suicide at various times so he is incredibly important in my life' (Survey participant 358)

'He's my best friend. He's been the reason I've got out of bed on some dark days and the reason I'm now so happy' (Survey participant 964)

'She's a pet that allows me to compete and also have a hobby that gets me fit' (Survey participant 1352)

6.4.4.3 Decision to refer for colic treatment - descriptive

When asked about referral decisions, 3% (549/1514) of respondents felt that there was a pressure to refer a horse with colic for hospital treatment. The majority (67%, 367/549) stated that veterinary professionals were a main source of referral pressure:

'I guess the vet doesn't want to be held responsible if treatments at the yard end up not working and the horse gets worse or dies because it wasn't referred in time. Though I do think that if a vet does refer a horse with colic to the hospital then it's for a very good reason and in my experience, they normally have to have surgery' (Survey participant 8)

Twenty percent (110/549) suggested that peer pressure is common within the equestrian community:

'I think it comes from pressure to look like you're doing the best thing for your horse - To others in the community, yourself and professionals. Money pressure too as it seems if you do not have the money, then it is frowned upon and looks neglectful/uncaring.' (Survey participant 6)

'I think that even where options are offered, there is a perception (from social media?) that because specialist treatments are available they

should always be pursued, and that as a horse owner you won't have done enough if you don't pursue the specialist option.' (Survey participant 790)

When asked if they would consider referral treatment for their horse, 49% (743/1514) of respondents said that they would always consider this an option. Forty-three percent (662 / 1514) were unsure whether they would choose referral, with most (48%, 317/662) stating that it would depend on the severity of the colic at the time. Only 7% (109 / 1514) indicated that referral would never be an option for their horse, with old age (49%, 53 / 109) considered the main barrier to intensive treatment.

6.4.4.4 Decision to refer for colic treatment – statistical evaluation

Ten explanatory variables and all ten relationship statements were taken forward to univariable regression. A total of four explanatory and three statement variables were subsequently removed. Therefore, a total of 13 variables were identified for inclusion within the final model (Appendix XII).

Multivariable analysis identified nine variables, five explanatory and four statements, which were significantly associated with referral consideration (Table 6-3). Owners were more likely to consider referral if their horse was insured, used for ridden work, and not considered a working animal. Referral was less likely to be considered with increased horse age and owner involvement within the equestrian industry.

Table 6-3: Results of multivariable analysis with outcome variables relating to owner intention to pursue referral treatment if their horse was to develop a critical case of colic

Variable	Significance (p value)	Odds Ratio	95% Confidence Interval (CI)	
			Lower	Upper
Explanatory Variables				
Age of horse	<0.001	0.921	0.904	0.938
Years involved with horses	0.015	0.990	0.982	0.998
Is horse currently insured?	<0.001	2.332	1.858	2.926
Is horse currently used for ridden work?	0.032	1.422	1.030	1.964
Does owner feel pressure to refer?	<0.001	0.556	0.443	0.696
Relationship Statements				
I own my horse for competitive sport	0.006	0.908	0.848	0.973
My horse is a working animal and / or a source of financial income	0.001	1.188	1.073	1.315
I have a strong personal connection with my horse	0.022	0.792	0.648	0.967
My horse is my life's biggest commitment	0.006	0.878	0.766	0.964

Model Fit: Akaike's Information Criterion (AIC) value 2745.918

Those who disagreed that they had a strong personal connection with their horse were also less likely to consider referral as an option. Perceived pressure to refer and owner disagreement that the horse was a competitive animal or their biggest commitment, were also seen to reduce referral consideration.

6.4.5 Impact of evidence-based information

6.4.5.1 Knowledge and approach to monitoring health

Most (61%, 936/1544) survey participants would only measure their horse's heart rate if it appeared unwell, with 18% (275/1544) stating that they had never monitored this health parameter. After being given evidence highlighting the association of pain with an elevated heart rate, 64% (984/1544) of respondents reported that they already knew this information. Of 984 participants who already knew this information, 43% would continue to monitor their horse's heart rate as before, with the majority (54%, 231/427) only doing so when illness was suspected. Those who were previously unaware of this information (36%, 560/1544) said they were more inclined to start monitoring heart rate on a weekly basis (Figure 6-3). Twenty-nine percent (451/1544) of participants remained unsure on their approach to routine health monitoring despite information being provided. Analysis of free-text answers (n=460) identified factors, such as lack of knowledge and already being familiar of signs of illness in their horse,

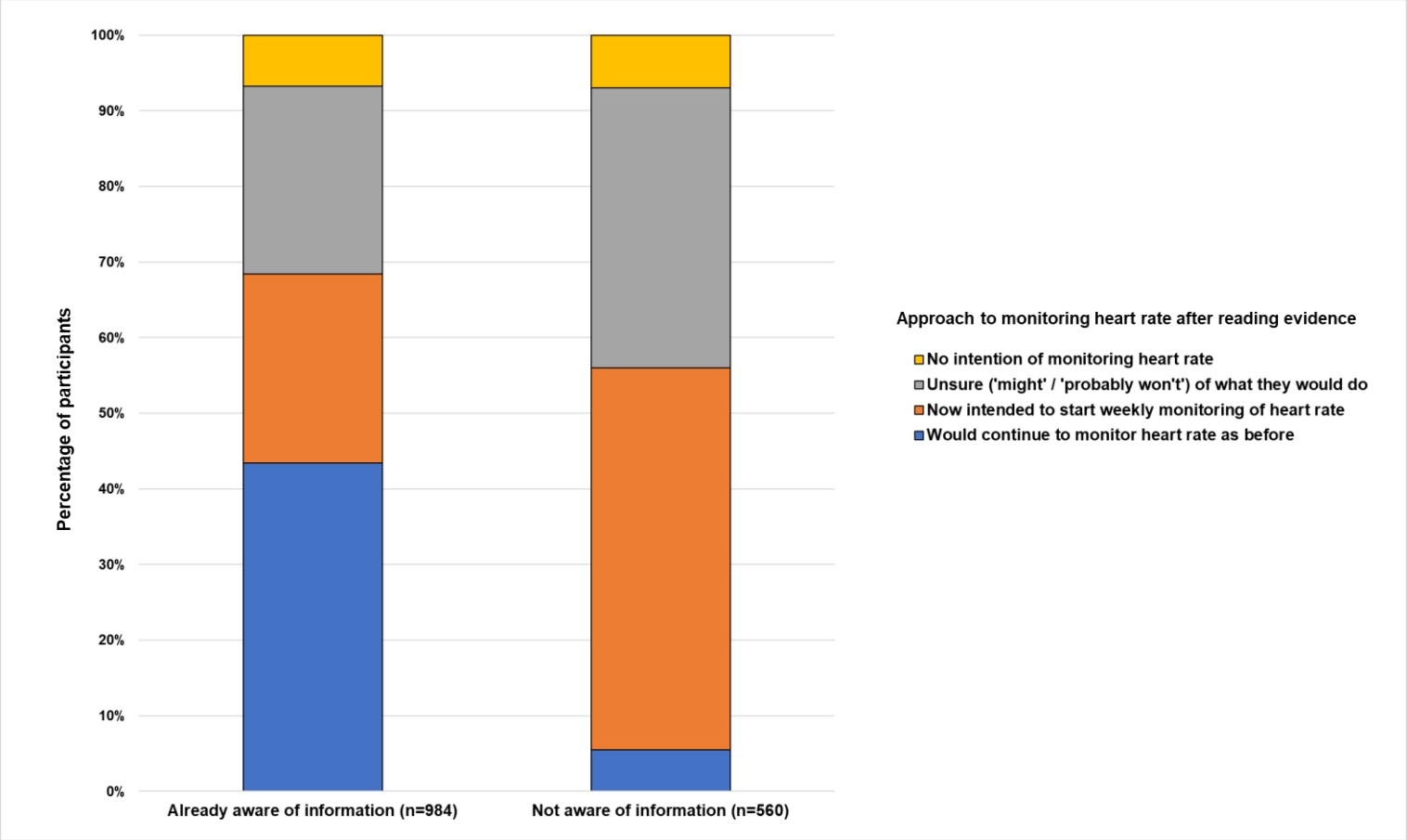


Figure 6-3: Stacked bar chart displaying participant intention to start weekly monitoring of their horse's heart rate after reading scientific evidence

as reason for no change. Additionally, some participants suggested that routine monitoring would cause them 'extra concern':

'Because I am already too obsessive about trying to do the right thing. I am in tears most days thinking my horses are going to die and I can't cope with yet another thing to fret about!' (Survey participant 1204)

6.4.5.2 Knowledge and approach to colic

Most (68%, 1051/1544) participants correctly identified that violent signs are not always shown in severe cases of colic. After being given evidence that even subtle changes could be an indication of critical colic, there was little impact on participants' approach to seeking veterinary assistance; the majority of those aware (75%, 1032/1378) and previously unaware (60%, 101/166) of this evidence would continue to immediately contact their vet if colic was suspected (Figure 6-4). Analysis of free-text answers (n=283) identified factors, such as participant's belief that colic did not always require veterinary attention and security in their current approach to colic, as reasons for no change:

'Because cases of spasmodic and obstructive colic often resolve quite quickly in my experience and it doesn't take long for my vet to get here, so as long as I knew the horse had only just developed colic I would monitor for a short time before calling the vet.' (Survey participant 538)

When asked how long it takes until there is irreversible damage in a strangulating case, 1236 participants provided an average time of 315

minutes (range, 2 – 87600 minutes). Twenty-six percent (407/1544) of participants felt that intestinal injury would occur within 30 minutes and one hour of colic signs, with 11% (162/1544) being unsure of this timeframe. Most (59%, 903/1544) respondents were not aware that irreversible damage could be sustained within a four hour period. However, this evidence had little impact on participants' approach to seeking help with the majority (75%, 1162/1544) indicating that they always sought immediate veterinary assistance when colic was suspected (Figure 6-4). Analysis of free-text answers (n=170) identified factors, such as participant's security in their current approach and their decision being dependent on the situation, as reasons for no change:

It would very much depend on how bad the colic is normally if colic is spotted I syringe fluids and liquid paraffin into (horse) normally through the night . . . Most of the time this is sufficient and (horse) is almost back to normal within 24-48hrs. However if still unwell vet is called for injection and we continue with fluids and paraffin. (Survey participant 1206)

Walking to prevent a horse from rolling was the chosen approach to managing colic for 69% (1064/1544) of participants. When asked why, the majority (41%, 430/1056) of those who provided an answer suggested that allowing a horse to roll would results in a 'twisted gut':

'I've always understood that the rolling could possibly give them a twisted gut or possibly make the twist worse. I do understand some

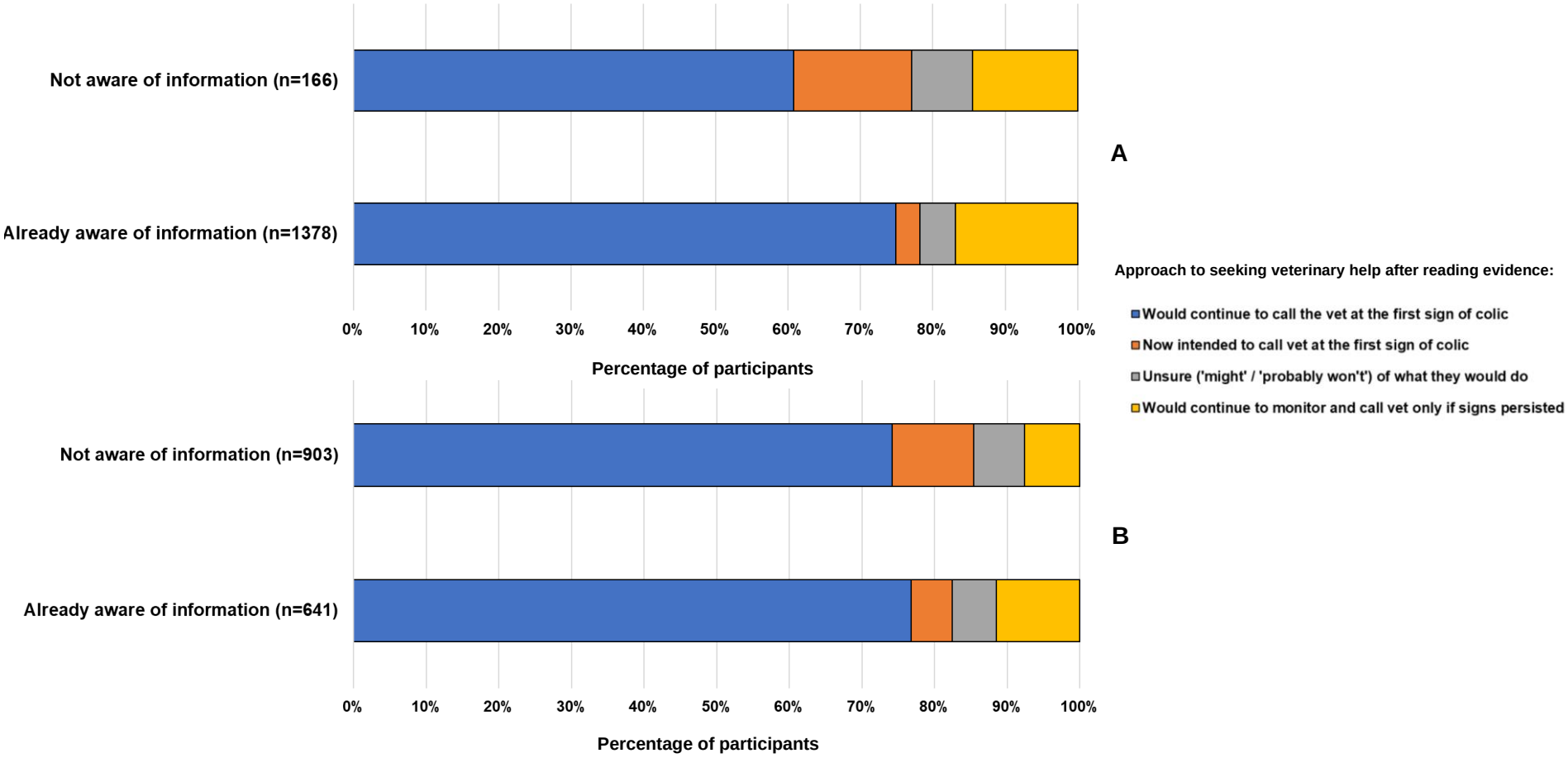


Figure 6-4: Stacked bar-charts illustrating participant intention to seek urgent veterinary help at the first sign of colic after reading scientifc evidence of A) subtle signs of colic and B) time until irreversible intestinal damage

people say to let them due to been able to untwist it themselves but I personally wouldn't like to take the risk of it worsening.'

(Survey participant 435)

When presented with information suggesting that allowing a horse to roll would not result in a 'twisted gut', the majority of participants indicated that they were already aware of this information (Figure 6-5). Of these, 52% (482/923) reported that they would always leave a horse with colic in a safe area and not walk it, despite 16% (76/482) previously suggesting that walking was their preferred approach. Most (46%, 286/621) of those previously unaware of this information now intended to leave a horse with colic in a safe area however, 32% (496/1544) of respondents were still unsure what they would do. Analysis of free-text answers (n=509) highlighted factors, such as the belief that leaving a horse stabled would result in further injury the fact that walking had worked previously, as reasons for no change:

'Because I have practised walking around 5-10 minutes when my horse had colic before and it worked so wouldn't change ways just because I read something different.' (Survey participant 126)

'I'm open to current research and theories being best approach but walking a horse has worked on a number of occasions I'm aware of over here plus seen with own eyes.'

(Survey participant 593)

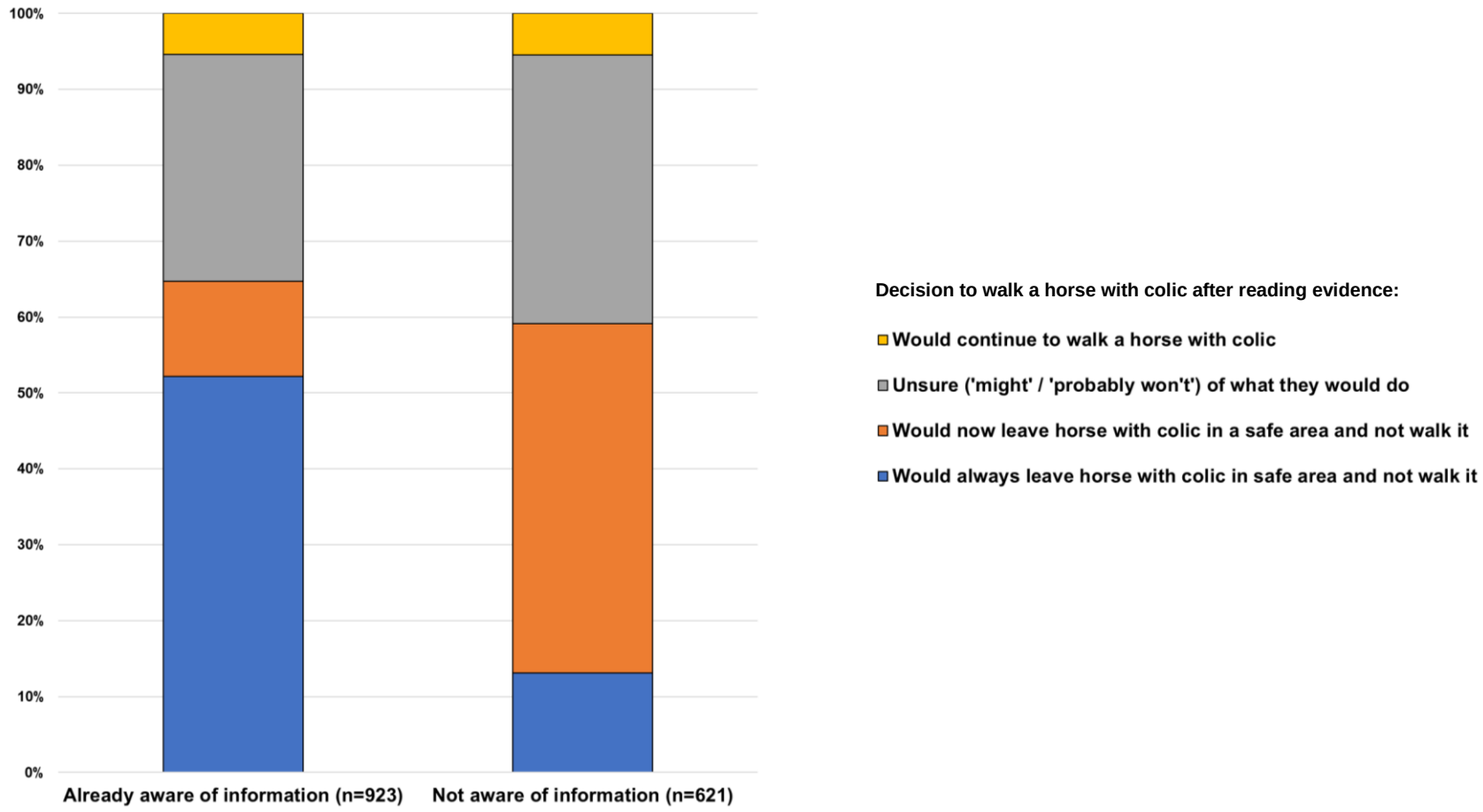


Figure 6-5: Stacked bar-chart illustrating participant intention to leave a horse with colic in a safe place and not walk it after reading scientific evidence

6.4.5.3 Decision to refer for colic treatment

Most participants believed that the term ‘referral’ was associated with a horse needing to go to an equine practice with hospital facilities (45%, 695 / 1544) or to a specialist practice or surgeon (33%, 510 / 1544) for further colic investigation or treatment. A small proportion (25%, 389 / 1544) of respondents suggested that this term indicated the need for colic surgery.

When presented with information highlighting that the term ‘referral’ does not always mean surgery is required, 78% (1206 / 1544) of participants reported that they were already aware of this information. Of those that were previously unaware, 29% (98 / 338) would now consider referral an option for their horse. However, little change in participants’ decision to refer was seen overall (Figure 6-6). Analysis of free-text answers (n=309) highlighted factors, such as the horse’s age and financial considerations, as potential barriers to referral:

‘Cost implications. I have a price I will not go above for medical treatments.’ (Survey participant 1448)

‘Due to age I would not want to put her through the stress of transport and testing if the prognosis would not change.’ (Survey participant 191)

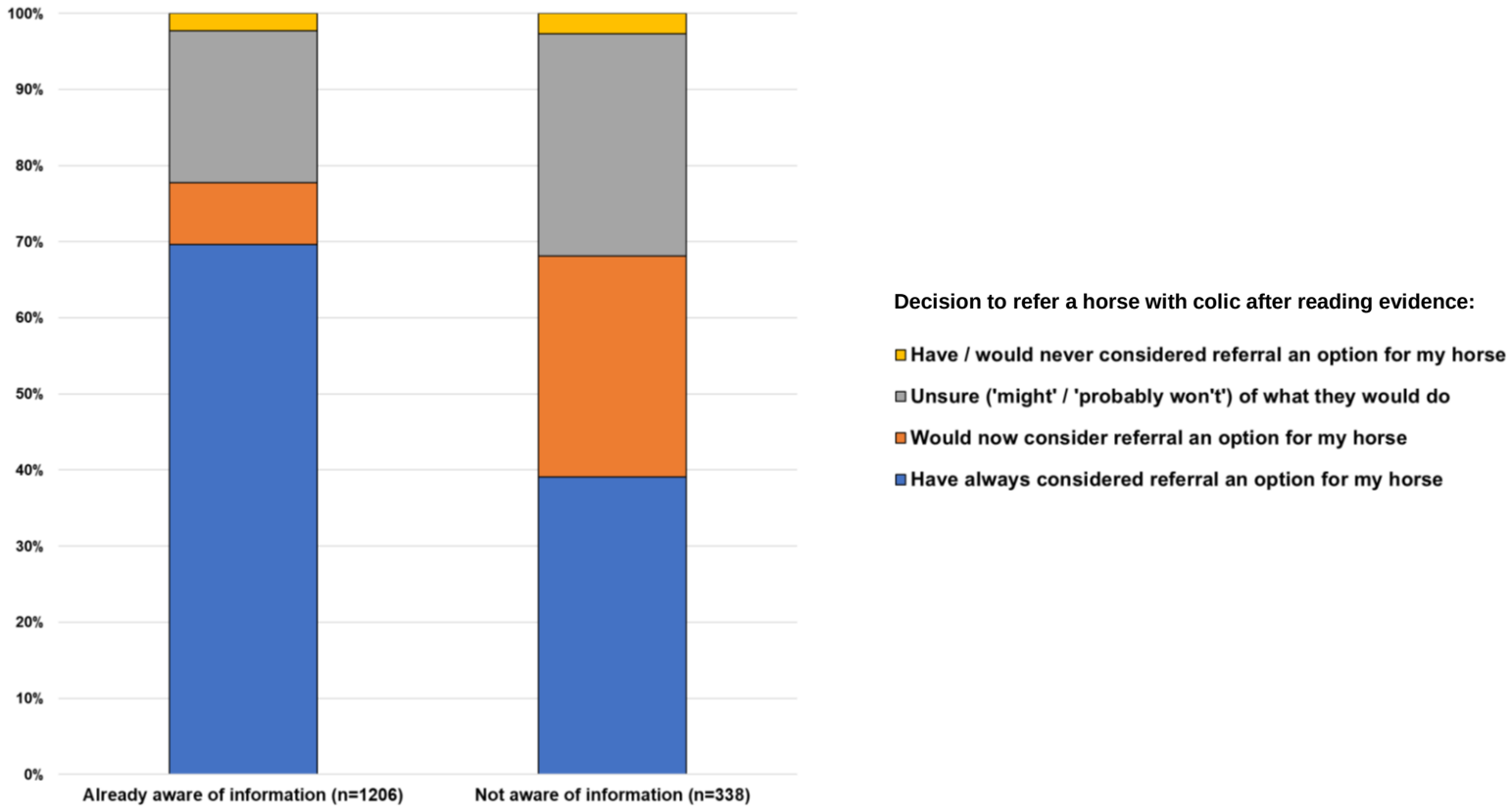


Figure 6-6: Stacked bar-chart illustrating participants' intention to consider referral treatment after reading evidence

6.4.5.4 Surgical intervention

Cost

Participants (n=1496) estimated that the average cost of colic surgery within UK veterinary hospital to be £5371 (range, £200 - £30, 000). Thirty-two participants did not provide an answer, with 16 simply stating 'thousands'. When asked to estimate what the maximum amount of financial cover equine insurers currently offer for colic treatment on average, respondents (n=1332) suggested a cost of £5644 (range, £0 - £1,000,000). When provided with evidence highlighting the cost of colic surgery versus the maximum financial cover available from equine insurers, 63% (966/1544) of participants reported that they were previously unaware of this information. However, this had little impact on whether participants' would choose to pursue surgical treatment (Figure 6-7). Analysis of free-text answers (n=571) identified factors, such as the horse's age and finance, as barriers to surgical intervention:

'It doesn't change the fact my horse is in his 20s and I really don't think surgery with a long recovery time would be fair on him.'

(Survey participant 141)

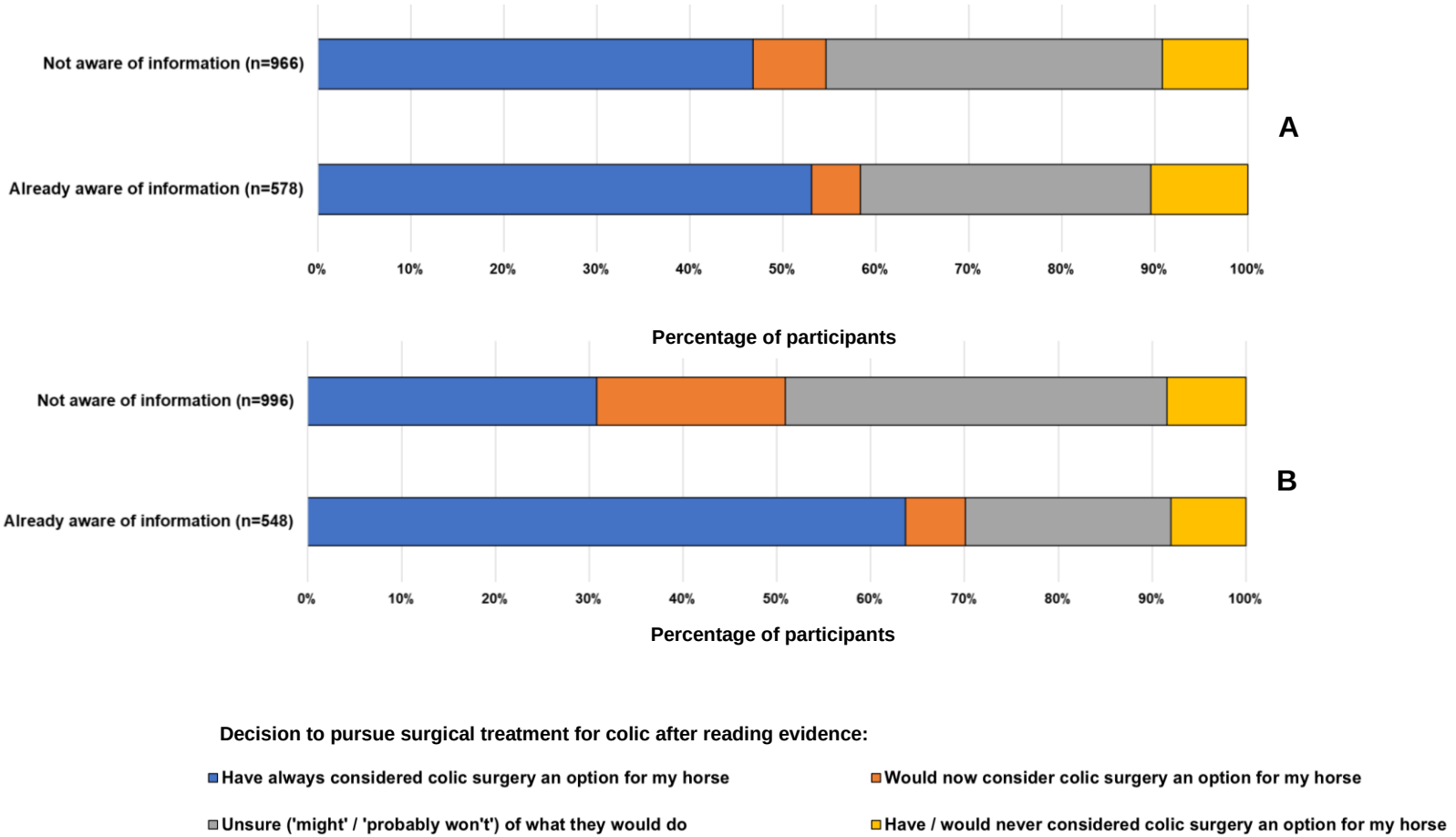


Figure 6-7: Stacked bar-chart illustrating participants intention to pursue surgical intervention after reading evidence on A) the average cost of colic surgery and B) the prognosis of horses over the age of 16 undergoing surgery

Age

Participants (n=1469) considered a horse to be ‘geriatric’ when they reached an average age of 20 years old (range, 8 – 40 years). Seventy-four participants stated that age was irrelevant and whether a horse was considered ‘old’ was dependent on the individual:

‘I think numbers shouldn't be used. The decision should be based on the individual horse, it's quality of life and their outlook …’

(Survey participant 257)

Most (68.5%, 1058/1544) participants would consider referring a horse over the age of 16 for colic treatment. Analysis of free-text answers (n=479) indicated that factors, such as poor prognosis and the demands of surgery / surgical recovery, were potential barriers to the referral of geriatric horses.

When presented with evidence highlighting that horses over the age of 16 were just as likely to survive surgical intervention when compared to younger animals, the majority (65%, 996/1544) of respondents reported that they were previously unaware of this information. However, there was little change in participants decision to consider surgery for a horse over the age of 16 after being given this information (Figure 6-8 A); most (43%, 656/1544) reported that surgery would always be an option regardless of age.

Survival and Return to work

Participants (n=1508) estimated that an average of 69% (range, 0 – 100%) of horses successfully discharged following colic surgery would be alive 12 months later. On average, respondents (n= 1502) estimated that 55% (range, 0 – 100%) of horses that were successfully discharged would be back in full work 12 months post colic surgery.

When presented with evidence showing that, following successful recovery and discharge, horses have about an 85% chance of being alive after 12 months, the majority (68%, 1051/1544) indicated that this information was previously unknown. Additionally, 68% (1052/1544) were previously unaware that between 70 and 90 percent of horses discharged would be in full work 12 months post colic surgery. However, there was little change in participants' decision to pursue surgical treatment (Figure 6-8 B), with most reporting that they had always considered surgery an option for their horse.

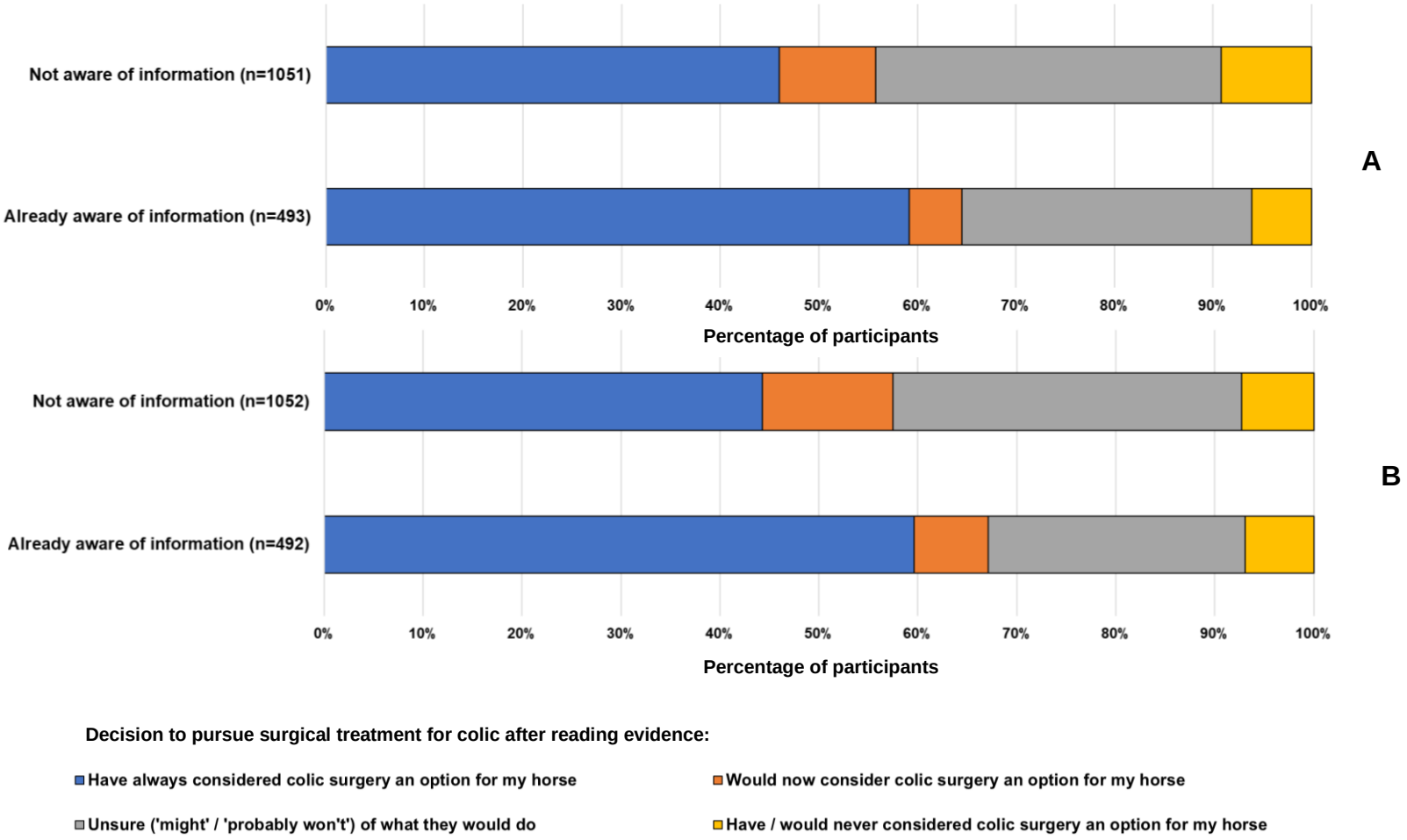


Figure 6-8: Stacked bar-chart illustrating participants intention to pursue surgical intervention after reading evidence on A) the long-term survival of horses undergoing colic surgery and B) return to work following surgery

6.5 Discussion

6.5.1 Overview of findings

The existence of inaccurate information, and subsequent development of misconceptions, can have severe implications for educational campaigns. This study aimed to investigate current beliefs associated with equine colic and how these affected owners' decision-making behaviours. The first part of the study investigated current levels of education and knowledge within the equestrian community. Very few horse owners had formal training in equine care or management. Those that did hold an equestrian qualification suggested that the topic of colic is often inadequately covered, with many saying that they had received 'out-of-date' or irrelevant information. Participants felt that an understanding of colic was often owner dependent, with many acknowledging the continuous presence of misconceptions about colic, such as the need to walk a horse with colic, within the equestrian community. The second part of the study focused on owners' current beliefs and behaviours, and whether providing information or evidence influenced this. Owner decision-making in the event of colic was found to be varied, with many reluctant to change their approach to colic management or thoughts on referral treatment, despite being provided with evidence-based information. Owners were less likely to choose referral treatment for older horses or if there was a perceived pressure to refer. Misinformation, prior colic experience, social pressure, and

reference to the horse-owner relationship were identified as frequent barriers to knowledge transfer.

6.5.2 Study limitations

To capture both horse owner opinions on referral treatment and current misconceptions associated with colic, an online questionnaire was selected as the most appropriate research method. The response rate of this survey was similar to that reported in previous equestrian studies (Bowden *et al*., 2020, Hotchkiss *et al*., 2007a, Hotchkiss *et al*., 2007b, Ireland *et al*., 2011a, Ireland *et al*., 2013, Scantlebury *et al*., 2014), with participating horse owners sharing similar demographics to those described in the previous two Chapters of this thesis. Yet, despite over 1,500 horse owners participating, the results cannot be considered representative of the horse owning population. Firstly, the use of online platforms to facilitate both survey dissemination and data collection may have favoured a computer literate population. Secondly, as described in Chapters Four and Five of this thesis, owners with prior experience of colic or strong views on this topic may have been more inclined to complete this survey. Although this may explain why the highest rate of 'drop-out' was seen immediately after the introductory page, within the survey there were large ranges of reported colic experience, levels of horse ownership and knowledge of colic suggesting that bias as a result of self-selection was actually minimal. Finally, not all participants provided an answer to every question, with many owners appearing to 'skip' queries which required a free-text answer. There has been much

debate over the use of closed versus open questions in survey research (Bradburn *et al*., 1978, Converse, 1984, Converse and Presser, 1986, De Vaus and de Vaus, 2013, Schuman and Presser, 1979), with the latter associated with the submission of unrestricted, free text answers. Whilst closed questions enable a rapid and simple way of collecting large quantities of data, the use of pre-determined answers can force participants to make choices they may not make in 'real-world' settings. Additionally, singular use of closed question can result in a simplistic, almost pre-determined, view of a concept (Neuman, 2013). Therefore, as this study aimed to explore potential misconceptions and capture individual views on colic referral, open-ended questions were deemed most appropriate. However, though this question type is useful for researchers aiming to extract in-depth information, it requires much more participant effort when compared to closed-question formats (Reja *et al*., 2003). Therefore, the increased demand associated with open-ended questions in this survey may have inadvertently led to a higher number of non-responses.

The current study used a three staged approach to identify and correct potential misconceptions: 1) assessment of current knowledge / beliefs / opinions associated with colic, 2) provision of up-to-date evidence and 3) reassessment of original beliefs / opinions. However, in many disciplines, particularly the social sciences and psychology (Taylor and Kowalski, 2014), misconceptions are frequently investigated using the traditional format of 'true' or 'false' questionnaires. As a result, some

may consider the approach described within this study as inappropriate and therefore a limitation. Yet, doubt has been cast on the usefulness of true/false testing, with several authors suggesting that this form of assessment is too simplistic as it does not acknowledge the complexity of misconceptions (Brown, 1983, Gardner and Dalsing, 1986, Griggs and Ransdell, 1987, Kuhle *et al*., 2009, Lamal, 1979, Taylor and Kowalski, 2004, Vaughan, 1977). In an attempt to avoid these issues, this study attempted to assess current knowledge of / approaches to colic and response to evidence-based information separately in order to highlight potential misconceptions. Although not based on an existing method, such as the true/false format, this approach is in line with research which suggests that knowledge or understanding of a topic should be assessed independently to a participant's confidence in held beliefs (Bensley and Lilienfeld, 2015, Landau and Bavaria, 2003).

6.5.3 Key findings

6.5.3.1 Emotional attachment as a barrier to knowledge transfer

It was interesting to find that the majority of horse owners were averse to routinely monitoring their horse's heart rate. Although colic is frequently associated with easily recognisable behaviours, such as continuous or violent rolling (Scantlebury *et al*., 2014, Yeoman *et al*., 2017), many horses will display mild signs only, including subtle changes in demeanour (Cook and Hassel, 2014, Pratt *et al*., 2003) and a reduction in faecal output (Mair and Hillyer, 1997). Evidence has shown that heart rate can be a useful tool in ascertaining colic severity,

with studies frequently associating an elevated heart rate with critical cases of abdominal pain (Orsini *et al*., 1988, Bowden *et al*., 2017, Curtis *et al*., 2015, Furr *et al*., 1995, Orsini, 2011, Reeves *et al*., 1989). Whilst this observation is in agreement with the findings of Chapters Four and Five of this thesis, this study adds to our understanding by identifying that the provision of evidence does little to change participants' views and this is concerning. Whilst many stated that their reluctance to change was because they already felt confident in their ability to recognise colic, a finding which will be discussed further in Chapter Nine, it was interesting to note that some owners felt that routine observations would cause them to worry excessively about their horse.

Although an unpleasant experience in itself (Mathews, 1990), the act of 'worrying' is thought to function as an aversion response to experiences that may cause physical or emotional harm (Borkovec, 1985, Borkovec, 1994, Borkovec *et al*., 2004, Hirsch and Mathews, 2012, Newman and Llera, 2011). However, persistent anxiety can lead to the negative reinforcement of continuous situation avoidance (Newman and Llera, 2011). This 'head-in-the-sand' mentality could be construed as an act of 'denial', in which an individual consciously chooses to ignore information or events that may evoke unpleasant emotions (Freud, 1946, Kortte and Wegener, 2004). Although some have argued that there are positive aspects to denial, such as allowing an individual to adapt to a situation through the reduction of unnecessary stress, high levels of disavowal can be maladaptive (Kortte and Wegener, 2004).

For example, the concept of ‘illness denial’, in which individuals refuse to acknowledge their susceptibility to or diagnosis of a particular illness (Weinstein and Kahn, 1955), has been linked to delayed help seeking (Croog *et al*., 1971, Herlitz *et al*., 1989, O'Carroll *et al*., 2001), minimisation of symptom severity (Gentry, 1978, Gentry *et al*., 1972) and a reduction in knowledge transfer and compliance (Croog *et al*., 1971, Levine *et al*., 1987, Shaw *et al*., 1985) in patients with heart disease. Although it has not yet been explored within the horse owning population, it could be theorised that ‘denial of illness’ is a potential cause of owner reluctance to adopt ‘REACT’ recommendations. For example, one owner stated that they would not start routine monitoring because, ‘*… I am already too obsessive about trying to do the right thing. I am in tears most days thinking my horses are going to die and I can’t cope with yet another thing to fret about!’* Owners concerned about potentially discovering that their horse is unwell, may actively avoid behaviours (such as routine health monitoring) that could result in their fears becoming a reality. Although this study provides early evidence of this, further research is required on this subject before any conclusive parallels can be drawn. However, in contrast to the denial of those facing a personal diagnosis of illness, the response from horse owners appears to be elicited through fear for their horse’s well-being. One potential explanation for this is could be the strong horse-human bond described by many participants within this study. As previously mentioned in Chapter Five, an owner’s relationship with their animal can influence a range of decisions, including the pursuit of veterinary

treatment or advice (Gray and Moffett, 2013). Although the majority of existing literature is concerned with companion animals (Cohen, 2002, Dawson, 2008, Dawson, 2010, Ross, 2013, Villalobos and Kaplan, 2017), this study has highlighted the significant impact the horse-human relationship can have on an owner's decision to seek referral treatment for colic. Furthermore, a large proportion of owners reported extensive physical and mental benefits of owning horses, which is consistent with previous research (Hausberger *et al*., 2008, Hemsworth *et al*., 2015). However, the apparent reliance on horses as a source of companionship or an 'escape' from reality could be fuelling owners' concerns about future illnesses and potential loss of their beloved pet. Subsequently, some owners may choose to ignore advice which may help them detect early signs of disease through fear of discovering that their horse is unwell.

This hypothesis may also account for the fact that advancing equine age was found to significantly decreased the likelihood of referral. The effect of age on colic survival has been a much debated topic, with two large retrospective studies identifying advanced age as a negative indicator of surgical survival (Mair and Smith, 2005a, Proudman *et al*., 2006). However, more recent evidence suggests that geriatric horses (≥ 16 years of age) were just as likely to survive surgical intervention when compared to non-geriatric horses (Gazzerro *et al*., 2015, Krista and Kuebelbeck, 2009, Southwood *et al*., 2010). However, it is important to consider that those populations may have been biased towards horses

with less severe clinical signs, with horses showing severe signs of illness being euthanised prior to referral. Nevertheless, Southwood *et al*. (2010) also suggested that a higher rate of euthanasia in geriatric horses with colic is more likely attributed to owners being averse to surgical intervention rather than a poor prognosis. This could again be attributed to the animal-owner bond, with owner attachment thought to strengthen over time (Villalobos and Kaplan, 2017). This may inadvertently result in a strong aversion to treatments which require long term separation from their animal or are perceived to have a negative impact on quality of life. Therefore, many may feel that euthanasia is the kindest option for both them and their horse. However, given that horses over the age of 16 have been noted in many published colic survival studies (Gazzerro *et al*., 2015, Krista and Kuebelbeck, 2009, Mair and Smith, 2005a, Southwood *et al*., 2010), aversion to colic surgery based on long term companionship cannot be attributed to all cases. Additionally, owners with a strong attachment to their animals frequently want to do everything they can to prolong life, despite a poor prognosis or a lack of financial support (Wensley, 2008a). Therefore, given the significant impact the horse-human relationship may have on both the 'REACT' campaign and the equine welfare, further research is warranted. Qualitative interviews with horse owners would provide an in-depth insight into non-clinical factors considered important during decision-making. Additionally, given the implications of the horse-human relationship on informed decision-

making, future studies should also aim to capture the views of veterinary professionals.

6.5.3.2 Existing knowledge and beliefs

Survival rates for colic surgery have improved significantly over the last 50 years due to advances in surgical techniques, hospital protocols and anaesthetic recovery (Burford, 2016, Freeman, 2018b, Southwood, 2012a). For instance, surgical correction of strangulating lesions of the small intestine, which carried a survival rate of 30 - 50% during the late 1980s and early 1990s (Edwards and Proudman, 1994, Macdonald *et al*., 1990), was found to be associated with a 80 - 95% success rate over 10 years later (Freeman and Schaeffer, 2005, Morton and Blikslager, 2002). Additionally, it has been reported that 84 – 87% of horses will be alive at 12 months (Christophersen *et al*., 2011, Mair and Smith, 2005c, van den Boom and van der Velden, 2001), with around 63 – 86% successfully returning to athletic use (Christophersen *et al*., 2011, Davis *et al*., 2013, Hart *et al*., 2014, Tomlinson *et al*., 2013). Yet, despite the availability of this evidence, the majority of participants within this study were still unaware of current surgical survival rates. With a high proportion of owners indicating that they had no formal training in horse care or management, a poor awareness of colic survival could be the result of limited access to academic research. However, although this would account for a lack of knowledge, it does not explain why many owners remained unsure or reluctant about surgical intervention after reading the information presented above.

As previously mentioned, in-depth qualitative interviews would provide further insight into the decision-making processes of horse owners. Therefore, a similar approach is recommended to further investigate why some owners are reluctant to pursue colic surgery. One potential explanation could be the financial implications of colic treatment. Many owners within this study stated that potential costs of referral treatment made them reluctant to consider surgery an option. It was also highlighted as a reason to why understanding of mortality rates would have little impact upon participants' future actions. With average costs ranging from £800 for euthanasia to over £6,000 for surgical intervention (Barker and Freeman, 2019), this opinion is not surprising and supports the fact that referral was significantly more likely for insured horses. Additionally, this may support the fact that mortality during surgical intervention has been frequently attributed to sudden death or elective euthanasia (van der Linden *et al*., 2003), with the latter usually occurring due to financial constraints or a poor prognosis (Christophersen *et al*., 2014). However, the decision for intraoperative euthanasia may also be based on misconceptions regarding the effect of age on recovery (Krista and Kuebelbeck, 2009) as well as potential athletic return and specific disease prognosis (Freeman, 2018a). This may explain why many owners were reluctant to change their views on surgery after reading evidence provided on surgical success rates. Furthermore, it supports the fact that some owners were sceptical of the information provided within this study as it did not align with what they had previously been told, witnessed, or personally experienced. If

correct, this may imply that the growing prevalence of intraoperative euthanasia, both within (Blikslager and Mair, 2014) and between (Edwards and Proudman, 1994, Espinosa *et al*., 2017, Klohnen *et al*., 1996, van der Linden *et al*., 2003, Wormstrand *et al*., 2014) hospital populations, is the result of misinformation rather than informed decision-making. However, there is limited evidence exploring factors associated with the euthanasia of horses referred for colic, with many survival studies excluding these cases in favour of those which support short or long term survival post-surgical intervention. As a consequence, many studies have drawn conclusions about colic survival based on horses who have recovered from surgery, whilst neglecting to acknowledge those who were electively euthanised. Therefore, further investigation into factors associated with the treatment and survival of horses diagnosed with colic is warranted. However, data collected retrospectively may not contain relevant information on non-clinical factors associated with euthanasia. Therefore, future studies should be prospective in nature to enable the development of a bespoke data collection tool.

6.5.3.3 Social ‘norms’ as a barrier to knowledge transfer

It was apparent that many owners believe that allowing a horse to roll may cause the intestinal tract to ‘twist’, potentially increasing the need for surgery or euthanasia. More concerning was the fact that many

owners would still continue to walk a horse with colic, despite being informed that there is currently a lack of scientific evidence to support this claim. Although some presentations of colic warrant the application of controlled exercise in order to resolve symptoms; for example, following phenylephrine administration to induce splenic contraction or lunging to assist in the reversal of a large colon displacement during a nephrosplenic entrapment (Abutarbush *et al*., 2005, Fultz *et al*., 2013, Hardy *et al*., 2000), this should only be performed following a veterinary examination. However, it seems that owners who have been previously informed by veterinary staff to walk a horse with colic (which has subsequently recovered), are exercising their horse in the hope that symptoms resolve, rather than seeking veterinary advice. Therefore, it is essential that veterinary practices are triaging calls appropriately to ensure owners are provided with advice appropriate to their current situation only. However, in addition to prior veterinary advice, some owners reported feeling pressured by their peers to walk a horse with colic, as not doing so would result in them being labelled ‘uncaring’. It is widely acknowledged that owner knowledge is often formed in a social context, such as livery yards, and frequently based on lay sources of information (Hockenhull *et al*., 2010, Visser and Van Wijk-Jansen, 2012, Buckley *et al*., 2004, Hockenhull and Creighton, 2013). The findings of this study suggest that a lack of appropriate colic knowledge could be attributed to the fact that many horse owners have not undertaken any formal training in equine care or management. This could also account for an apparent reliance on prior experience, or the

advice of those perceived as more experienced, when responding to a suspected episode of colic. Yet, access to equine specific education was not necessarily seen as advantageous, with many of those holding an equestrian qualification reportedly being dissatisfied with taught content associated with colic. Furthermore, quality of delivered material appeared to vary according to course, with degree level programs apparently providing more in-depth information when compared to those offering owner level 'certificates'. Although the provision of a more challenging curriculum is expected from university level courses, it is disappointing that horse owners with lower levels of education are seemingly at a disadvantage in terms of knowledge that could potentially enhance their horse's welfare. However, it must be noted that opportunities to access further information have been reportedly declined by horse owners, with factors such as time and financial constraints, lack of interest or the belief that their skills do not require improvement often cited (Pearson, 2003). This contention would coincide with the fact that many participants within this study felt confident in their current approach to colic management, subsequently declaring that the provision of information within the survey would have little impact upon their future actions. Yet, evidence to support owners claims of inadequate course content is lacking, with the majority of existing literature focusing solely on degree level courses within the United States (Conners, 2009, Lofgren *et al*., 2015, Long and Morgan, 2010, Splan *et al*., 2016). In order to combat the spread of misinformation, research into the availability of UK equestrian courses

and the content they offer is warranted. To capture a wide range of views, all relevant stakeholders should be included within future studies, including past / present students, teachers, and course designers. Focus groups or qualitative interviews with stakeholders would provide a foundation on which future topics of interest can be explored. These findings could then be extrapolated to the wider population in order to identify where current gaps in knowledge are most prevalent.

6.5.4 Recommendations for future study

In order to maintain good levels of equine welfare, decision-making in the event of an emergency should be based on correct and up-to-date information. The results of this study have shown that owners often rely on prior colic experience, with many reluctant to adopt new approaches or ideas because of persistent false beliefs or the fear of social criticism. Therefore, further investigation into the potential impact of a colic event on horse owner decision-making is warranted.

This study has highlighted that many owners allow their horse to roll due to prior or recent advice from a veterinary professional. However, little evidence exists on how colic calls are triaged within veterinary practices and what advice may subsequently be given to an owner. It is therefore reasonable to suggest that the persistence of misconceptions, such as preventing a horse from rolling, may be caused by a lack of

knowledge and the inappropriate triage of colic calls by members of veterinary teams. Consequently, further investigation into how veterinary teams manage potential colic calls is needed.

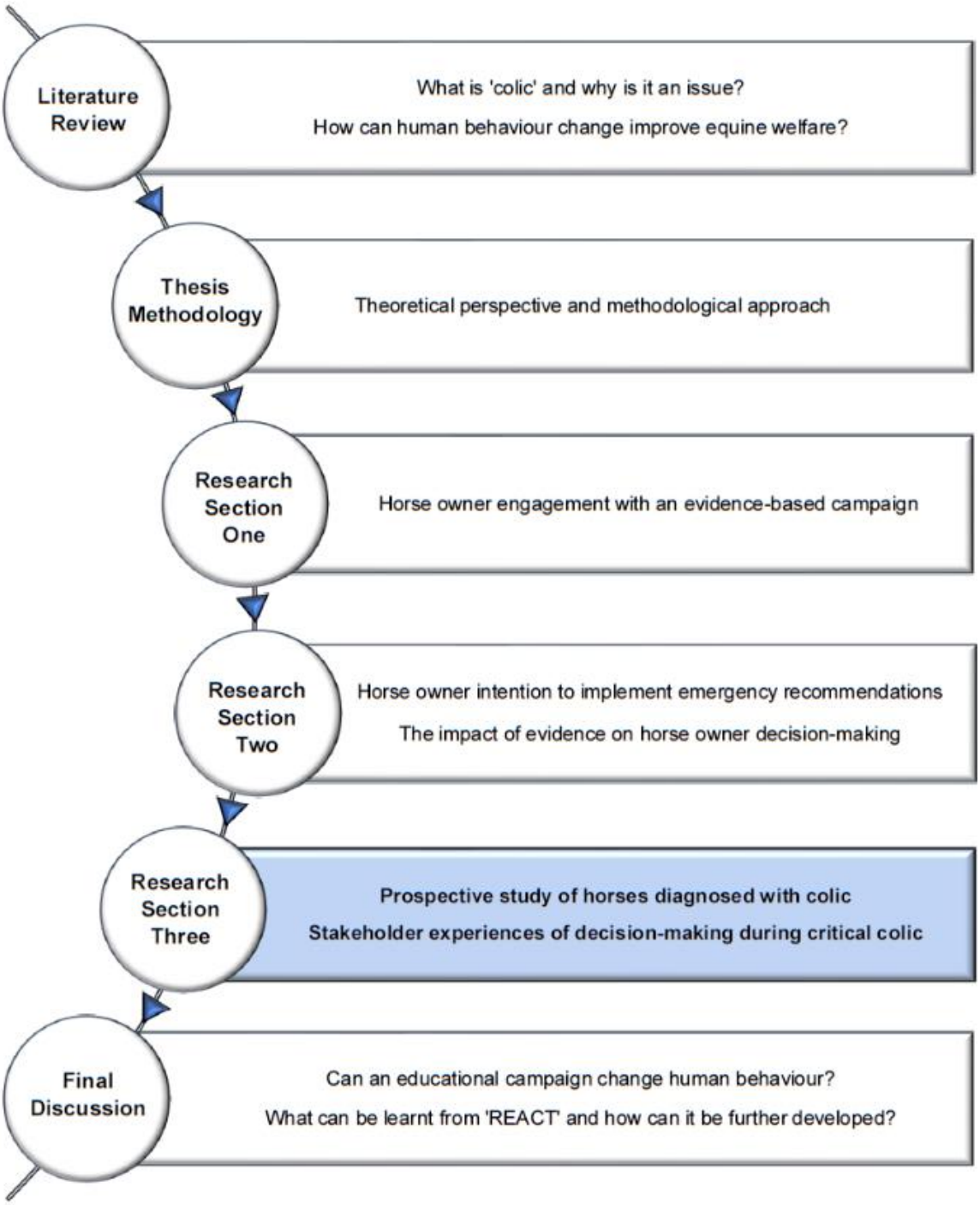
The strength of an owner's 'bond' with their horse was also shown to have a significant influence on owner decision-making, with evidence suggesting that animal-owner bond strengthens over time. However, despite advancing horse age being highlighted as a significant barrier to colic referral, this finding is in contrast with previous clinical studies of colic which suggest that an increased occurrence of intra-operative euthanasia could be linked to owner misconceptions about age and surgical survival. Given that some owners may be driven to do everything possible to prolong their horse-human relationship, further research is required to establish whether age truly is a barrier to intensive veterinary treatment.

6.6 Conclusions

There is currently no published evidence on misconceptions about colic within the equestrian community. This is the first study to evaluate the effect of evidence-based knowledge on owner decision-making and the pursuit of emergency colic treatment. The results show that owners evaluate new information against their own prior experience or knowledge of colic, with many reluctant to adopt new approaches or ideas because of persistent false beliefs or the fear of social criticism. Additionally, the veterinary profession has been identified as a trusted

source of information for owners therefore, it is important that advice provided by veterinary teams is consistent and case specific. Given that many campaigns are based on the provision of knowledge in the hope of eliciting a positive behavioural change, an understanding of existing beliefs and potential barriers to knowledge transfer is essential. Additionally, given the severe implications of incorrect knowledge for both horse and owner, the identification and correction of misconceptions is essential.

Research Section Three



Chapter 7: In-depth case analysis of critical decisions made by horse owners and veterinary professionals: findings from a prospective clinical study

7.1 Introduction

Despite the need for rapid decision-making (Proudman *et al.,* 2002b) there are a multitude of factors that can hinder the decision to refer a horse, such as knowledge limitations within the horse owning population (Bowden *et al*., 2020, Scantlebury *et al*., 2014) and the potential for the animal to return to previous levels of work (Davis *et al*., 2013). Several studies have documented colic mortality due to elective euthanasia (Bowden, 2017, Curtis *et al*., 2015a, Ireland *et al*., 2011b) however, none have documented factors considered important during the decision-making process. Ireland *et al*., (2011b) identified several factors which could influence owner decision-making for euthanasia following a diagnosis of colic: veterinary advice, hopeless prognosis, and severe/uncontrollable pain. However, specific evidence on decision-making associated with critical cases of colic, by both veterinary surgeons and owners, is lacking. Furthermore, results from the preceding studies within this thesis have highlight the powerful influence of non-clinical factors, such as the horse-human relationship and prevalence of misconceptions about colic, on owner decision-making. Therefore, due to the potential impact on campaign engagement, as well as equine welfare, further research into factors affecting decision-making during critical cases of colic is required.

7.2 Study aims and objectives

The aim of this study was to describe the assessment and decision-making processes for horses referred for colic management and identify factors that may contribute to death/euthanasia.

The objectives of this study were:

- To describe the clinical presentation of horses diagnosed with colic
- To document the diagnostic assessment and subsequent treatment of horses diagnosed with colic
- To explore factors associated with the decision to pursue medical or surgical treatment for colic.
- To identify factors associated with the decision to euthanise a horse referred for colic assessment.

7.3 Methods

7.3.1 Study design

7.3.1.1 Participant recruitment

A prospective 12 month study was developed to collect data from veterinary surgeons routinely involved in the clinical assessment of horses presenting with abdominal pain (colic). To ascertain factors associated with decision-making at both primary and referral stages of colic assessment, equine veterinary establishments which provided both first opinion and referral services to clients were identified as the target population for this study. A convenience sample of three UK veterinary practices, which met these criteria, were recruited to participate (Appendix XIII). No financial incentive was offered to encourage participation.

7.3.1.2 Case selection

Participating practices were asked to report information for all horses examined for colic, regardless of case outcome or severity. In accordance with previous research, colic was defined as ‘any incidence of abdominal pain as assessed by the veterinary surgeon in attendance’ (Curtis *et al*., 2015). Cases were deemed separate occurrences if a colic free period of seven days was noted. Short-term survival; time from initial veterinary examination to hospital discharge or conclusion of primary assessment or treatment; was the focus of this study, therefore follow-up information was not sought after case completion.

7.3.2 Data collection

7.3.2.1 Development of data collection forms

To facilitate data collection, bespoke colic assessment forms, one for primary examinations and one for referral cases, were developed. Paper-based forms were created using Microsoft PowerPoint (Microsoft Office 2016, Version 16.0) and then converted to editable computer-based forms using Adobe Acrobat XI (Acrobat XI, Adobe Systems Inc., San Jose, CA).

To ensure submitted cases could be traced back to participating practices, key information, such as practice post code, initials of attending practitioner and date of examination, was requested at the start of each form. The main body of the document was comprised of eight sections and utilised a mixture of closed and open question formats. The specific sections were:

1. Horse details
2. Recent management changes (in the last 30 days)
3. Colic history
4. Current colic episode
5. Clinical exam
6. Results of diagnostic procedures
7. Diagnosis
8. Treatment and case outcome

Information presented on both the primary and referral assessment form, apart from section eight, was identical. Content which differed in the final section of the form was associated with case treatment and outcome. Where primary forms requested indications for referral or

details of treatment provided at the owner's premises, referral forms collected data associated with intensive medical or surgical treatment performed in the hospital.

Form content was initially based on the amalgamation of information from colic assessment forms currently used by participating practices. This design was then further developed through the inclusion of data identified in existing literature as associated with either the - development of colic or case outcome (Table 7-1).

Breed categories presented in section one were based on those defined by Bowden *et al*., (2017), with the most common signs of colic (Wild *et al*., 2017; Yeoman *et al*., 2017) listed in section four. To maintain consistency, several scoring systems were developed based on existing literature. These were as follows:

- Body condition scoring (BCS) system (Carroll and Huntington, 1988)
- Demeanour score (Curtis *et al*., 2015; Mair and Smith 2005; Southwood and Fehr 2013; Sutton *et al*., 2013)
- Behaviour severity (Curtis *et al.,* 2015, Sutton *et al*., 2013; Mair and Smith 2005)

Pre-defined answer options presented in the final three sections were created following discussions with three equine veterinary surgeons. These categories represented the most frequent diagnostic outcomes and colic diagnoses experienced during a colic assessment, although participants could enter a free-text answer under the 'other' option if necessary.

Table 7-1: Existing scientific literature consulted in the development of a bespoke colic assessment form

Information requested	Reason for inclusion	Information source
Section 1: Horse details		
Age	Risk factor for the development of colic	Blickslager *et al*., (1992) Cohen and Peloso (1996) Cohen *et al*., (1997) Cohen *et al*., (1999) Edwards and Proudman (1994) Reeves *et al*., (1989) Southwood *et al*., (2002) Southwood *et al*., (2010) Tinker *et al*., (1997) Traub-Dargatz *et al*., (2001)
Gender	Risk factor for the development of colic	Blickslager *et al*., (1992) Edwards and Proudman (1994) Kaneene *et al*., (1997) White (1997)
Breed	Risk factor for the development of colic	Cohen *et al*., (1995) Cohen *et al*., (1999) Dunkel *et al*., (2017) Tinker *et al*., (1997) Traub-Dargatz *et al*., (2001)
Use / discipline and level of work	Risk factor for the development of colic And Indicator of case severity or influence on outcome	Cohen *et al*., (1999) Christophersen *et al*., (2011) Hillyer *et al*., (2001) Hillyer *et al*., (2002) Launois *et al*., (2006) Kaneene *et al*., (1997) Reeves *et al*., (1996) Tinker *et al*., (1997)

Ongoing health issues	Indicator of case severity or influence on outcome	No existing evidence, but potential non-clinical factor affecting treatment choice or case outcome.
Stereotypic behaviour	Risk factor for the development of colic	Archer *et al*., (2004) Escalona *et al*., (2014) Hillyer *et al*., (2002)
Anthelmintic use and current parasitic infection	Risk factor for the development of colic	Cohen *et al*., (1995) Cohen *et al*., (1999) Hillyer *et al*., (2001) Little and Blickslager (2002) Mair *et al*., (2000) Proudman *et al*., (1998) Reeves *et al*., (1996) Southwood *et al*., (2002) Traub-Dargatz *et al*., (2001) Uhlinger (1990)
Dental care and current disease	Risk factor for the development of colic	Cohen *et al*., (1995) Hillyer *et al*., (2002)
Section 2: Recent management changes		
Dietary changes	Risk factor for the development of colic	Cohen *et al*., (1995) Cohen *et al*., (1999) Hillyer *et al*., (2002) Hudson *et al*., (2001)
Stabling / pasture changes	Risk factor for the development of colic	Cohen *et al*., (1995) Cohen and Peloso, (1996) Hillyer *et al*., (2002) Hudson *et al*., (2001) Kaneene *et al*., (1997) Traub-Dargatz *et al*., (2001)
Section 3: Previous colic history		
Colic episode within the past 30 days	Increased risk of colic recurrence	Cohen *et al*., (1995) Cohen *et al*., (1999) Hillyer *et al*., (2002) Reeves *et al*., (1996) Tinker *et al*., (1997) Traub-Dargatz *et al*., (2001)

Section 4: Current colic episode		
Duration of signs	Indicator of case severity or influence on outcome	Hackett *et al*., (2015) Proudman *et al*., (2005)
Signs shown	Indicator of case severity or influence on outcome	Braun *et al*., (2002) Pratt and Hassel (2003) Proudman *et al*., (2006) Wild *et al*., (2017) Yeoman *et al*., (2017)
Section 5: Clinical exam		
Medication prior to exam	Information requested to establish what medication horses receive either prior to the veterinary examination or admission to an equine hospital.	
Demeanour and behaviour severity	Indicator of case severity or influence on outcome	Bowden *et al*., (2017) Braun *et al*., (2002) Curtis *et al*., (2014) Mair and Smith, (2005) Proudman *et al*., (2006) Van der Linden *et al*., (2003)
General body condition	Indicator of case severity or influence on outcome	Husted *et al*., (2005)
Clinical parameters **(e.g. heart rate, mucous membranes, and capillary refill)**	Indicator of case severity or influence on outcome	Bowden *et al*., (2017) Braun *et al*., (2002) Curtis *et al*., (2014) Ducharme and Lowe, (1988) Furr *et al*., (1995) Garcia-Seco *et al*., (2005) Grulke *et al*., (2001) Husted *et al*., (2005) Mair and Smith, (2005) Parry *et al*., (1983) Pratt and Hassel., (2003) Proudman *et al*., (2002) Proudman *et al*., (2005) Proudman *et al*., (2006) Reeves *et al*., (1990) Van der Linden *et al*., (2003)

Abdominal observations	Indicator of case severity or influence on outcome	Bowden *et al*., (2017) Curtis *et al*., (2014) Grulke *et al*., (2001) Ducharme and Lowe, (1988) Van der Linden *et al*., (2003)
Extremity checks **(e.g. digital pulse)**	Indicator of case severity or influence on outcome	Reeves *et al*., (1990)
Signs of injury	Indicator of case severity or influence on outcome	Curtis *et al*., (2014) Southwood (2010)
Section 6: Results of diagnostic procedures		
Rectal palpation	Indicator of case severity or influence on outcome	Hanson *et al*., (1996) Taylor *et al*., (2006)
Nasogastric intubation	Indicator of case severity or influence on outcome	Cook and Hassel, (2014)
Abdominal paracentesis	Indicator of case severity or influence on outcome	Freden *et al*., (1998)
Abdominal ultrasound	Indicator of case severity or influence on outcome	Santschi and Frank (1993) Scahrner *et al*., (2002)
Response to analgesia	Indicator of case severity or influence on outcome	Curtis *et al*., (2015) White *et al*., (2005)
Haematology and biochemistry	Indicator of case severity or influence on outcome	Bristol, (1982) Deleselle *et al*., (2005) Groover *et al*., (2006) Hinchcliff *et al*., (2005) Hollis *et al*., (2007)

Section 7: Diagnosis		
Lesion type	Indicator of case severity or influence on outcome	Frederico *et al*., (2006) Freeman *et al*., (2000) Freeman *et al*., (2005) Fugaro *et al*., (2001) Garcia-Seco *et al*., (2005) Hardy *et al*., (2000) Mair and Smith (2005) Martin *et al*., (1999) Plummer *et al*., (2007) Ruggles *et al*., (1991) Semevolos *et al*., (2002) Southwood *et al*., (2002)
Section 8: Treatment and outcome		
Discussion of treatment plan	Potential influence on outcome	Little evidence in regard to non-clinical factors which may contribute to case outcome. Therefore, this section was developed to capture non-clinical aspects, such as owner preference and financial constraints (e.g. Egenvall *et al*., 2008), associated with the treatment and survival of horses diagnosed with colic.
Medical or surgical treatment	Potential influence on outcome	Archer *et al*., (2011) Dunkel *et al*., (2015) Linegaard *et al*., (2011) Mair and smith (2005a) Mair and Smith (2005b) Mair and Smith (2005c) Southwood *et al*., (2010) Torfs *et al*., (2009)
Reasons for euthanasia	Information requested to ascertain both clinical and non-clinical factors associated with mortality.	

7.3.2.2 Pilot

Paper-based forms were piloted for two weeks (July/August 2018) by participating practices. The pilot was performed to identify issues associated with form layout and usability, as well as highlighting grammatical errors or potential misinterpretation of questions. Minor corrections were performed and ethical approval for the final document design (Appendix XIV) was gained prior to survey dissemination to practices.

7.3.2.3 Form dissemination

To comply with data protection regulations, horse owner information sheets and study consent forms were created. Additionally, supplementary information sheets which provided practice team members with a study overview, instructions for submitting postal and online forms, and guidance for completing scoring systems, were also developed. All aforementioned documents can be found in Appendix XIV.

A personalised 'Research Pack' (Figure 7-1), containing paper-based copies of all study resources, was sent to participating practices one week prior to study launch. Additional resources were supplied on a bi-monthly basis and practices could request further copies at any time. Online forms could be accessed and completed via the Vet React website (www.react.vet).



Figure 7-1: The bespoke practice 'Research pack' and associated resources sent to participating veterinary practices

7.3.2.4 Form submission

The study was launched at the end of August 2018 and ran for approximately 12 months (September 2019). A named contact person at each practice received weekly emails reminding participants to submit cases. Online forms were automatically submitted to the primary researcher upon completion, whereas paper-based forms were manually returned using pre-paid, self-addressed envelopes, provided in the aforementioned research pack, to the University of Nottingham's Sutton Bonington campus.

7.3.3 Data analysis

Upon receipt of completed forms, data was manually entered into an Excel spreadsheet (Microsoft Office 2016, Version 16.0) for data cleaning. Results were updated and saved on a weekly basis. Data was stored on password encrypted software at all times and accessed only by the principle researcher involved in the study.

Exploratory descriptive analyses were performed. The mean, median and range were computed for continuous data, such as age of horse and drug dosage. Normality of distribution was determined using histograms and Kolmogorov Smirnov testing. Non-parametric data was reported as the median (range), whereas, mean values were used when parametric distribution was indicated. Frequency percentages and mode values were calculated for categorical data, with optional free-text responses associated with the pre-defined answer of '*other*' being reviewed and grouped where appropriate into either existing or new answer categories. Answers which specifically requested a free-text answer were reviewed individually before being categorised, using a content analysis approach, and ranked based on frequency of occurrence.

7.4 Results

7.4.1 Study engagement

7.4.1.1 Primary vs referral colic cases

A total of 72 colic cases were collected. Preliminary data analysis revealed that the majority (83%, 60/72) of cases represented referral colic assessments. Due to a bias towards a hospital population, it was decided that the 12 primary cases should be excluded from the final dataset.

7.4.1.2 Practice participation

Practice B did not submit any cases during the data collection period and were therefore excluded from the study. Practice C submitted the majority (72%, 43/60) of cases, with practice A providing details for 28% (17/60). Most (9/60) cases were submitted in October 2018, with practices providing no data in February 2019 (Figure 7-2).

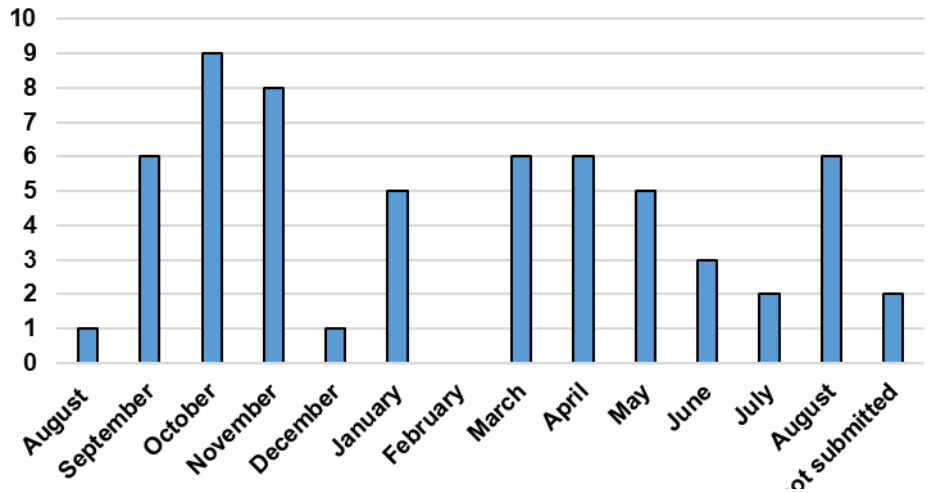


Figure 7-2: Bar chart displaying the submission of colic cases during a 12 month prospective study

7.4.2 Horse demographics

7.4.2.1 Signalment

The majority (58%, 35/60) of horses were geldings and had an average age of 12.2 years (range, 1 – 26 years). Twenty-one equine breeds were represented (Appendix XV) with most horses being either a Thoroughbred (27%, 16/60) or Sports horse (15%, 9/60). Horses were primarily used for general or leisure purposes (40%, 24/60), with most being in light (42%, 14/33) or medium (33%, 11/33) work. Seventy percent (39/56) were uninsured. Of those who were insured (30%, 17/56), seven were covered for both mortality and veterinary fees, three only had protection for veterinary fees and seven did not provide policy details.

7.4.2.2 Previous medical history

Most (63%, 37/59) horses had no ongoing or previous medical issues. Thirty-seven percent (22/59) had at least one current health complaint, with the majority reportedly having gastric ulcers (14%, 3/22), laminitis (14%, 3/22) or respiratory illness (14%, 3/22). Stereotypical behaviour was present in 17% (10/60) of horses, with windsucking most commonly reported (8%, 5/10). Of the cases that provided details for preventative health care, the majority of owners did not know or could not remember when their horse was last wormed (72%, 42/58) or received a dental examination (68%, 39/57). Further health details can be found in Appendix XVI.

7.4.2.3 Recent management changes

No changes in routine management (77%, 46/60) or feeding (93%, 56 / 60) were reported for the majority of horses. Stabling or pasture changes occurred in 23% (14/60) of cases, with the most common reason for change being reported as a decrease in turnout (3/14) or alternative grazing (3/14). Feeding regimen had been changed in four (7%) cases.

7.4.2.4 Previous history of colic

The majority (93%, 55/60) of horses had not experienced a colic event within the previous 30 days. Of those that had (4/59), two horses were attended by a vet one day prior to admission, with one horse being examined for colic six days previously. One horse received two veterinary visits, with the other three requiring only one.

7.4.2.5 Current colic episode

Eighty-eight percent (53/60) of cases recorded both the date when colic signs were first noticed by the owner and the last time the horse was observed ‘normal’. Most (55%, 29/53) owners reported seeing colic signs on the same day they last saw their horse in good health. Horses (53%, 32/60) went on average 15.0 hours (range, 0 – 120 hours) before colic signs were first recognised by their owner. Attempts to lie down (45%, 27/60), pawing at the ground (37%, 22/60) and a depressed or dull demeanour (37%, 22/60) were the most common owner reported signs of colic.

7.4.3 Clinical presentation

7.4.3.1 Time first examined vs time of admission

The date of the first examination and subsequent hospital admission were provided for 93% (56/60) of cases. The majority (82%, 46/56) of horses were admitted on the same day they were initially examined. Eleven percent (6/56) were admitted the following day, with one horse arriving at hospital seven days post the initial exam. Seventy percent (42/60) of cases recorded both the time of first exam and admission to hospital, with horses admitted, on average, 13.2 hours (range, 0.5 – 170 hours) after being examined.

7.4.3.2 Drug administration prior to admission

Fifty-two (87%) horses received medication prior to hospital admission. Medication was provided by the attending practitioner in 92% (48/52) of cases, with flunixin meglumine most frequently administered (85%, 41/48). Four horses received medication from their owner (Table 7-2).

Table 7-2: Details of veterinary presecribed drugs adminstered to horses prior to hospital admission

Drug Name	Use	Number of horses*	Administered by	Dosage	Route of administration
Dexamethasone (Colvasone ®)	Corticosteroid anti-inflammatory	1.9% (1 / 52)	Primary veterinary practitioner	18 ml	Intra venous (IV)
Flunixin meglumine	Non-steroidal anti-inflammatory; analgesia	78.8% (41 / 52)	Primary veterinary practitioner	Average: 10.4ml Range: 4 – 25ml	Intra venous (IV)
***N*-butylscopolammonium bromide (Buscopan ®)**	Spasmolytic analgesic	5.8% (3 / 52)	Primary veterinary practitioner	Average: 7.8ml Range: 4 – 25ml	Intra venous (IV)
Phenylbutazone (Equipalazone ®)	Non-steroidal anti-inflammatory; analgesia	1.9% (1 / 52)	Horse owner	1 gram	Orally
Suxibzone (Danilon ®)	Non-steroidal anti-inflammatory; analgesia	3.8% (2 / 52)	Horse owner	1 – 2 sachets (1.5 – 3 grams)	Orally
Trimethoprim & Sulfadiazine (Trimediazine™)	Broad spectrum antibiotic	1.9% (1 / 52)	Horse owner	Unknown	Orally
Xylazine (Chanazine ®)	Alpha-2 adrenergic agonist; sedative analgesic	3.8% (2 / 52)	Primary veterinary practitioner	Average: 3.5ml Range: 2 – 5ml	Intra venous (IV)

**A total of 52 horses received medication prior to hospital admission however, drug details were not provided for one case*

7.4.3.3 Demeanour and behaviour severity on admission

The majority (43%, 26/60) of horses were quiet and responsive (QAR) on admission. Seventeen percent (10/60) presented as dull or depressed, with 13% (8/60) being severely restless. Behaviour severity was recorded in 56 cases. Horses had an average combined behaviour score of 3.03 (range, 0 – 12) however, this varied greatly with only a small proportion of horses showing severe colic signs (Table 7-3).

Table 7-3: Colic behavioural severity scores for 56 horses referred for colic treatment

Sign of colic	**Severity score**			
	0 / None / Normal	1 / Slight / Occasional	2 / Moderate / Frequent	3 / Severe / Continuous
Kicking at stomach	77% (43 / 56)	18% (10 / 56)	5% (3 / 56)	-
Pawing	66% (37 / 56)	23% (13 / 56)	7% (4 / 56)	5% (3 / 56)
Sweating	45% (24 / 56)	23% (13 / 56)	20% (11 / 56)	13% (7 / 56)
Flank watching	64% (36 / 56)	27% (15 / 56)	7% (4 / 56)	2% (1 / 56)
Attempting to lie down	63% (35 / 56)	11% (6 / 56)	16% (9 / 56)	11% (6 / 56)
Rolling	88% (49 / 56)	4% (2 / 56)	4% (2 / 56)	5% (3 / 56)

7.4.3.4 Assessment of body condition

Body weight and body condition score (BCS) was recorded in 93% (56/60) and 97% (58/60) of cases, respectively. Horses had an average weight of 494.4 Kg (range, 126 – 731 Kg), with most being assigned a BCS of either three (48%, 28/58) or four (33%, 19/58). The majority of horses were not clipped (71%. 40/56) and described as clean (59%, 33/56) on admit.

7.4.3.5 Clinical parameters

Heart and respiratory rate was recorded in 97% (58/60) and 83% (53/60) of cases, respectively. Horses had an average heart rate of 54.4 beats per minute (range, 26 – 110 beats per minute) and an average respiratory rate of 18.8 breaths per minute (range, 10 – 64 breaths per minute) on hospital admission. Most (67%, 30/45) were described as having a strong pulse and normal coloured oral mucous membranes (52%, 29/56) with a moist feel (66%, 36/55). Capillary refill time (CRT) was less than 2.5 seconds in most (69%, 35/51) horses. Rectal temperature was recorded in 80% (48/60) of cases, with an average temperature of 37.8 °C (range, 36.6 – 40 °C) observed. Normal extremity temperature and absent digital pulses were recorded in 70% (37/53) and 84% (42/50) of cases, respectively. Self-trauma was present over the eyes or on the head of 33% (19/57) of horses.

7.4.3.6 Abdominal examination

Horses presented with varying degrees of abdominal distension and levels of borborygmi (Table 7-4). Sixty-seven percent (36/54) of horses had absent or reduced gut sounds in two or more abdominal quadrants. Four horses has increased gut sounds in two or more quadrants.

Table 7-4: Details of abdominal examination performed on horses referred for colic treatment

	Response category	Result
Signs of abdominal distension	None	58% (30 / 52)
	Slight	27% (14 / 52)
	Moderate	14% (7 / 52)
	Severe	2% (1 / 52)
Auscultation of upper left side	Normal	26% (14 / 54)
	Absent	26% (14 / 54)
	Reduced (Hypo)	41% (22 / 54)
	Increased (Hyper)	7% (4 / 54)
Auscultation of lower left side	Normal	24% (13 / 54)
	Absent	24% (13 / 54)
	Reduced (Hypo)	43% (23 / 54)
	Increased (Hyper)	9% (5 / 54)
Auscultation of upper right side	Normal	30% (16 /54)
	Absent	24% (13 / 54)
	Reduced (Hypo)	35% (19 / 54)
	Increased (Hyper)	11% (6 / 54)
Auscultation of lower right side	Normal	30% (16 /54)
	Absent	24% (13 / 54)
	Reduced (Hypo)	35% (19 / 54)
	Increased (Hyper)	11% (6 / 54)

7.4.3.7 Drug administration and response to analgesia

At least one drug (Table 7-5) was administered during the clinical exam in 73% (44/60) cases. The majority (71%, 31/44) of horses received *N*-butylscopolammonium bromide (Buscopan ®), at an average dosage of 5.4 ml (range, 2 – 10 ml), mainly to facilitate a safe rectal examination (21/23). Response to analgesia was recorded in 83% (50/60) of cases. An improvement in demeanour was seen in 26% (13/50) of horses however, no change or a deterioration in behaviour was seen in 74% (37/50) of cases (Figure 7 -3).

Table 7-5: Details of veterinary presecribed drugs administered during the initial clinical exam

Drug Name	Use	Number of horses	Dosage
Butorphanol	Opiate sedative analgesic	9% (4 / 44)	Average: 0.45 ml Range: 0.3 – 05 ml
Detomidine	Alpha-2 agonist; sedative analgesic	7% (3 / 44)	Average: 0.43 ml Range: 0.3 – 0.5 ml
Flunixin meglumine	Non-steroidal anti-inflammatory; analgesia	14% (6 / 44)	Average: 11.3 ml Range: 8 – 14 ml
Gentamicin	Antimicrobial; gram negative spectrum	2% (1 / 44)	40 ml
Morphine	Opiate analgesic	2% (1 / 44)	120 mg
***N*-butylscopolammonium bromide**	Spasmolytic analgesic	71% (31 / 44)	Average: 5.4 ml Range: 2 – 10 ml
Penicillin	Antimicrobial; gram positive and anaerobic bacteria)	2% (1 / 44)	44 ml
Xylazine	Alpha-2 adrenergic agonist; sedative analgesic	73% (32 / 44)	Average: 2.3 ml Range: 1.5 – 4.5 ml

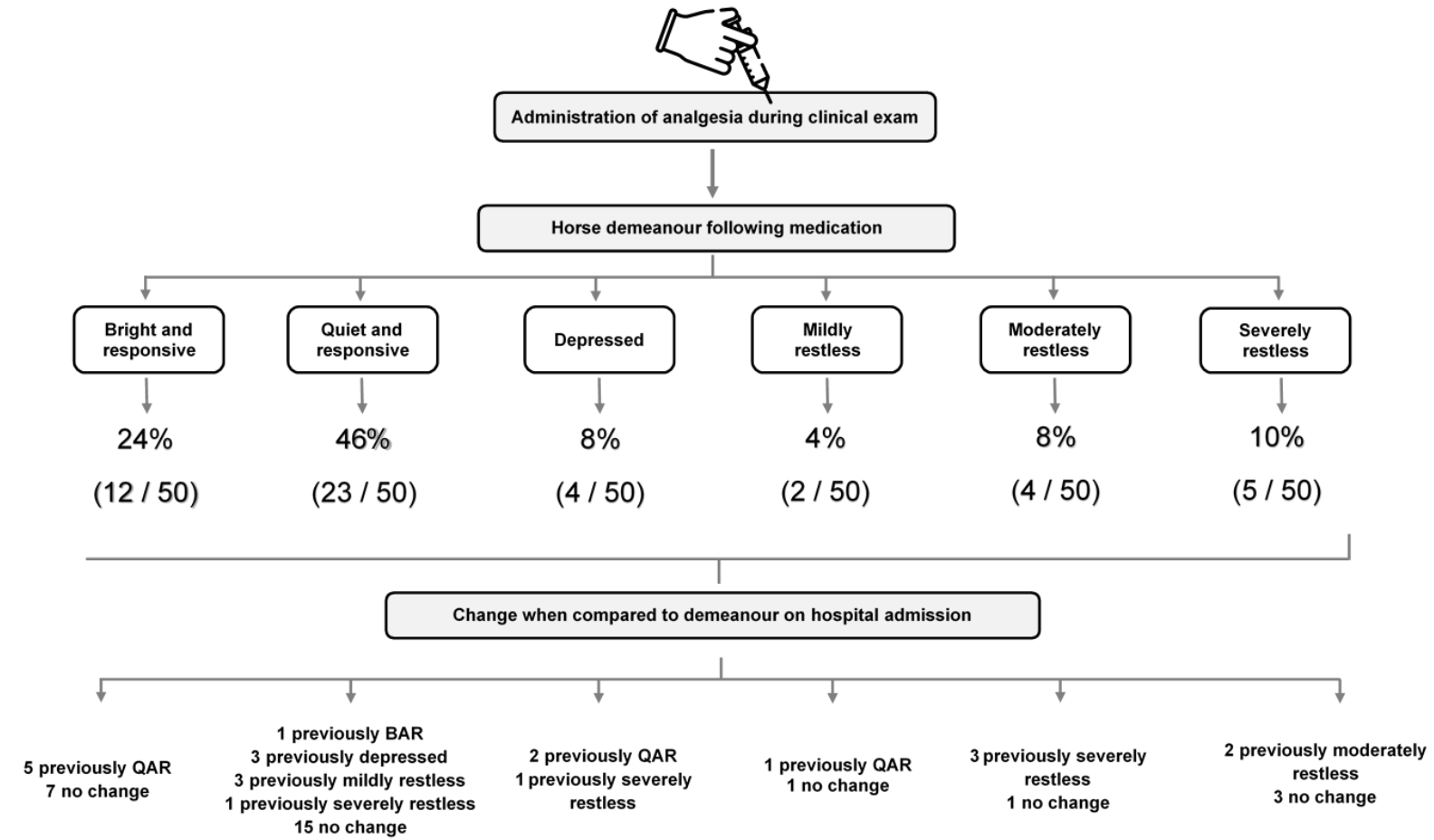


Figure 7-3: Flow-chart comparing the demeanour of horses following the admistration of analgesia and their presentation upon arrival at the referral hosiptal

7.4.4 Diagnostic evaluation

7.4.4.1 Rectal palpation

Rectal palpation was performed in 86% (51/60) of cases. Right dorsal displacement (24%, 12/51) and distension of the large colon (17%, 9/51) were most frequently reported. However, nothing abnormal was detected in 29% (15/51) of horses.

7.4.4.2 Nasogastric intubation

Nasogastric intubation was recorded in 57% (34/60) of cases. The procedure was performed therapeutically and diagnostically in 27% (9/34) and 74% (25/34) of horses respectively (Appendix XV).

7.4.4.3 Abdomino-paracentesis

Peritoneal fluid was obtained in 57% (34 / 60) of cases. Eighty-eight percent (30 / 34) of fluid collections were described as ‘simple’, with fluid quantity being recorded for 56% (19 / 34) of horses. An average of 4.6 ml (range, 0.001 – 20 ml) of fluid was obtained, with most samples being described as either normal (28%, 9 / 32) or serosanguinous (19%, 6 / 32) in colour.

7.4.4.4 Abdominal ultrasound

Eighty-one percent (49/60) of horses underwent abdominal ultrasound. Reduced small intestinal motility and increased peritoneal fluid were recorded in 27% (13/49) and 22% (11/49) of cases, respectively. Nothing abnormal was detected in 20% of cases.

7.4.4.5 Haematology and biochemistry

Laboratory tests were performed in a number of cases, of which the results are displayed in Table 7-6.

Table 7-6: Details of laboratory tests performed on horses referred for colic treatment

Laboratory test	Number of cases	Average result	Result range
Packed Cell Volume (PCV)	95% (57 / 60)	40.1%	27.7 – 65.0%
Total Protein (TP)	93% (56 / 60)	34.1 g/Litre	3.8 – 95 g/Litre
Lactate	78% (47 / 60)	3.1 mmol/Litre	0.68 – 12 mmol/Litre
White Cell Count (WCC)	5% (3 / 60)	7.8 cells x 10^9/Litre	4.1 – 14.5 cells x 10^9/Litre

7.4.5 Diagnosis and treatment

A diagnosis was provided for 85% (51/60) of cases (Table 7-7), with dorsal displacement of the right colon the most frequent finding (16%, 8/51). No definitive diagnosis was reported in nine cases. Thirty-three (55%) horses received intensive medical treatment, 22 (37%) underwent surgical intervention and five were euthanised following the initial clinical exam.

Factors considered significant in the formulation of the treatment plan were recorded in 98% (59/60) of cases. The majority (80%, 47/59) of horses underwent chosen treatment due to the severity of clinical signs. Financial concerns were referred to in 10% (6/59) of cases, with ongoing health issues and a previous history of colic taken into consideration for 5% (3/59) of horses. Owner related factors, such as inexperience, concern about box rest and an aversion to colic surgery, were also recorded (Appendix XV).

Of those treated medically, both enteral and intravenous fluids were given in 39% (13/33) of cases. Flunixin meglumine was the most commonly administered drug (17/33), with a variety of antimicrobials also used (Appendix XV). Nineteen horses (86%) undergoing surgical correction received intravenous fluids, with three horses requiring a second surgery due to post-operative complications; colonic torsion, small intestinal entrapment, and persistent colic signs.

Table 7-7: Details of colic diagnoses for 51 horses referred for colic treatment

Diagnosis	Number of cases with diagnosis	Number of horses receiving treatment		
		Medical	Surgical	Euthanasia
Caecum				
Impaction	2	1	0	1
Large colon				
Impaction	1	1	0	0
Left dorsal displacement	4	3	1	0
Right dorsal displacement	8	6	2	0
Rupture of left ventral colon	1	1	0	0
Volvulus	3	0	3	0
Small colon				
'Abnormality'	1	0	1	0
Small intestine				
Entrapment	3	0	2	1
Strangulation	5	0	5	0
Volvulus	1	0	1	0

Diagnosis	Number of cases with diagnosis	Number of horses receiving treatment		
		Medical	Surgical	Euthanasia
Multiple pathologies				
Impaction and left dorsal displacement	1	1	0	0
Impaction and right dorsal displacement	1	1	0	0
Large colon impaction and small intestinal entrapment	1	0	1	0
Right dorsal displacement and small intestinal strangulation	1	0	1	0
Multiple adhesions within abdomen	1	0	1	0
Small intestinal strangulation and impaction	1	0	1	0
Other				
Impaction (unspecified region)	2	2	0	0
Enteritis/colitis/enterocolitis	2	2	0	0
Rupture (unspecified region)	1	0	0	1
Unspecified strangulation	2	0	1	1
Lawsonia intracellularis	1	1	0	0
Peritonitis	6	6	0	0
'Spasmodic'	2	2	0	0
No definitive diagnosis	9	6	2	1

7.4.6 Case outcome

7.4.6.1 Overview

Case outcome was available for 55 (92%) horses (Figure 7-5). Short term survival (to discharge) was 67% (37 / 55) for all horses and 65% (13 / 20) for those recovering from anaesthesia.

7.4.6.2 Demographic features of horses undergoing euthanasia

The majority of horses euthanised were geldings (72%, 13 / 18), used for general / leisure purposes (33%, 6 / 18) and were uninsured (67%, 12 / 18). Although euthanised horses appeared to be older in age when compared to those which survived (Figure 7-6), very few demographical differences were observed (Appendix XV).

7.4.6.3 Clinical features of horses undergoing euthanasia

On clinical examination the majority of horses euthanised presented with pale mucous membranes (12 / 18) and a capillary refill time of over 2.5 seconds (10 / 18). Absent gut sounds were also a common clinical feature of euthanised horses. Mean heart (Figure 7-7) and respiratory rates (Figure 7-8) were higher for euthanised horses, surviving horses also had a lower combined behaviour severity score (Figure 7-9). Factors considered significant in the decision to euthanise, such as financial constraints and a poor prognosis, were recorded for all 18 cases (Table 7-8).

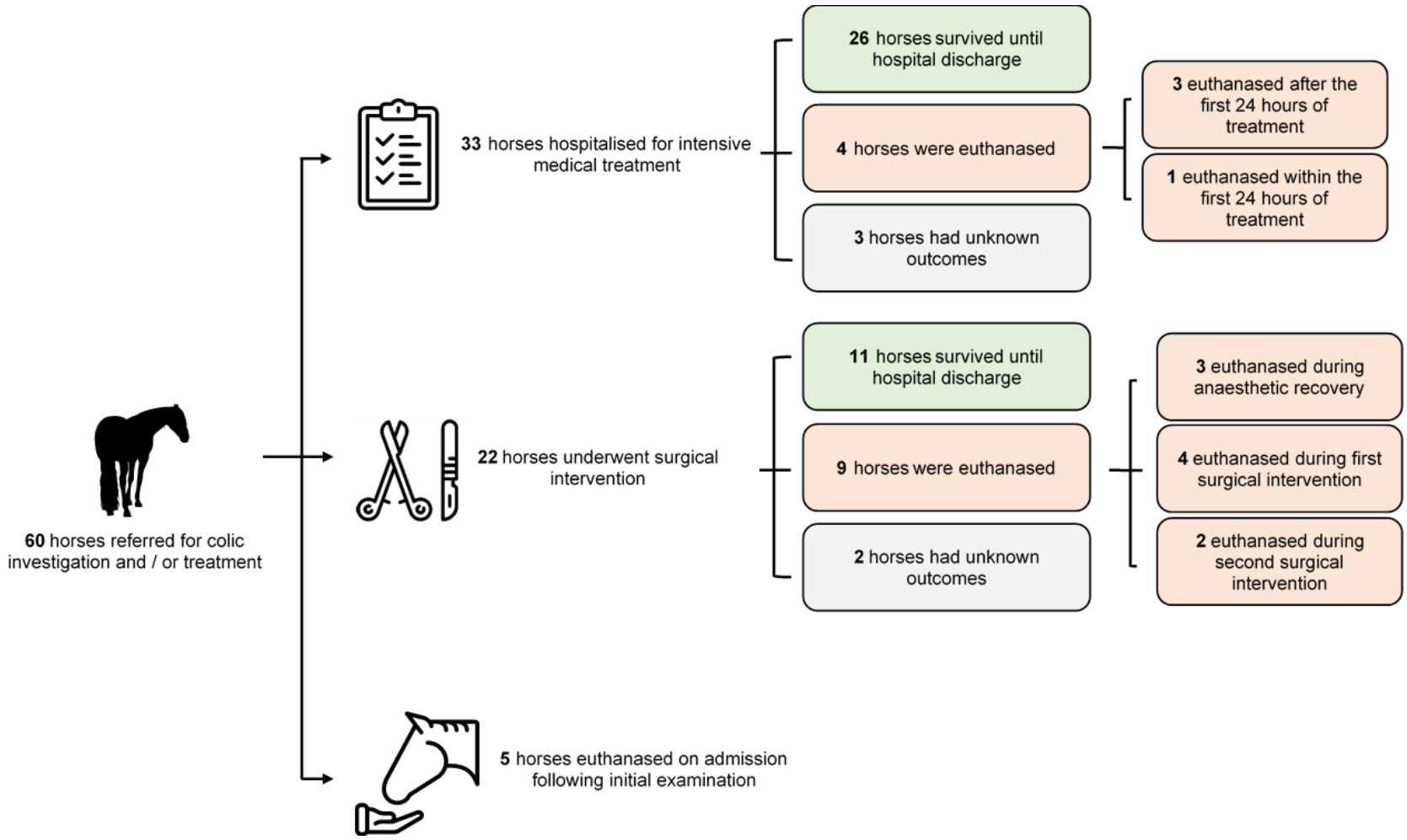


Figure 7-4: The short-term survival of 60 horses referred for colic treatment

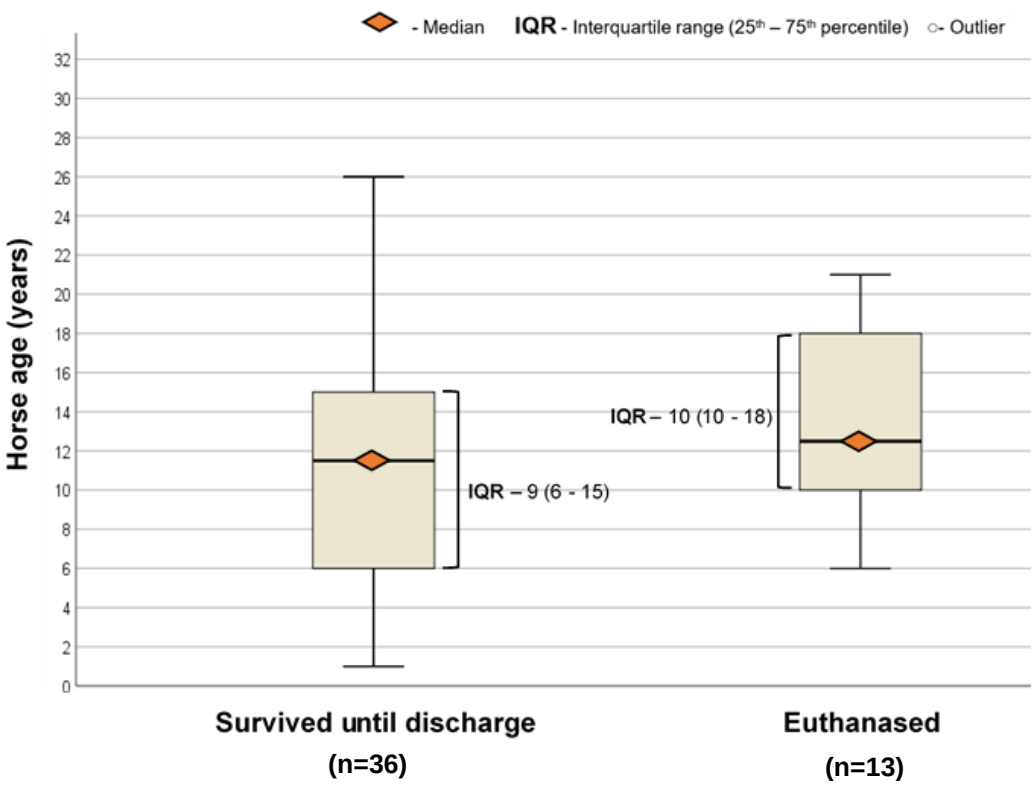


Figure 7-5: Box and whisker plot illustrating the average age of horses that were either euthanased or survived

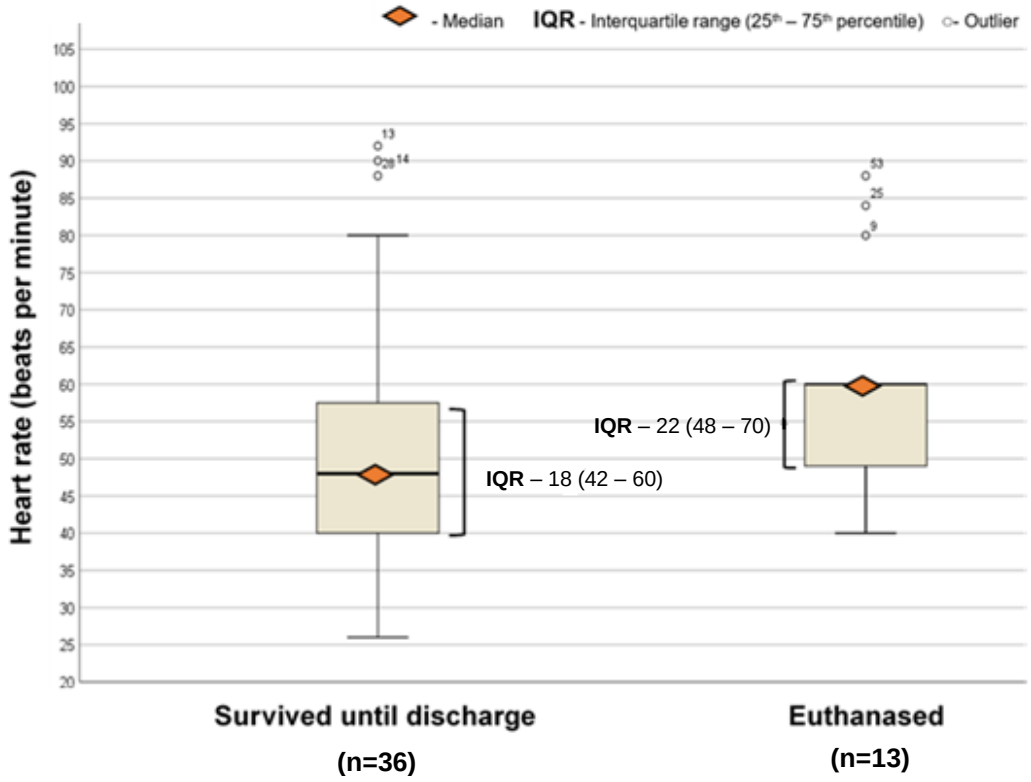


Figure 7-6: Box and whisker plot illustrating the average heart rate of horses that were either euthanased or survived

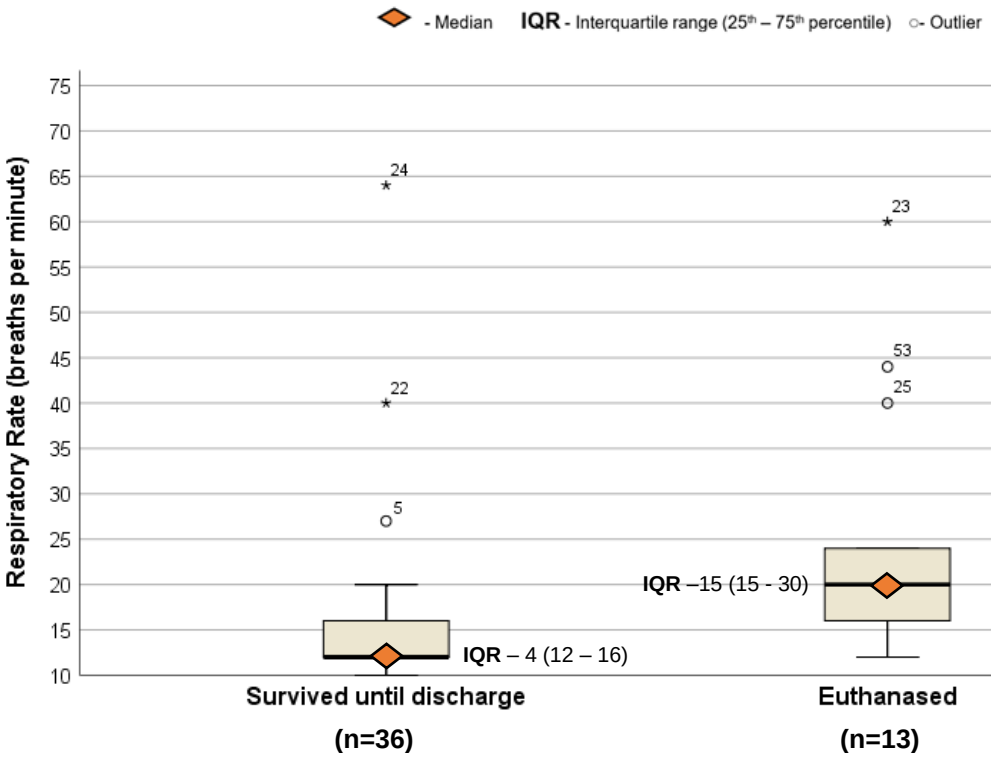


Figure 7-7: Box and whisker plot illustrating the average respiratory rate of horses that were either euthanased or survived

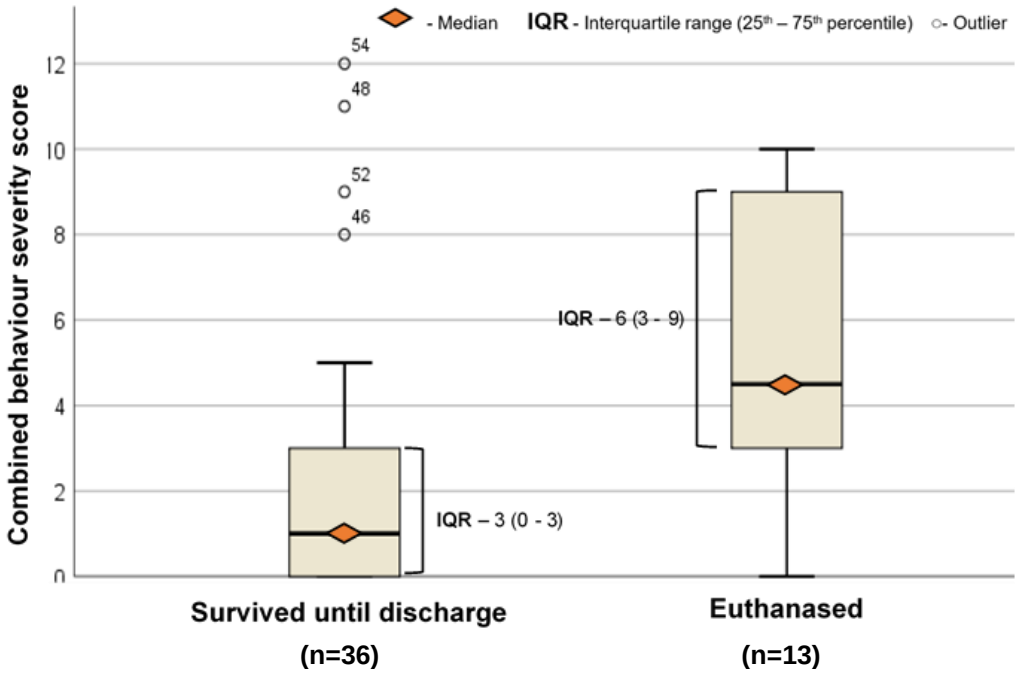


Figure 7-8: Box and whisker plot illustrating the combined behavioural severity score of horses that were either euthanased or survived

Table 7-8: Factors associated with the euthanasia of horses diagnosed with colic

Treatment	Diagnosis	Time of euthanasia	Factors considered significant in decision
Medical	Peritonitis	After first 24 hours of medical treatment	Deterioration of clinical signs and no response to analgesia
	No definitive diagnosis	After first 24 hours of medical treatment	Development of neurological signs and no response to analgesia
	Caecal impaction	After first 24 hours of medical treatment	Owner concerned regarding financial costs and requested euthanasia
	Rupture of left ventral colon	Within first 24 hours of medical treatment	Severity of clinical signs / poor prognosis
Surgical	Large colon volvulus	During first surgical treatment	Poor prognosis due to extent of intestinal injury
	Displacement of the left dorsal colon	During anaesthetic recovery	Femoral fracture on recovery
	No definitive diagnosis	During first surgical treatment	Poor prognosis due to extent of intestinal injury
	Unknown	Following second surgical treatment	Post-operative colic and reflux
	Small intestinal volvulus	Following second surgical treatment	Post-operative ileus and increasing reflux
	Small colon abnormality	During first surgical treatment	Poor prognosis due to extent of intestinal injury
	Displacement of the right dorsal colon	During anaesthetic recovery	Femoral fracture on recovery
	Multiple abdominal adhesions	During first surgical treatment	Owner concerned about horse returning to full athletic career
	Small intestinal strangulation	During anaesthetic recovery	Femoral fracture on recovery

No treatment - euthanasia	Gastrointestinal rupture	After initial hospital assessment	Food material observed in peritoneal fluid
	No definitive diagnosis		Owner concerned regarding financial costs
	Strangulation (unspecified)		Owner concerned about horses age and underlying heart murmur
	Small intestine entrapment		Owner concerned about horses age and quality of life
	Caecal impaction		Owner concerned regarding financial costs and surgery was not an option

7.5 Discussion

7.5.1 Study overview

This is the first study to use a prospective methodology to investigate both clinical and non-clinical factors associated with the treatment and survival of horses diagnosed with colic. Rapid recognition and prompt decision-making can help to maximise a horse's chance of survival when colic is suspected. However, the results of this study indicate that a considerable amount of time can elapse between recognition of symptoms and subsequent admission to a veterinary hospital. The decision to pursue surgical or intensive medical treatment was found to be frequently based on the severity of clinical signs. Additionally, when compared to horses who survived, poor clinical characteristics appeared more commonly associated with euthanased horses. However, non-clinical factors, such as financial constraints, horse age and owner concerns regarding equine welfare, were also considered significant in the decision-making process. Though submitted case numbers were lower than expected, the methodology employed within this study can be used to inform similar projects in the future. Furthermore, the results of this study highlight potential areas for future investigation, including the influence of finance and the horse-human relationship on the decision to refer.

7.5.2 Limitations

This study aimed to investigate cases of equine colic from primary assessment through to the cessation of veterinary treatment or euthanasia. However, submission of primary colic cases was disappointing and subsequently led to this phase of the study being removed. One potential cause of non-compliance could have been the use of a prospective methodology. Frequently described as the ‘gold standard’ of cohort studies (Sedgwick, 2013, Vandenbroucke, 2008), prospective investigations enable the observation of disease development in real time (Euser *et al*., 2009). However, this type of approach is reliant on participating stakeholders for data submission, which can be complex and time consuming. Although data collection forms were based on existing practice formats (with both paper and electronic versions available), the fast paced and potentially distressing nature of colic emergencies may have resulted in form completion becoming a challenge for attending practitioners. Additionally, given that colic is a frequent out-of-hours emergency (Bowden *et al*., 2017), many cases may have occurred during the night or at a time when additional support was unavailable, consequently reducing opportunities for data collection. This could explain why referral data was easier to collect, with hospitals more likely to have a substantial support network in place to deal with emergency admissions, even outside of normal working hours. Issues associated with stakeholder compliance could have been minimised through the retrospective

collection of data. However, given that studies of this design rely on the extraction of relevant information from existing datasets, the risk of missing data is high (Brusco and Watts, 2015, Hassan, 2006, Sedgwick, 2014). Therefore, as this study aimed to gather information on factors associated with both the decision to refer and subsequent treatment choices, a prospective approach was deemed most suitable. Yet, the design of the data collection form itself could have also been a limiting factor for data collection. Though based on existing literature and existing colic assessment forms used in practice, it was lengthy at three sides of A4 paper. Therefore, completion of all relevant fields would have been time consuming, especially in an emergency situation. However, the information on the form was chosen to represent all possible factors associated with colic decision-making in order to ascertain which are most useful. Additionally, the fact that no online data submissions were made suggests that paper-based forms are preferred over electronic ones. As a consequence, the design of this form can be used to inform future studies aiming to collect prospective colic data.

The use of only two hospital populations may have also contributed to the lack of primary case submissions. However, issues such as a lack of information consistency and the introduction of bias due to selected cases submission are frequently associated with multicentre studies (Euser *et al*., 2009, Shapiro and Rosenberg, 2014, Vandenbroucke, 2008). For example, though the study by Curtis *et al*. (2015) obtained

case data for over 1,000 primary cases of colic, information was submitted by 167 practitioners employed at 108 different veterinary practices, which may cast doubt on both the consistency of information and the reliability of findings. Therefore, the recruitment of only a select number of practices was chosen as the most appropriate approach to data collection. As a result, data were collected for a total of 60 cases of equine colic. Although this is a small sample size when compared to previous epidemiological studies (both prospective and retrospective) investigating colic (Abutarbush *et al*., 2005, Bowden *et al*., 2017, Christophersen *et al*., 2014, Cohen *et al*., 1995, Cohen and Peloso, 1996b, Curtis *et al*., 2015, Dabareiner and White, 1995b, Dolente *et al*., 2008, Hillyer *et al*., 2001, Lindegaard *et al*., 2011, Mair and Smith, 2005a, Mair and Smith, 2005b, Mair and Smith, 2005c, Tinker *et al*., 1997a), a vast amount of detailed information was obtained and could be compared within and between individual horses, giving a more in depth case analysis. However, given the size of the study population, the results cannot be considered representative of the UK horse population. For example, the findings of this study relate to cases in which referral was an option, which may have resulted in bias towards owners who had either the funds available for treatment or adequate equine insurance. Additionally, type and prevalence of colic has previously been linked to geographic location (Edwards, 2000, Freeman, 2000, Hassel *et al*., 1999, McCarthy *et al*., 2001, RAGLE *et al*., 1989), which may mean that there could be a regional difference between hospital populations within this study. However, the fact that a

high proportion of horses were uninsured, and a wide range of illnesses were reported suggests that any bias present was minimal.

7.5.3 Key findings

7.5.3.1 Owner recognition and response

Congruent with previous owner research overt behavioural signs, such as continuous attempts to lie down and pawing at the ground, were most frequently reported. However, violent signs of colic are not always indicative of disease severity, with horses suffering from critical cases of abdominal pain often displaying subtle changes in behaviour only (Bowden *et al*., 2020, Scantlebury *et al*., 2014). Therefore, it was encouraging to note that owners also recognised the milder sign of a dull or depressed demeanour as being a potential indicator of disease. Yet, despite this positive result it was concerning that owners reported observing signs of abdominal pain an average of 15 hours *after* last seeing their horse behaving ‘normally’. Though this finding is most likely due to owners witnessing their horse in good health during an evening and then discovering their horse had colic the following morning, rapid recognition of colic is crucial, especially when the underlying cause is unknown. Yet, in addition to the prolonged time period prior to owner recognition of signs, an average of 13 hours reportedly elapsed between the initial veterinary exam and the admission of horses to a referral hospital. Although duration of travel could account for a large proportion of this time, extensive delays could have had significant impact on disease severity. Additionally, despite a relatively poor

prognosis, a recent study has highlighted that early recognition and prompt surgical correction of strangulating lesions can lead to a more favourable prognosis (Hackett *et al*., 2015). However, given the descriptive nature of this study, and a bias towards a referral hospital population, definitive conclusions relating to the impact of time on case outcome cannot be drawn. Furthermore, given a general lack of evidence pertaining to the decision-making process involved in the referral of horses diagnosed with colic, reasons for treatment delays can only be speculated. Therefore, further in-depth research into this area is warranted.

7.5.3.2 Factors affecting decision-making

This study identified several factors that can affect owner's decision making. These can be further subdivided into owner related factors (finance, previous experience) and horse factors (age, severity of condition, pre-existing condition). Given that the majority of horses in this study were uninsured, it is reasonable to assume that owners had been made aware of the financial implications of hospital treatment prior to referral. Yet, it was interesting to note that a large proportion of horses were euthanased prior to surgical intervention or intra-operatively due to financial concerns. Whilst apprehensions regarding the cost of colic treatment have been previously associated with the intra-operative euthanasia of horses (Christophersen *et al*., 2014), little research has investigated the potential impact of cost on horse owner decision-making. A recent study by Barker and Freeman (2019)

evaluated the financial implications of colic at five UK referral hospitals and reported average costs ranging from £800 for euthanasia to over £6,000 for surgical intervention. Although this study was conducted retrospectively and did not investigate whether finance was a major influence on treatment choice, it does appear to validate existing owner concerns. Yet, the authors also reported that over 60% of horses within the study were uninsured, which casts doubt on the significant role of finance in the decision to refer. Though these owners may have had alternative funds in order to finance the treatment of their horse, this finding is remarkable given that a lack of insurance was identified as a significant barrier to referral in Chapter Five of this thesis. Given the potential welfare implications associated with the transportation and treatment of critically ill horses, the fact that some owners may be choosing to refer their horse despite not having the funds to support this venture is concerning. Therefore, further investigation into owner decision-making in the event of a colic emergency is required. Further exploration should be qualitative in nature in order to capture individual factors associated with decision-making. Furthermore, it is recommended that the influence of attending veterinary surgeons on owner decision-making, especially in relation to the transfer of knowledge pertaining to survival and costs, is also investigated.

The survival rate of horses undergoing surgical exploration within this study is consistent with figures previously reported (Abutarbush *et al*., 2005, Christophersen *et al*., 2014, Johnson and Keller, 2005, Mair and

Smith, 2005a, Sutton *et al*., 2009, van der Linden *et al*., 2003, Voigt *et al*., 2009, Wormstrand *et al*., 2014) however, survival to discharge appears to be lower than published evidence (67%) (Abutarbush *et al*., 2005, Christophersen *et al*., 2014, Freeman *et al*., 2000, Johnson and Keller, 2005, Mair and Smith, 2005a, Morton and Blikslager, 2002, Naylor *et al*., 2014, Stewart *et al*., 2014, Sutton *et al*., 2009, van der Linden *et al*., 2003, Voigt *et al*., 2009, Wormstrand *et al*., 2014). One potential reason for this discrepancy could be the limited sample size of this study, which may have led to an over representation of horses with critical illnesses. This would coincide with the majority of treatment decisions, including euthanasia, reportedly being based on the severity of clinical signs. Poor cardiovascular status and severity of pain have been frequently associated with an increased risk of mortality (Furr *et al*., 1995, Grulke *et al*., 2001, Ihler *et al*., 2004, Orsini *et al*., 1988, Parry *et al*., 1983, Proudman *et al*., 2006, Puotunenreinert, 1986, Thoefner *et al*., 2001, van der Linden *et al*., 2003). However, although an increase in heart rate has been repeatedly linked with decreased survival (Proudman *et al*., 2005a), specific values that will reliably predict mortality are yet to be reported. Additionally, despite several scoring systems specific to colic being developed (Graubner *et al*., 2011, Mair and Smith, 2005a, Pritchett *et al*., 2003, Sutton *et al*., 2019, Sutton *et al*., 2013a, Sutton *et al*., 2013b, Taffarel *et al*., 2015, van Loon *et al*., 2014), pain assessment can be a subjective process with practitioner approach reportedly influenced by both year of graduation and attendance at a particular University (Price *et al*., 2002). Therefore, the

fact that euthanised horses displayed greater levels of pain when compared to horses which survived in this study should be interpreted with this factor considered.

Equine age was highlighted as potential factor associated with mortality, with older horses appearing more likely to be euthanised. Though this may have been the result of illness severity; with elective euthanasia being attributed to poor prognosis in several cases; a number of horses were reportedly euthanised due to owner concerns regarding ‘old age’ and subsequent quality of life. This finding would coincide with the suggestion of Southwood *et al*. (2010) who indicated that a higher rate of euthanasia in geriatric horses is more likely attributed to owner preference rather than a poor prognosis. However, the decision to euthanise has also been reported to be based on misconceptions regarding the effect of age on recovery (Krista and Kuebelbeck, 2009), a notion which is supported by the results of Chapters Six. Yet, despite raising concerns regarding the potential impact of treatment on equine welfare, it was surprising that owners were still willing to refer their geriatric horse only to have them euthanased on arrival. As previously mentioned in Chapter Six of this thesis, this finding could be associated with the horse-human relationship and the need for owners to try everything within their power to care for their horse. Indeed, published literature in the companion animal sector suggests that owners with a strong attachment to their animals frequently want to do everything they can to prolong life,

despite a poor prognosis or a lack of financial support (Wensley, 2008a). It is also possible that these decisions were the result of a perceived social pressure to refer. However, further research is required before definitive conclusions can be made. Given the quantitative nature of this study, it would be beneficial for future investigations to be qualitative in design in order to gain an in-depth understanding of owner decision-making.

7.5.4 Recommendations for future study

This study aimed to ascertain both clinical and non-clinical factors associated with the treatment and survival of horses diagnosed with colic. The use of a predominantly quantitative data collection form resulted in a detailed medical history being obtained for each horse within this study. However, in-depth information associated with non-clinical factors, such as finance, were not assessed. Therefore, future studies aiming to understand the complex nature of owner decision-making should employ a qualitative methodology. This is especially important if the concept of the horse-human relationship is to be further explored, given that data of this type will most likely be obtained by talking to those with personal experience. Furthermore, given the pivotal role veterinary surgeons have in guiding owners to an informed decision regarding their horse's health, further in-depth investigation into the experiences of veterinary professionals is warranted. Future studies on this subject should be qualitative in nature, such as in-depth

interviews or ethnographic observations, to ensure all potential factors associated with decision-making are captured.

7.6 Conclusions

The research project adds to a growing body of evidence attempting to identify factors significant in owner's critical decision-making. In this study an average total of 13 hours elapsed between the initial veterinary assessment of horses with colic and subsequent hospital admission. The decision to pursue surgical or intensive medical treatment was predominantly based on the severity of clinical signs. Elective euthanasia of referred horses was frequently associated with the identification of deteriorating clinical parameters and a low chance of survival. However, factors such as financial constraints, horse age and owner concerns regarding equine welfare, were also important in the decision-making process. Future studies should strive to understand the influence of owner-related factors, such as the horse-human relationship, to ensure informed decisions are being made.

Chapter 8: A qualitative investigation of stakeholder experiences and decision-making during critical cases of equine colic

8.1 Introduction

The preceding studies within this thesis have highlighted prior colic knowledge or experience as a potential barrier to campaign engagement. Additionally, the strong bond between owner and horse has frequently emerged as an influencing factor in the decision to pursue specialist colic treatment. Horse owners have primary responsibility for maintaining the health and welfare of their animals (Hemsworth *et al*., 2015). A large proportion of veterinary literature has focused upon an owner's ability to recognise and act upon primary indicators of poor health (Allison *et al*., 2011, Bowden *et al*., 2020, Buckley *et al*., 2004, Hemsworth *et al*., 2015, Hotchkiss *et al*., 2007a, Hotchkiss *et al*., 2007b, Ireland *et al*., 2012, Ireland *et al*., 2011a, Ireland *et al*., 2011b, Ireland *et al*., 2013, Laumen *et al*., 2010, Pollard *et al*., 2017, Scantlebury *et al*., 2011, Scantlebury *et al*., 2014). Much of this research was concerned with chronic illnesses, for example laminitis (Ireland *et al*., 2012, Ireland *et al*., 2013, Pollard *et al*., 2017), with very few exploring emergency conditions, such as colic (Bowden *et al*., 2019, Bowden *et al*., 2020, Scantlebury *et al*., 2011, Scantlebury *et al*., 2015, Scantlebury *et al*., 2014).

Only one study has attempted an in-depth investigation of factors associated with owner decision-making during a colic event

(Scantlebury *et al*., 2014). Yet, although Scantlebury *et al*. (2014) were the first to provide further insight into horse owners primary response to colic, the potential impact of a colic event on subsequent decision-making remains unknown. Therefore, given the need to understand the context in which an intervention is to be implemented, it is imperative that decision-making during a colic event is further investigated.

8.2 Study aims and objectives

The aim of this study was to explore horse owner and veterinary practitioners' experiences of the decision-making process for critical cases of equine colic and identify potential barriers to knowledge transfer.

The objectives of this study were:

- To explore horse owners and veterinary practitioners' experiences of recognising signs of colic and deciding when veterinary assistance is needed.
- To establish how horse owners and veterinary practitioners work together in order to reach a treatment decision following a critical diagnosis.
- To describe the impact an experience of critical colic can have on future horse owner decision-making.
- To explore potential barriers to the implementation of resources designed to aid decision-making during critical cases of equine colic.

8.3 **Methods**

The Consolidated Criteria for Reporting Qualitative research (COREQ) guidelines (Tong *et al*., 2007) have been used as a framework for the reporting of this study.

8.3.1 Study design

8.3.1.1 Theoretical framework

The framework for this research study lies between critical realist and bounded relativist ontology and has been written using a pragmatic theoretical perspective (see Chapter Three for further explanation). Data was collected using semi-structured interviews and analysed using Thematic Analysis (Braun *et al*., 2019).

8.3.1.2 Research team and reflexivity

The primary author of this research study (Katie Lightfoot) organised and performed all aspects of data collection and subsequent analysis. An in-depth reflexivity statement for this researcher is available in Chapter Three and Appendix III.

A researcher-participant relationship was generally not established prior to data collection, with study participants only contacted in order to arrange a mutually convenient interview date and time. However, one interview was conducted with an individual known to the primary researcher through previous employment.

Participants were provided with an information sheet describing the purpose of this research study when invited to participate. Additional information, introducing the primary researcher and interview process, was emailed to participants upon confirmation of an interview date (Appendix XVI).

8.3.1.3 Participant selection

A convenience, purposive sample of UK horse owners and registered equine veterinary surgeons were invited to participate between January and April 2019. Involvement in this study was entirely voluntary and no financial incentive was offered.

To ensure a broad range of experiences were explored, sampling frames encompassing a range of demographical attributes were developed prior to participant recruitment. Due to the specific nature of the phenomenon in focus, sampling frames also included explicit inclusion criteria, as shown in Table 8-1 and Table 8-2, to ensure only those with relevant experience were selected.

8.3.1.4 Participant recruitment

Research has shown that 6 – 12 interviews are sufficient to capture perspectives on a central phenomenon and identify common themes (Guest *et al*., 2006). Therefore, this study aimed to recruit at least 12 horse owners and 12 veterinary surgeons to participate.

Table 8-1: Sampling frame, including inclusion criteria, used to select UK horse owners for participation in telephone interviews

Participant Attribute	Inclusion Criteria
Age	Must be over 18 years of age
Gender	Any
Location	Must currently reside within the UK
Horse ownership	Does not have to currently own a horse and can be involved in any equestrian discipline
Interest in interview participation	Must have expressed an interest in interview participation at both the start and end of recruitment survey (see section 8.3.1.4)
Recent colic experience	Must have personally owned a horse which developed a critical case of colic; required either referral (medical or surgical) and / or euthanasia as a direct result of colic; within the past 12 months
Awareness of the 'REACT Now to Beat Colic' campaign	Can be either aware or not aware

Table 8-2: Sampling frame, including inclusion criteria, used to select UK veterinary surgeons for participation in telephone interviews

Participant Attribute	Inclusion Criteria
Age	Must be over 18 years of age
Gender	Any
Veterinary qualification	Registered UK veterinary surgeon + / - advanced / postgraduate qualifications
Veterinary employment	Currently employed within a UK veterinary practice which treats equids on a regular basis
Veterinary caseload	If working in a mixed-practice setting, the participant must be undertaking at least a 50% equine caseload
General colic experience	Must be currently attending, or have prior experience of, ambulatory / primary colic assessments
Experience of critical colic	Must have personal experience of critical colic: cases which required urgent referral for medical / surgical treatment and / or euthanasia as a direct result of the colic
Awareness of the 'REACT Now to Beat Colic' campaign	Can be either aware or not aware

Horse owner recruitment

Potential participants were selected from a list of horse owners who registered an interest in being interviewed when completing the online survey described in Chapter Five of this thesis. Those who met the aforementioned inclusion criteria were randomly assigned a number, generated using Microsoft Excel (Microsoft Office 2016, Version 16.0), and organised in descending order. The first 12 horse owners on the list were then invited to participate (Figure 8-1).

Veterinary Surgeon recruitment

To maximise participation, an email containing a study overview and link to a short recruitment survey (Appendix XVII) was sent to 66 UK veterinary practices registered with the 'Vet REACT Champions' scheme (co-developed by The British Horse Society and University of Nottingham). Weekly reminder emails were sent, with uninterested parties and invalid email addresses removed from the distribution list. A recruitment survey was active between January and March 2019, which allowed potential participants to register their interest and collected demographical information. Veterinary practitioners who met the inclusion criteria described previously were invited to participate.

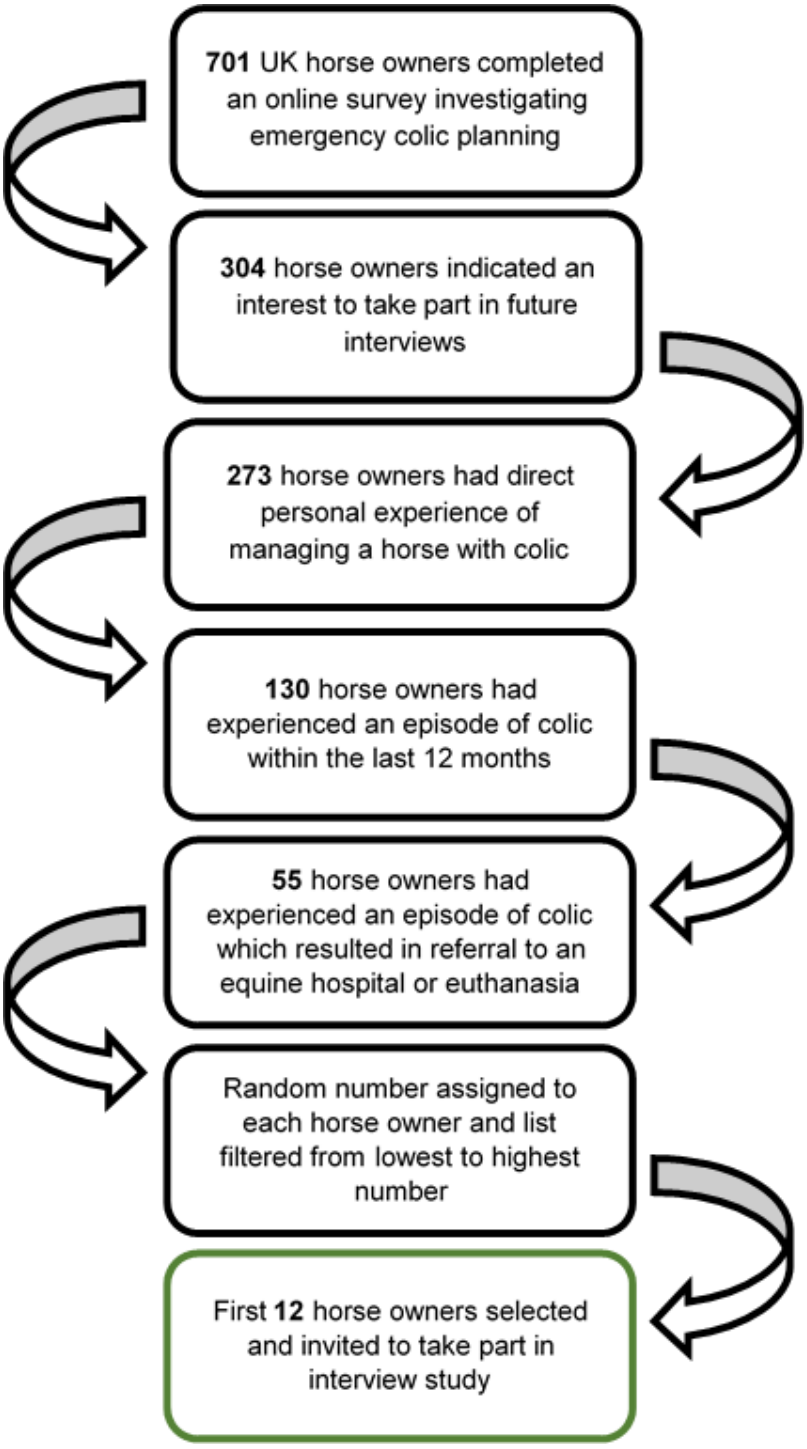


Figure 8-1: Flow-diagram illustrating the recruitment of UK horse owners to participate in a telephone interview exploring their experience of critical colic

Study invitation

An email, containing study information and an invitation to participate in interviews, was sent to selected participants. This correspondence contained a link to a short online survey, which served several purposes:

- Obtain written consent to participate in interviews.
- Obtain written consent for the interview to be audio recorded.
- Collect demographical data relating to the horse involved in the participant's most recent experience of colic (horse owner survey only).
- Participant preference on days / times most suitable for the telephone interview to take place.
- Participants contact details.

Follow-up emails were sent to non-responders one week post initial contact. If there was no contact after two weeks, replacement participants were selected.

8.3.1.5 Setting of data collection

Data were collected via the telephone. To avoid potential issues with telephone signal and audio quality, participants were asked to use a landline, rather than mobile phone, if possible. The primary researcher contacted participants using a landline from the University of Nottingham's Sutton Bonington campus. The majority of participants were alone at their home address or located at their veterinary practice for the duration of the interview. On one occasion a child under the age of 18 was present at the time of the interview therefore, permission to

audio record the session was sought from the parent prior to starting the interview and the child did not participate in the discussion.

8.3.1.6 Data collection

Interview schedules, which contained a list of open questions exploring various aspects of participant's experience with critical colic, were developed. Questions were based on previous qualitative research investigating similar topics, such as: clients' decision making regarding seriously ill companion animals (Christiansen *et al*., 2016), horse owners' attitudes, perceptions and practices in response to Hendra virus (Wiethoelter *et al*., 2017), and the impact of an educational campaign on response to stroke (Act FAST) (Dombrowski *et al*., 2013). A brief introduction, which explained the purpose of the study and asked for verbal consent to record the interview, was included at the start of each interview. The horse owner schedule was personalised to each participants' most recent experience of colic (e.g. their horses name was included throughout) to aid rapport building. The vet schedule focused on participants experience of colic assessment and the challenges they had experienced. The interview schedule was piloted by three veterinary surgeons (one equine and two small animal) and a member of the equine research team at the University of Nottingham. The pilot was conducted to identify issues associated with the overall interview design, as well as potential misinterpretation of questions. Corrections were performed (Appendix XVIII) in order to produce the final interview schedules (Figures 8-2 and 8-3).

1) **To start with, I'd like to know more about your experience as a horse owner. Can you tell me a little bit about how you came to be involved with horses?**

*What do you enjoy most about [owning / working with] * horses?*

Are there any negatives?

*How many horses do you currently own? What [does / do your horse / s] * mean to you?*

2) **So, your most recent experience of colic involved your horse *[horse name] **, is that right? Can you describe what happened when you first noticed *[horse name] ** was unwell?**

*What were your first thoughts about [horses name] * condition?*

Was there anything in particular that prompted you to call the vet?

3) **What did you do whilst waiting for the vet to arrive?**

Did the vet offer any advice on what to do when you telephoned the practice?

What? Did this help? / Would advice have helped you in anyway?

4) **What happened when the vet arrived to examine *[horses name] * ?**

*Do you remember how you felt when you were told [horse name] * [had a severe case of colic / needed referral / was critically ill] * ?*

*Do you feel [horse name] * condition was clearly explained at the time? Why?*

5) **What options did the vet discuss with you?**

*Do you feel you understood all of the options available to you and [horse name] * ? What makes you feel this way?*

Was cost something you discussed with the vet? How did you feel about this?

6) **During your experience with *[horse name] **, did you worry or think about anything in particular?**

*Had you ever considered what you would do [in a situation like this / if your horse needed referring to hospital] * before?*

Did this make things easier or harder at all?

Figure 8-2: The final interview schedule used to investigate horse owner experiences of decision-making during a critical case of colic

7) **Thinking about your decision to *[refer / euthanise] [horses name]* *, was this a difficult choice to make? Why?**

Did you share the responsibility of this decision with anyone else?

*Did this make things [easier / harder] * ?*

8) **Was there anything in particular that influenced your decision to *[refer / euthanise] [horses name]* *?**

Why?

*Do you think the relationship you [had / have] * with your horse had an impact on your decision? In what way?*

Do you think the vet did, or could have done, something to help you come to this decision?

9) **What did you know about colic before your experience with *[horse name]* * ?**

Where do you think this information had mainly come from?

Do you feel your prior knowledge of colic helped / hindered you during this experience? In what way?

10) **Had you cared for a horse with colic before your experience with *[horse name]* * ?**

What happened?

*Do you feel your previous experience of colic influenced your decisions in any way during your experience with [horse name] * ? In what way?*

** Only those with horses referred **

11) **What happened during *[horses name]* * time in the referral hospital?**

(SURVIVED ONLY) What decisions did you have to make during this time? How did you feel about making this / these decisions?

*(EUTHANISED ONLY) How did you feel about making the decision to euthanise [horse name] * ? Did the vet do anything to help you come to this decision?*

12) **Thinking of your experience with *[horses name]* * as a whole, what impact, if any, has it had on you personally?**

What about on your approach to colic in the future?

What do you think the hardest part of this experience was?

*Do you regret [any decisions / the decision you made] * ? Why?*

13) How did you feel in the time following this experience?

Did you seek any support / further information?

If so what?

14) Is colic something you'd continue to seek information on?

Why?

Where would you go for this information? Why?

What information would be of most interest to you? Why?

***** Only those aware of REACT *****

15) What are your views on the 'REACT Now to Beat Colic' campaign?

Have you read any information provided by the campaign?

Why not? / Do you think the resources provided will help horse owners prepare for difficult decisions? Why?

16) Thinking about your experience with *[horses name]* * and the decision you had to make, what would you say to a horse owner facing a similar *[situation / decision]* *?

Is there anything a vet could do or say to help horse owners in a similar situation? Why?

1. **To start with I'd like to know about your experience of assessing horses with colic.**

   - How often are you called to examine a horse for colic?
   - How do you feel about attending this type of emergency?
   - Do you think colic is viewed a certain way by owners?

(Initial Call)

2. **When an owner calls for assistance, what information are you provided with prior to attending the call?**

   - Who is this provided by?
   - What information do you feel is most important / helpful to obtain? Why?
   - Do you think knowing more about a horse / owner / situation before you arrive helps you in your approach to a case? Why?

3. **Do you ever provide owners with advice on what to do whilst they wait for you to arrive?**

   - *If yes* – What? Why?
   - *If no / not really* – why not? Is there anything you would like owners to do whilst waiting?

4. **In your experience, do you think owners call for veterinary assistance at the appropriate time? Why?**

(Examination)

5. **What challenges or issues have you faced during a colic assessment?**

   - How have you found owners to be during these types of cases?
   - Can this affect how you approach a case?

6. **Thinking about cases you have seen that have resulted in referral or euthanasia, how do these tend to differ from your typical colic assessment?**

   - Are there are any particular signs that would alert you to a critical colic case?
   - Do you find these cases more challenging? In what way?

7. **Do you find owners' worry about anything in particular during colic assessments, particularly those of a critical nature?**

   - How do you feel when discussing treatment options?
   - Do you think owners understand all of the options available to them in these situations? Why?
   - Have you found cost an issue? Why?
   - Does an owner having insurance make a difference?

Figure 8-3: The final interview schedule used to investigate veterinary practitioner experiences of decision-making during a critical case of colic

(Treatment decision)

8. **How have you found owners respond when told their horse is critically ill or requires referral/euthanasia?**

    - Why do you think this is?
    - Do they seem prepared to make an emergency decisions? Why? Which aspects?

9. **Have you found it difficult to reach a decision with an owner regarding their horse's colic treatment?**

    - Why?

10. **What do you think has the most influence on an owners' decision when discussing treatment?**

    - Have you found owners seek advice or support from people other than yourself during these situations? Who? Does this make things easier or harder?
    - Do you think the relationship an owner has with their horse has an impact on their decision? In what way?

11. **What do you do to help owners come to a decision during situations like this?**

(Referral)

12. **Have you faced any challenges when referring a horse for colic? What?**

    - Have you found owners who have had horses referred before are more open to this option in the future? Why?

(Euthanasia)

13. **How do you feel when an owner chooses euthanasia as a treatment option for colic?**

    - What would prompt you to suggest euthanasia as a treatment option?

(Experience / Impact on decision)

14. **Thinking about your experience of colic as a whole …**

    - How has your approach to colic changed during your career? Why?
    - Do you find it harder or easier to make decisions during colic assessments now?

15. **What advantages do you think your experience has brought you?**

    - Are there any negatives?

16. Is colic something you think owners regularly seek information or advice on?

- Why?
- What information do you think would be most helpful to owners?

** Ask only those who are aware of the 'REACT' campaign **

17. What are your views on the 'REACT Now to Beat Colic' campaign?

- Do you think the resources provided will help horse owners prepare for difficult situations? Why?

18. Finally, what would you like horse owners to know or do that would help you during a colic assessment?

Interviews were performed on a day / at a time most convenient to each participant and audio recorded using a Dictaphone (Olympus, VN-711PC) and an inner-ear microphone (Olympus, TP8) to maximise audio-quality. Interviews were not repeated, and data collection continued until theoretical saturation had been reached.

8.3.2 Data analysis

8.3.2.1 Transcription

Transcription was performed by an external service provider (Penguin Office Services, Watton, UK). Data were transcribed intelligent verbatim with words such as ‘umm’ and ‘err’ removed. Upon completion, transcribed documents were reviewed against the original audio recording by the primary researcher. Grammatical corrections and removal of content which could identify participants (e.g. age, geographical locations, and names) were performed. Transcripts were not reviewed by interviewees prior to coding.

8.3.2.2 Coding and theme generation

Data management and analytical coding were performed using NVivo software (QSR International Pty Ltd. Version 12). Vet and owner transcripts were initially analysed as separate groups, with data amalgamated after code generation. Granular coding of data was initially undertaken by the primary researcher to ensure all relevant content had been identified. Codes generated were both inductive and

deductive in nature, with deductive codes primarily referring to behavioural and physiological signs of colic.

A codebook was compiled following complete coding of two transcripts (one horse owner and one veterinary surgeon). This codebook was then used by a secondary coder (SF) to code the same transcripts. Upon completion, both researchers met to discuss potential issues and refine codes. In line with Morse (1997), no further coding was performed by the secondary coder. Therefore, all transcripts were coded iteratively by the primary researcher, with all transcripts revisited when new codes were generated.

Subthemes were generated through the grouping of similar codes. These were frequently reviewed and reorganised before relationships between subthemes were explored, using visual mapping (Wong, 2008), in order to identify the final over-arching themes of the data.

8.4 **Results**

8.4.1 Demographics

8.4.1.1 Horse owner

A total of 14 telephone interviews (Appendix XIX) were conducted with UK horse owners between January and March 2019. Participants were female and had an average age of 47.5 years (range, 31 - 64 years). Length of equestrian involvement varied, with participants being engaged with horses for an average of 27.4 years (range, 7 – 45 years). A summary of participants most recent colic experience is displayed in Table 8-3.

8.4.1.2 Veterinary practitioner demographics

Thirteen telephone interviews (Appendix XIX) were conducted with UK equine veterinary practitioners between February and April 2019. Participants had been graduated for an average of 15.2 years (range, 2 – 30 years), with 39%,(5 / 13) working within a first opinion equine practice with ambulatory and hospital facilities. An average of 4.6 (range, 1 – 10) colic cases were reportedly seen by participants per month, with most (92%, 12/13) having attended a critical case of colic within the previous 6 months.

Table 8-3: Details of participating horse owners most recent colic experience, including horse age, breed and insurance status

Question	Response
When was your most recent colic experience?	**35.7%** (5 / 14) Over six months ago but within the last year **28.6%** (4 / 14) Over one month ago but within the last six months **35.7%** (5 / 14) Within the last month
What was the nature of your most colic experience?	**57.1%** (8 / 14) referred to an equine hospital **42.9%** (6 / 14) treated at the yard
Did euthanasia / death occur as a result of this colic experience?	**35.7%** (5 / 14) horse was euthanased at the yard without further investigation and / or treatment **35.7%** (5 / 14) horse was treated and recovered from this episode of colic **28.6%** (4 / 14) horse was euthanased during surgical treatment at the hospital
How old was the horse involved in this experience?	Horses involved were an average of 17.2 years old at the time of colic experience
Was this horse insured at the time of this colic experience?	**71.4%** (10 / 14) Insured **28.6%** (4 / 14) Not insured
What breed was the horse involved in this colic experience?	**7.1%** (1 / 14) Appaloosa 57.1% (8 / 14) Cross breed **7.1%** (1 / 14) Highland **7.1%** (1 / 14) Irish Draught **7.1%** (1 / 14) KWPN **7.1%** (1 / 14) Shetland **7.1%** (1 / 14) Warmblood
What discipline / activity did you mainly do with this horse?	**35.7%** (5 / 14) Leisure / hacking **21.4%** (3 / 14) Retired / companion **21.4%** (3 / 14) Dressage **14.3%** (2 / 14) Showing **7.1%** (1 / 14) Show jumping

8.4.2 Thematic analysis

Thematic analysis revealed four over-arching themes: '*head', 'heart',* *'*practicalities' and *'impact'.* Each theme was found to interact (Figure 8-4), with *'head'* and *'heart'* being in constant conflict. Each theme is reported separately, with selected participant quotes used for illustrative purposes.

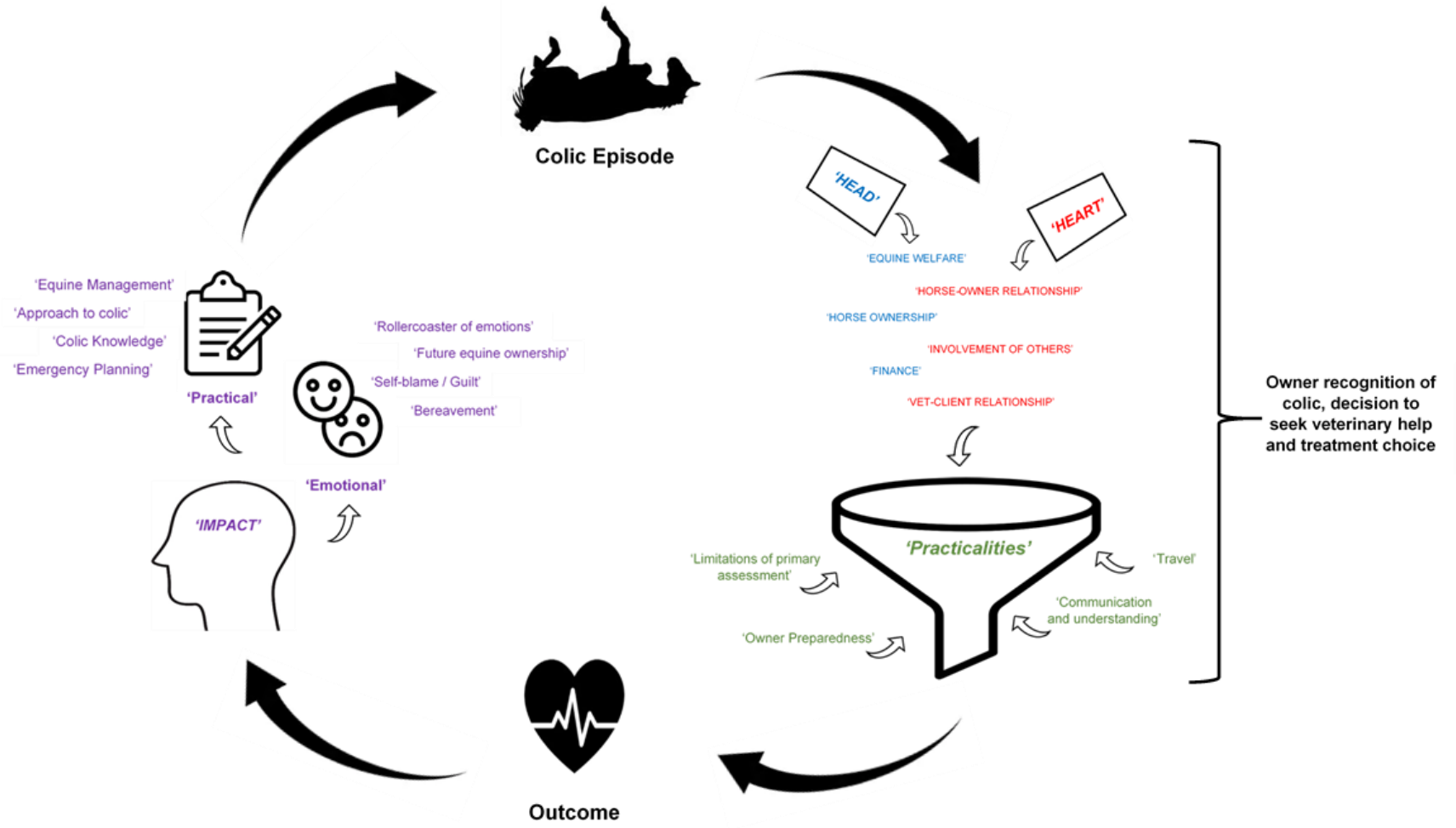


Figure 8-4: Thematic diagram illustrating the interation of overarching themes, themes and sub-themes as identified during thematic analysis

8.4.2.1 'Head'

The over-arching theme '*head*', and its three associated themes (Figure 8-5), refers to pragmatic factors which contributed to participants' decision-making.

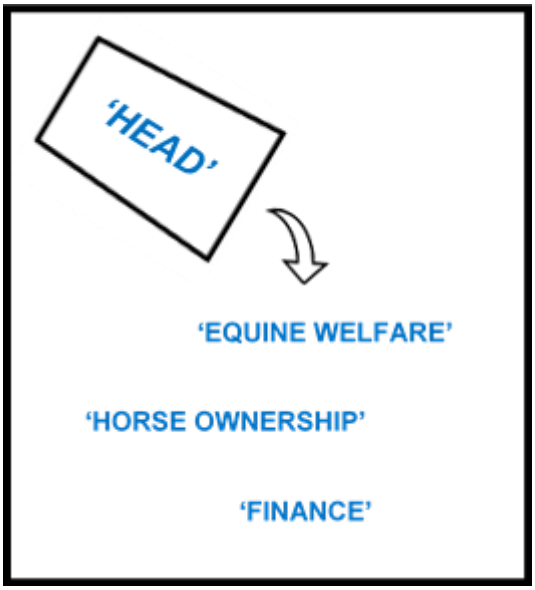


Figure 8-5: Thematic diagram illustrating the over-arching theme *'head'* and three associative themes.

Theme One: Horse Ownership

The majority of participating owners had developed an interest in horses at a young age, usually through family involvement. Being a horse owner was seen to bring both physical and mental health benefits, with a number of participants suggesting that their horse gives them a '*reason to get up in the morning*'. Though ownership was generally seen positively, participants frequently acknowledged the challenges owning a horse could bring, including the personal and financial investment required. However, all owners indicated that any

negatives were far outweighed by the positives, challenges just being '*part and parce*l' of horse ownership:

'Financially <laughing>. They ain't cheap. I'd be a billionaire if I didn't have horses. Yeah. No, financial burden. And it's more the time constraints, you know, you can't just go out for an evening (…) You can't do that if you have horses. There is a lot of restraints in that respect. But it's far outweighed by the positives of having them.'

(Horse owner 003)

Owners had varying levels of equestrian knowledge, with most having experienced a colic episode prior to the one discussed during the interview. Previous colic encounters, particularly with the same horse, were frequently referred to by owners as significant in their decision to seek veterinary help. For example, participants described how assessment of severity was achieved by comparing signs observed to those experienced previously:

'(…) I was like, 'This isn't normal for him,' (…) he was going flat out and rubbing his head onto the floor, and then looking at his belly. Because he is quite colic-y, I was like, 'I don't really know whether to ring the vet or just leave him and see how he is,' but I thought because this was different to how he normally reacted, I did call a vet (...)'

(Horse owner 010)

Additionally, response to lay treatment, such as walking their horse in hand or offering an alternative feed, was also taken into consideration when deciding if veterinary attention was required:

'So I made him some fast fibre, soaked it, just a little feed really and he sniffed it and didn't want to eat it (…) So then we got the carrots out and he refused a carrot (...) and literally that was probably no more than ten minutes from him refusing the haylage, so I phoned the vet (...).'

(Horse owner 014)

Theme Two: Equine Welfare

Owners frequently commented on the fragile nature of horses, with all acknowledging that maintaining good levels of equine welfare was their responsibility. However, accountability for their horse's wellbeing was a source of great anxiety for owners:

'I think the main worry is the responsibility of having this huge animal that you have this sort of relationship with, but it's the overall responsibility because they're large animals, they're so fragile and there's so many things that can go wrong with them.'

(Horse owner 013)

When discussing their experience of colic, both veterinary surgeons and owners highlighted the prevention of pain and suffering as their main priority. This had a significant influence on owners' decisions to

elect for euthanasia, especially when their horse had not responded well to veterinary treatment, with some owners describing how it would be '*unfair*' to continue:

' (…) I rang her back and I was like, (Veterinary Surgeon) turn around, I'm calling it, it's not fair on him, I'm not having him keep going through this.' (Horse owner 005)

Participating veterinary surgeons also regarded euthanasia as a valid treatment option to prevent further suffering. However, they reported feeling conflicted when owners chose this option without further investigation or referral:

'(…) I mean it's always valid option I think ultimately you end up with a horse that's no longer suffering (…) I don't know, I think sometimes you end up wondering if it's a horse that you've just examined and they've decided on the basis of that to euthanize it, (…) you don't necessarily know exactly what's going on or why you're doing it.'

(Veterinary surgeon 004)

Both veterinary surgeons and owners described having welfare concerns around the risk of the horse injuring itself as a result of attempting to roll. This was frequently associated with an owner's decision to walk their horse in hand or move them to an arena or enclosed paddock. Participating veterinary surgeons also said that in-

hand walking could help to reduce the risk of injury and alleviate symptoms in mild cases of colic. However, concerns were raised about owner safety and the potential health implications continuous walking could have on a critically ill horse. Veterinary surgeons also suggested that, in addition to wanting to prevent further injury, some owners may be motivated to walk their horse due to the belief that rolling may result in a 'twisted gut':

'I mean I think people may understand more now that rolling doesn't twist their gut but I think they're still worried about them being injured, you know, and classically when you see these horses with really bashed up heads and eyes (…), I think people worry about what they can see on the outside rather than what's going on inside. So, I think they do still have a tendency to try and stop them rolling.'

(Veterinary surgeon 012)

Theme Three: Finance

Although finance was a concern for owners, they said that they did not consider it the most important factor when deciding on colic treatment. In contrast, veterinary surgeons saw cost as one of the biggest influences on decision-making, especially when survival depended on urgent referral:

'The cost. They obviously worry if the horse is gonna survive but cost is the main thing that they worry about because they may want to do

surgery, but they may just not be able to afford to.'

(Veterinary surgeon 002)

Having equine insurance reduced owner anxiety, with owners less concerned about discussing costs and requesting that everything possible was done if their horse was insured. This view was shared by participating veterinary surgeons who suggested that owners who have insurance or the funds to pay for colic treatment display a much calmer demeanour than those who don't:

'(…) they are stressed but you will notice that people that have either their money or an insurance in place to cover for the colic, they're a lot more relaxed than people that actually have no, well, they have no insurance and finding the money will be a bit of a struggle.'

(Veterinary surgeon 010)

In comparison, finance was a much bigger concern for owners who did not have insurance cover or available funds, with a lack of awareness regarding treatment costs also reported:

'(…) I had no concept of how much colic surgery might cost. (…) I hadn't even considered how much, I mean, I think the average cost they talked about there was between £5,000 and £7,000. But so, actually, I wouldn't have been able to afford it, my credit card wouldn't have stretched to that.' (Horse owner 012)

Although insurance was generally seen as advantageous, some owners reported experiencing difficulties contacting their policy provider during an emergency. Additionally, veterinary surgeons raised concerns about insurance companies excluding future colic or associated illnesses following a claim:

'(…) insurance is increasingly difficult because if it's had any sort of colic ever before (…), or if they've had anything, even like gastric ulcers or something like that they're probably not gonna cover it.'

(Veterinary surgeon 007)

'I knew I had insurance, but the funny thing with it is it happened on a Sunday so I couldn't contact the insurance provider, until the Monday. I had to make decisions on her treatment resting on the faith that the insurance would pay out. (…) I did take a bit of a risk, I felt, not having the insurance company's authority.' (Horse owner 008)

Though insurance enabled owners to pursue all available treatment options for their horse, some owners stated that they intentionally did not have insurance as they felt this would result in them being forced to agree to unnecessary treatments:

'One of the reasons I don't insure my horses is because I don't ever want to be on a conveyer belt to the most drastic treatment immediately. (…) I think if you're insured it's very hard to say no (…) It

doesn't mean I won't pay for operations or I won't pay for extensive treatments, it just means I want the option to start with.'

(Horse owner 013)

Owners understood that veterinary care was a 'business' and that treatment options would always depend on their financial status. However, owners frequently suggested that the topic of cost is often handled insensitively by veterinary surgeons and could create difficulties during decision-making. For example, one owner reported feeling as though the financial costs of colic treatment was being placed before their horse's care:

'(…) And he said, 'It's gonna be at least £5,000 this surgery, can you afford it?' And that really upset me because it was like he was putting the money before my horse's life, you know? Which I totally understand it's a business and stuff but he said it more than once, he said it three or four times.' (Horse owner 001)

Participating veterinary surgeons also reported experiencing difficulties when discussing finance, particularly when urgent referral is required, and the owner has limited finances:

'(…) you are asking people to make a big decision. You are saying, 'Are you able to fork out a load of money? Otherwise you have to put your horse down now.' They are very high stress situations and they are upsetting for owners because they are having to make decisions when

they are already in a state of anxiety and stress.'

(Veterinary surgeon 013)

However, veterinary surgeons suggested that many of the challenges they have experienced when discussing finance often stem from owners being dishonest with themselves about what they can afford:

'There's an awful lot that say, 'Don't worry, we'll sort it out.' And you look at them and you think, you're not, you're not gonna have that and I think they don't want to pull the plug on the horse because they can't afford to treat it, or they say, 'Just refer it, we'll work it out later.' And you're like hmm… I can't not because you've asked me to but… I sincerely doubt that the funds are gonna be forthcoming.'

(Veterinary surgeon 007)

Interestingly, veterinary surgeons reported feeling pressured by not only their own practice, but the external referral hospital to ensure payment was secured. They also suggested that they would always try and provide owners with a good estimate of potential costs to avoid feelings of guilt should the owner get into financial difficulties:

'(…) if the horse is going to be referred I will try and bring it up because it is a lot of money. (…) The vets at the hospital get really cross with us when we don't, which I don't always agree with. I don't really think it is our job as vets to discuss finances with owners necessarily. To a degree, but I don't think we should be viewed too much as the person getting money off people.' (Veterinary surgeon 013)

8.4.2.2 'Heart'

The over-arching theme '*heart*', and three associated themes (Figure 8-6), captures emotional or personal factors associated with decision-making. Though owners attempted to take a pragmatic approach to their horse's care, themes within '*heart*' were often in constant conflict with those reported in '*head*'.

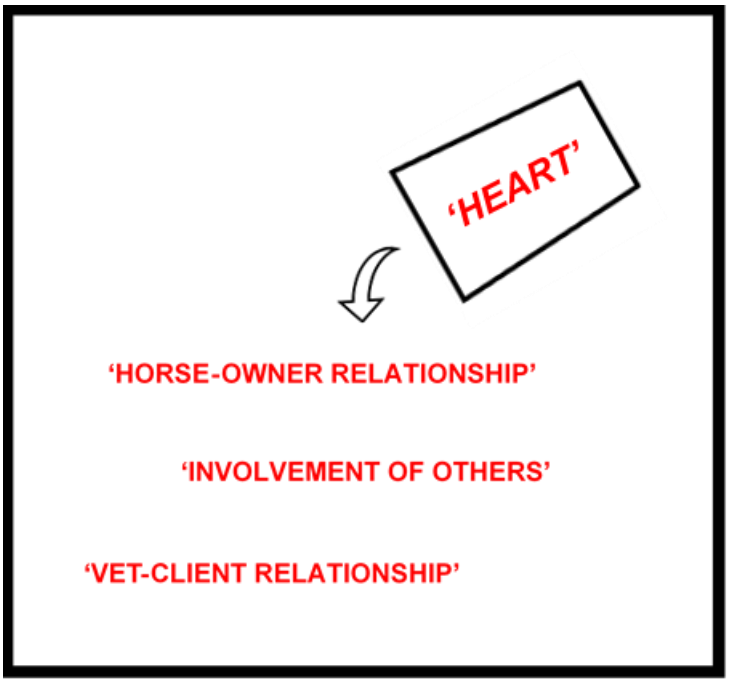


Figure 8-6: Thematic diagram of the over-arching theme 'heart' and three associative themes

Theme One: Horse-owner relationship

Owners frequently eluded to having a strong personal connection or relationship with their horse. Horses were rarely referred to as working animals, with many owners using the terms '*friend*', '*family member*' or

‘*soulmate*’ to describe the role their horse had in their life. Some owners even suggested that, in the absence of a family of their own, they viewed their horse as a ‘*child*’:

‘They're a big part of everything you do every day, (…) so they have to take part in everything, I guess. Just in terms planning your holidays and your life and stuff. They're the first thing that you have to think about. You can probably tell I don't have kids, so he was like my child, I guess.’ (Horse owner 010)

The strong bond shared between horse and owner was seen as the most compelling aspect of horse ownership, with owners frequently suggesting that their unique relationship helped them to determine the severity of colic signs:

‘She showed me the signs; she’s very, very good at letting me know early on. (…) she was stood up but I could see she was uncomfortable, she started to kick her flank, then she’d lay down and she’d lay flat out on her side stretching her legs and that is when I know she’s in pain.’ (Horse owner 001)

This connection was also seen to have a significant bearing on an owner’s decision to pursue referral treatment or elect for euthanasia. Owners described ‘*knowing*’, just by observing their horse’s behaviour or the ‘*look in their eye’*, whether intensive treatment would be an option:

'The more we walked him, he kept looking at me as if to say, 'Mum, I have had enough. I don't want to do this anymore.' (…) I didn't make it anywhere near the horse box. There must have been 500 yards between the hill, the green patch of grass and the horse box. He decided he wasn't going any further.' (Horse owner 004)

'He said, 'She's in a lot of pain!' But she looked at me, at that point she looked at me with this look in her eye and it was, 'Sort this out.' OK, I said, 'Right, surgery.' (Horse owner 001)

An in-depth understanding of their horse's temperament or personality was an additional aspect considered by owners when deciding on treatment. For example, factors such as the ability to tolerate box rest, handleability or how 'nice' the horse was, were frequently commented on:

'Because he was a nice horse, I don't mean just a well put together horse etc. I mean he had a nice personality. If it was a horse that kicked me and bit me regularly <chuckles> and made my life hell I might not be quite so, I don't know, I'd still probably do whatever I could for a horse.' (Horse owner 002)

The horse-owner relationship was also acknowledged by participating veterinary surgeons as a major influence on decision-making. They suggested that treatment would often depend on the 'type' of owner, with two 'groups', those owning horses for professional gains and those who own for leisure, frequently referred to:

'For some owners the horses are their children, so they'll do whatever needs be. Other ones, yeah we have some horses (…) they are a commercial item, earns them money then it's got to be an economic decision.' (Veterinary surgeon 006)

However, though this relationship could aid in selecting the most appropriate treatment option, veterinary surgeons suggested that it could potentially create barriers when urgent decisions needed to be made. They also commented that the strength of an owner's attachment was often seen to increase with a horse's age, with it being difficult to know how attached people were until they asked directly about it:

'(…) it was quite an old pony (…) It took me about 45 minutes to be able to prize her off him enough that I could even get a vein, (…) she agreed that it was the best thing for him, but she just couldn't bring herself to let it happen basically. (…) He was part of the furniture.' (Veterinary surgeon 003)

An owner's personal connection to their horse was also seen to be in conflict with practical elements of their decision-making. For example, the need to care for their horse was often put before the financial implications of colic surgery, despite an owner knowing they would not be able to afford it:

'(…) I think they get a bit caught up between doing the best for the horse and looking after the horse and therefore they feel that they should be able to put them through surgery because the horse is like five or six or whatever they're not ready to be put to sleep yet, but then they might not be able to afford it if they're being honest with themselves.' (Veterinary surgeon 003)

Theme Two: Vet-client relationship

When discussing the recognition of colic and subsequent help seeking, owners reported that having a close relationship with their vet or veterinary practice helped when urgent attention was required:

'No, they just asked how he was and I explained what I was doing, to them, and I have a great relationship with my vet to be fair, she knows exactly how I treat my horses and how I work with my horses, so she pretty much knew that, yeah, that she needed to come <laughing> straight away, so.' (Horse owner 003)

Familiarity was also an important factor during a vet's decision to provide owners with colic advice. If an owner was well known or considered a 'professional' with sufficient knowledge and experience, then advice was generally limited. Additionally, a vet's interpretation of case severity prior to arrival was often based on their knowledge of the owner:

'I think that knowing the client, you know, we have some clients where they would phone and say, 'My horse has got severe colic signs', and you would absolutely… that's all that you need to know, you know that they would recognise that, and if they feel that it's severe then it probably is severe. I think other times you… I think knowing the client is sometimes helpful because it will give you an indication as whether or not what they believe they're seeing is truly what is happening.'

(Veterinary surgeon 005)

Continuity of care was also considered important by owners, with many suggesting that having their 'usual vet' attend in an emergency made them feel more comfortable. This was especially important when euthanasia was a possibility, although owners acknowledged that this was not always possible:

'I had such a good relationship with my last vet because she saw him so often, (…) Because she got us, if you see what I mean, because she knew the history with him and all the rest of it. I was disappointed it wasn't her at the end, but that's not fair on (Veterinary Surgeon) because I couldn't have faulted (Veterinary Surgeon) for what she did for me that night.' (Horse owner 005)

Accepting information and using it to make an informed decision depended on whether or not the owner had trust in the vet:

'I think about whatever the vet tells me I have to have a really good vet that I absolutely have faith in… because of my own experience I can sometimes query what a vet might say. Whereas if the chief vet had come, the top guy, I trust him implicitly. I do need to really know that I've got a good vet.' (Horse owner 002)

A similar view was noted when owners discussed the need to feel confident in a vet's professional ability to treat their horse. Veterinary competency was frequently perceived to be associated with age, with some suggesting that veterinary surgeons often rely on 'taught' knowledge, rather than what they have gained through experience:

'(…) when she said it I did, if I'm totally honest I did feel… (Veterinary Surgeon) was only saying what she'd been taught which is absolutely fair enough, but I didn't… I've kind of said what an experience that was for her as well because (Horse Name) taught her that actually, do you know what, this can happen sometimes, it's not always like that. But no, when she said that, I thought well this is finally it.' (Horse owner 001)

Owners stated that receiving assistance from a vet who was experienced in equine care was essential, with a number of reporting difficulties when a mixed or small animal oriented practitioner attended their horse:

'If you have got a practice, then send a horse vet to a horse, not a dog vet to a horse. If I had been a more novice owner, the first vet that came wouldn't have instilled any confidence with me at all. He was jumping around. It probably would have made me panic a lot more.'

(Horse owner 008)

Owners frequently acknowledged that being a veterinary surgeon '*must be difficult*', especially when a poor prognosis had to be conveyed. However, although owners appreciated veterinary surgeons being honest or '*blunt*' about their horse's chances of survival, professionals who showed compassion and had a '*good bedside manner'* were favoured. Additionally, owners reported that both the colic experience and associated decisions were helped by practitioners who '*pitched*' explanations to the individual owner:

''cause I trained as a nurse originally and worked as a nurse and I found that … our local vets, we look at them as being the GP, so going into (Veterinary Hospital), the way the vets treated me and my daughter and were able to communicate far surpassed what I've experienced with doctors in hospital.' (Horse owner 014)

Theme Three: Involvement of others

The involvement of others during a colic experience was viewed both positively and negatively by interview participants. Owners indicated

that the decision to refer or euthanise their horse as a result of colic was solely their responsibility. However, the presence of family members or friends was seen as a welcomed source of emotional or practical support:

'My friend from up the lane came immediately to help me. And I rang my husband (…), physically it helped me 'cause of loading the horse up (…). And then just moral support, just getting on with it and you know you've got somebody… when you've got a poorly horse to be on your own is a bit frightening.' (Horse owner 002)

In contrast, some owners described the involvement of family members as being an additional source of concern:

'At the time I think the only opinion I was worried about was the opinion of my mum, as stupid as that sounds. She had been there when I went to look at him, she bought him for me. He was her horse as much as he was mine, but I had the full responsibility of him.' (Horse owner 004)

Participating veterinary surgeons reported that owners would frequently seek help and advice from those around them, including yard owners, friends and family members. Though this could sometimes aid in the owner's decision-making process, for example when seeking financial aid, the presence of others had the potential to cause delays in veterinary care:

'It depends on the people involved I think, 'cause I think sometimes if you've got a trusted, experienced, horsey person there saying, 'This is serious', and kind of backing up what you're saying, but equally you can have family members there and they're all very hysterical about it and no one wants to make a decision.' (Veterinary surgeon 004)

Veterinary surgeons also suggested that peer-pressure from individuals such as yard owners or liveries, can have a major influence on an owner's decision to pursue referral:

'…sometimes it can be difficult if you've had a livery yard owner who doesn't believe in colic surgery who then wants to talk the owner out of colic surgery when that's a perfectly good candidate. You always get one know it all don't you that doesn't, 'They all die when you do colic surgery' or whatever.' (Veterinary surgeon 006)

Additionally, owner tendency to focus on the negatives associated with colic, even if they had experienced a successful outcome, was also seen as a barrier to decision-making:

''(…) bad news travels much faster and seems to stick around for longer. So, I do find that people tend to forget about the good cases and ones where it's gone really well, and they had a really good referral experience…' (Veterinary surgeon 008)

Peer-pressure within the equestrian community was frequently referred to by horse owners. One particular area of concern was associated with euthanasia and owners being criticised if they did not pursue surgical intervention for colic:

'It's not acceptable to lose horses to colic like that (euthanasia) apparently, and maybe I should have had him operated on, and you know you're like, you have no right to judge me and my situation and what I could see in that horse. (…) people can't be frightened of making the decision. (…) I just think that we put a lot of pressure on ourselves that people are going to judge us and, why didn't we do this? We should have done that, when actually, how is it the wrong thing to do if we're respecting that animal?' (Horse owner 005)

Veterinary surgeons also raised concerns about ongoing equestrian beliefs and misconceptions associated with colic. For example, the belief that a colic diagnosis was an automatic 'death-sentence' or that allowing a horse to roll would incur irreversible intestinal damage, were frequently seen be to barriers to early veterinary intervention and a successful recovery. Though based on little or no scientific evidence, historic beliefs such as these were seen to be engrained within the horse owning population, with veterinary surgeons expressing concerns that owners were unwilling to accept new ways of thinking:

'I think the problem is that clients will latch onto a concept, to an idea and then they never evolve from that and inevitably as the veterinary profession is evolving in how we approach diseases or pathology in general, then we need to make sure that clients are moving with the times as well. Because I think that inevitably a client will just remember one idea or concept and that's it.' (Veterinary surgeon 001)

8.4.2.3 'Practicalities'

The over-arching theme 'practicalities' represents both the routine and sometimes unexpected challenges of a colic diagnosis and subsequent treatment (Figure 8-7).

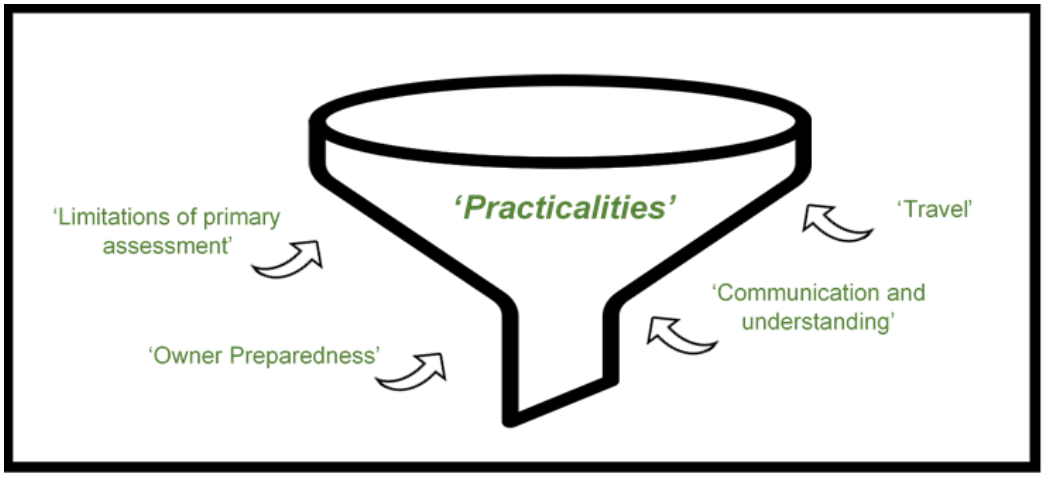


Figure 8-7: Thematic diagram illustrating the over-arching theme 'practicalities' and associative themes

Theme One: Limitations of primary assessment

Participating veterinary surgeons reported various challenges associated with attending a potential case of colic. When arriving at the owner's yard, veterinary surgeons frequently suggested that locating the horse's owner and obtaining a relevant history could be difficult:

'… you can have a lot of people crowded around and trying to work out who's who, (…) who knows what's going on with the horse, and what it's feeding and that sort of thing, maybe who mucked it out, whether it's passed droppings. Sometimes just working out the ins and outs of the situation can be more frustrating than dealing with the colicking horse itself.' (Veterinary surgeon 012)

Limited facilities, such as a lack of electricity or suitable light, were a common source of frustration for veterinary surgeons, as their diagnostic approach could be severely compromised. Additionally, concerns regarding personal safety, particularly when an inexperienced handler was present, were routinely expressed:

'Safety, personal safety, particularly with regards to rectalling a horse, lack of facilities to adequately do things like rectal a horse or even prep for a belly tap if it's in a field, in the dark, at night, you know, things like that can be very challenging. Inappropriate help, insufficient help, so if you've got like a 16-year-old girl helping you or younger or whatever, it can be difficult to get adequate restraint or an extra pair of hands to do stuff.' (Veterinary surgeon 002)

Horse-related factors, such as temperament, size and pre-existing health issues, were also found to be limiting factors:

'…she wanted to, obviously, do an internal examination to see what she could feel, but one of his places he had a tumour removed from was around his anus. So A, that was still quite sore from his operation in May and it hadn't completely finished healing, but B, because of that, he is very anti ... Anything round the back end…' (Horse owner 010)

Additionally, owners reported experiencing unexpected complications, such as the horse becoming 'cast', which subsequently delayed the vet's initial examination:

'…he was very distressed, he was on the floor, he'd rolled, you know, caked in mud, he'd got himself wedged against my hay barn. So, the vet turned up and basically, (…) she was like, 'OK, let's just take one thing at a time'. (Horse owner 005)

Theme Two: Owner preparedness

Owners being prepared to make rapid decisions about their horse's treatment was frequently discussed. Participating veterinary surgeons reported experiencing a high number of owners who had never considered what they would do if their horse developed a critical illness. Additionally, practitioners suggested that, although some may have thought about the possibility of referral, owners could often become conflicted when in an emergency situation:

'No, most times people have not thought about this in preparation. (…) even if they have they may find actually being in that situation is not… they feel differently to how they expected to feel and sometimes even if owners have said, 'I would never put my horse through colic', sometimes they will change their mind… '

(Veterinary surgeon 002)

This view was echoed by owners who suggested that, even though they may have considered their options previously, deciding on treatment was much harder when in an emergency situation:

'…So, he was 20 at this point, and if he needs something (…) You're not gonna do that to him because it's obviously something quite complicated because of his age, so I had that in my mind, but it's very different when you're in that situation and you wanna just do whatever you can and what you think's the right thing…' (Horse owner 010)

However, some owners suggested that not having a plan actually made their colic experience easier. A lack of pre-conceived ideas regarding which treatment option they would pursue allowed them the freedom to consider both verbal and visual information at the time:

'… I think it made things easier because I didn't have any preconceptions. I didn't think, 'Uh no, I've always said I won't put her through surgery so now I won't put her through surgery', or vice versa. I had to think there and then, on the spot, with the emotions that I was

feeling, what the vet was telling me, how (Horse Name) was looking, you know, …' (Horse owner 001)

Additionally, owners also eluded to the fact that making an emergency plan for colic in advance was not always feasible, despite the vast array of information available to them. They suggested that due to the multifactorial nature of the disease, owners couldn't plan for every eventuality:

'… You know, it's difficult. There's plenty of information out there, if people want to look and read up all about colic and options. The thing you have to remember though is that no two colic cases are the same, and no two horses are the same, so you can read all this stuff of, 'I did this, this and this, and my horse survived.' And, 'I did this, this and this and my horse didn't survive.' But you've got to weigh up what you are dealing with directly in front of you.' (Horse owner 003)

Veterinary surgeons concurred that educational resources were useful in getting owners to consider the potential implications of a colic emergency. However, barriers to knowledge transfer, such as time constraints and accessibility of resources, were highlighted by both groups of stakeholders. Additionally, many veterinary surgeons expressed their concerns that interventions, such as the REACT campaign, would often only be used by those actively seeking further information:

'The things that we do, like the client talks and things, it is a certain type of owner that comes to those and they are very engaged. I think it is reaching the not so engaged ones that is difficult.'

(Veterinary surgeon 011)

Theme Three: Travel

Both the logistics and availability of transportation were a frequent cause of anxiety for both veterinary surgeons and owners. Practitioners reported that a common barrier to referral treatment was the fact that many owners did not have access to a suitable horse box at a moment's notice:

'The ones that have got their own transport (…), you're guaranteed that the tax hasn't run out on the lorry, it's full of fuel, it's in full working order, (…). It's absolutely fine, it's not a problem. But when they're relying on other people or the trailers sat there with a flat tyre, all that sort of thing it's not ideal.' (Veterinary surgeon 007)

Horses that were difficult to load or did not tolerate travel well were also a frequent barrier to referral. However, some owners indicated that, although they were able to transport their horse to a referral hospital, they were concerned about their safety during the journey:

'How I was going to get my horse to the referral hospital safely because I had to transport her, and my horse was at that point throwing itself on the floor. I thought a 3.5 ton lorry isn't going to be the most ideal situation if my horse throws itself on the floor.' (Horse owner 008)

Journey length was also frequently discussed, with both owners and veterinary surgeons highlighting that referral to an equine hospital was often not possible or in the horse's best interest:

'If it looked like it was not going to survive the journey very well I'd, yeah 'cause I'm always mindful, even if they're only an hour away from the hospital there's time to get the lorry set and get the horse on the lorry and then get it there and then get it off the lorry, get it assessed so you're still looking at probably a good two-to-three hours to surgery.' (Veterinary surgeon 008)

'And the other thing to bear in mind is we're three and a half hours from the nearest place that can do that sort of surgery, so chances are he would have died on the way anyway or died on the operating table and he was in so much pain, I made the decision to have him put to sleep then.' (Horse owner 008)

Additionally, owners reported experiencing unexpected issues with transportation, such as adverse weather conditions and difficulties accessing their horse's location:

'…She said, 'He needs to go to (Veterinary Hospital).' I was like… The field he was in, the hill is quite steep getting him down. I said, 'Look, let's try and get him to the horse box.' My friend went and got a horse box and reversed it down to the bottom of the hill. I said, 'We will try and

get him there. We will give him the best possible shot,'

(Horse owner 004)

Theme Four: Communication and understanding

When discussing their horse's treatment options, owners reported feeling as though they did not have a choice. This was often attributed to owners not considering euthanasia as a treatment option:

'No, not really. I mean again, you know… none of us were really making a decision, the only decision was which vet hospital are we going to. 'cause if not you put down in that situation.' (Horse owner 013)

Owners also indicated that veterinary surgeons often do not consider horses as individuals. As a result, many indicated that they would prefer veterinary surgeons to communicate options which are applicable to the horse seen at the time, rather than what they have seen 'work' in the past:

'I would like vets to consider every horse as an individual and how one horse reacts isn't necessarily how another horse is gonna react (…). You know, rather than say, 'this is what you need to do' maybe this, maybe that, you know? (…) open mindedness I guess with regards to every horse is different, every horse will react differently.'

(Horse owner 001)

The highly emotive nature of a colic emergency was seen to be a barrier to effective vet-owner communication, with veterinary surgeons

acknowledging that the discussion of treatment and prognosis was often challenging. However, many indicated that their approach to shared decision-making has improved as a result of experience:

'I think that the hardest thing is to give all the information that's going round in your head to the client that's upset in a way that they can process, you know, they say don't they that people hear the word cancer and the next ten minutes that you've said to them is a complete blur. So I think that over time I've got a little bit better about judging the situation (…) I think I have got a little bit better about perhaps altering slightly the order of that information.' (Veterinary surgeon 005)

Varied understanding of the pathophysiology of colic often led owners to be unrealistically optimistic despite a guarded prognosis from the attending veterinary practitioner. In particular, observing a horse pass faeces was viewed as an indication that an obstruction was not present in the digestive system. Subsequently, owners felt unprepared to make emergency decisions such as choosing euthanasia or consenting to surgery:

'The only thing I can really, really remember from that conversation when he came up to me, was him saying, 'Is surgery an option for him?' And that's the only thing that really stuck in my head (...) 'cause I had convinced myself, especially 'cause he had been fine travelling, and he'd passed droppings getting there, he was actually alright. So I wasn't expecting that.' (Horse owner 010)

A poor understanding of colic was also seen to be responsible for delays in referral treatment, with veterinary surgeons reporting that some owners do not seem to appreciate the potential severity of colic:

'Oh, I've got plenty of clients that they have stopped for fish and chips on the way to the hospital (…) again, it's lack of knowledge. They don't acknowledge that this is an emergency situation, it needs surgery, delaying surgery will affect the cost (…) and it will affect negatively the outcome of the case (…)' (Veterinary surgeon 010)

8.4.2.4 'Impact'

The over-arching theme 'impact', and two associated themes (Figure 8-8), describes the lasting effects of a colic experience on those involved. These themes also highlight the impact of colic on future decision-making and management of a colic episode.

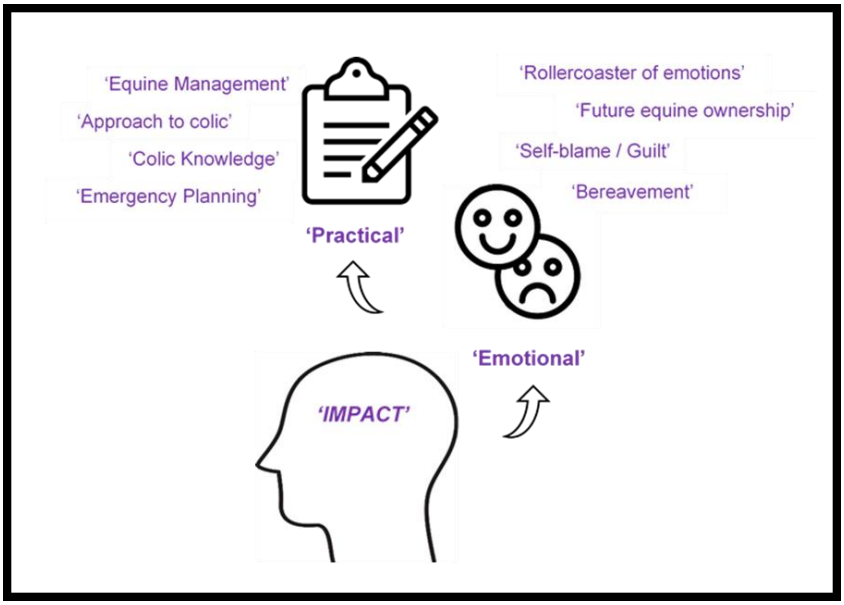


Figure 8-8: Thematic diagram illustrating the over-arching theme 'impact;' and associate themes

Theme One: Practical

A change in knowledge and approach to colic was frequently reported following participants experience. Planning for a potential emergency, such as ensuring equine passports and transportation were readily available, was a common step implemented by owners after they had experienced a critical episode of colic. Additionally, actively seeking further information on colic and ways to prevent future episodes was frequently reported:

'(…) this time I've done loads of reading around it to just be more informed with how I dealt with it. Like in terms of diet, things you can do to help. Before that, I didn't even really look into the foods and the things like that.' (Horse owner 010)

Owners suggested that their colic experience had made them more confident in their recognition and approach to colic management. Some even indicated that it had made them more proactive if they witnessed another owner experiencing colic:

'(…) as I said to you previously it was the worst colic I had ever seen. I am far more prepared. We have had instances of colic at the yard where I kept (Horse Name) since his colic (…). I have been quite involved, I have been the one that has almost taken charge. (…) I have gone and got stuck in whereas some people who don't really know about colic might be a bit standoffish and not want to be involved.'

(Horse owner 004)

However, veterinary surgeons expressed their concerns that colic experience could potentially become a barrier to appropriate treatment when owners' feel that they can manage an episode themselves:

'I think there are some owners that have quite a lot of experience with horses with colic. They generally can differentiate a mild, short-lived spasmodic colic from something a bit more serious (…). I think there are owners out there that will deal themselves with a mild case of colic and won't ever call the vet, but I think that can go against you sometimes when… the middle ground people, where they think they know what a mild colic looks like and leave it too late to phone you.' (Veterinary surgeon 011)

Obsessive or paranoid behaviour was common following a colic experience. Owners reported over-reacting to even the smallest change in behaviour, and a tendency to micro-manage feed or turnout. One owner suggested that their experience had even made them wary of purchasing a horse with a history of colic in the future:

'It's made me quite wary about that in the future ... One of the things I always ask when I've ... Looking them is that, 'Are they colic-y? Have they colic?' Whereas before, that wouldn't have even crossed my mind. I think if any of them said, 'Oh yeah. They have colics and stuff,' it would put me off, to be honest.' (Horse owner 012)

Theme Two: Emotional

The term ‘rollercoaster’ was frequently used to describe the vast array of emotions experienced during a colic event, with owners reporting feeling exhausted or ‘drained’ in the days following. A significant impact on day to day life was a common occurrence, with owners of horses which had undergone surgical treatment having to juggle work commitments with the demands of aftercare:

‘…it was just a lot out in terms of the time stuff, 'cause obviously you're trying to build him back up and stuff, trying to fit in four feeds a day and looking after him properly around working and things like that ...’

(Horse owner 012)

For owners of euthanased horses, the experienced had a profound impact on their mental wellbeing, with many seeking professional medical help or having to take time off work. Bereavement was acknowledged as extremely difficult with all experiencing feelings of guilt or blame:

‘I went down the whole, ‘shit, what if I had gone down the yard that morning? Would I have noticed him down? Did I not put the gate handle on the gate properly last night? Is it because I gave him a treat before I saw him the night before?’ Everything goes through your head. You almost go through blame and upset and everything else. It is a really bizarre feeling when you have to make that decision for them because you think, maybe I did the wrong thing.’ (Horse owner 004)

Though bereavement was common, owners expressed concern about the lack of support available:

'I had a problem with the whole bereavement process. If you lose a person through cancer, there is a helpline. There is someone you can pick up the phone to and talk it through. There is nothing publicly advertised for anybody that loses a horse, which is basically the same as losing a family member.' (Horse owner 004)

Owners of horses who underwent referral treatment for colic also struggled emotionally, with some reporting feelings of guilt when their horse survived:

'I've spoken to several people since who made the decision to have their horses put to sleep and then regretted it afterwards. And they've asked me what happened with (Horse Name) and I was like, oh I feel a bit awkward now because (Horse Name) is a survivor of colic surgery but a lot of them aren't, you know… We're one of the lucky ones.' (Horse owner 001)

The hospitalisation process itself was also seen to be a traumatic, with owner 008 referring to the experience as being *'like having a dying relative in hospital'*. Owners were also often panicked upon on arrival at the referral hospital, which made them feel like their horse's care had been *'taken out of their control'*:

‘So, when we got there, it was like nothing I'd ever experienced before, just thought I'd say. Before he'd even got all four feet of the lorry, there was a team of about eight people all taking of his bandages and doing bits and pieces, and whisking him in. That, obviously, is a great service, but it made me panic, 'cause I was like, 'Shit. There must be something really wrong with him.' (Horse owner 010)

Owners with experience of colic surgery, including those in which the horse survived, indicated that they would be reluctant to choose this option again in the future. This was usually attributed to the emotional strain they experienced or the fact that they felt it would be ‘unfair’ to subject their horse to a second surgery if colic recurred:

‘…I don't know why I was so adamant not to have a second surgery. I'd been told by the vet, previously, that it's always a good option. But it is an owner’s choice, I knew that the prognosis for second surgery wasn't as good anyway, and ... Although he come through it and seemingly recovered from it, he wasn't himself and seeing him deteriorate the way he had done, I thought, 'Second time round, is gonna be even worse…’

(Horse owner 010)

8.5 Discussion

8.5.1 Study overview

This is the first study to investigate decision-making during critical cases of colic through an in-depth exploration of the experiences and perspectives of key stakeholders (horse owners and veterinary practitioners). Four over-arching themes were identified: ‘head’, ‘heart’, ‘practicalities’ and ‘impact’. Owners understood that they were responsible for their horse’s welfare (‘head’) however, the horse-human relationship (‘heart’) often led to conflict during decision-making. ‘Practicalities’, such as the availability of transport and adverse weather conditions, were identified by both owners and veterinary practitioners, as unforeseen challenges when considering referral. Additionally, both veterinary practitioners and owners acknowledged that an owner’s interpretation of their horses wants / needs (‘heart’) had a major bearing on their decision to refer for colic. The experience often left owners with feelings of guilt and a change in help seeking behaviour (‘impact’).

8.5.2 Limitations

As mentioned in Chapter Three of this thesis, qualitative research enables a deeper understanding of human reality, such as personal beliefs, attitudes and individual experiences (Braun and Clarke, 2013). However, despite the use of a purposive sampling frame to collect a

variety of participants from both the veterinary and horse owning communities, the methodology is not without its limitations.

Alternative methods of data collection were considered during the conception of this study, including the possibility of observing client-vet interactions during an ongoing colic assessment. The use of a 360 degree methodology (Lanza *et al*., 2009) would have facilitated the un-biased collection of data pertaining to all stakeholders in real time. However, given the potentially distressing nature of colic, the unpredictability of the disease, the need for rapid decision-making and the logistics associated with both primary and referral assessments, this method was deemed inappropriate. Additionally, the time required to follow a single horse and owner from primary visit to case resolution would have resulted in a significantly smaller sample size. Therefore, the collection of interview data from veterinary surgeons and owners with prior experience of critical colic was pursued. Although this approach relied on the recall of past events, the selection of participants with experience of colic within 12 months of the interview session should have minimised the effects of recall bias (Brusco and Watts, 2015).

Congruent with previous reports, telephone interviews resulted in the fast and efficient collection of data from a geographically diverse sample (Chapple, 1999, Novick, 2008, Sturges and Hanrahan, 2004, Sweet, 2002). However, some have argued that interviews performed in this way lack the face-to-face contact required to elicit rich qualitative

data (Shuy, 2003). Although in-person interviews create a more natural environment in which participant rapport can be developed, extensive investigation of the use of remote interviewing in both quantitative and qualitative research failed to identify sufficient evidence to support a bias against telephone interviewing (Novick, 2008). Alternatively, Novick (2008) reported that interviews conducted remotely may actually increase participant willingness to disclose sensitive information. Therefore, given that this study aimed to investigate personal, and potentially upsetting experiences, this approach was deemed most suitable for this project. Extensive efforts were made to develop a rapport with participants both prior to and during the interview process. An informal discussion at the start of each interview session allowed the researcher time to answer questions and begin building a relationship with participants (Burnard, 1994). Additionally, an empathetic and non-judgemental approach was maintained throughout the interview process to encourage discussion and prevent participants from feeling criticised (Tausig and Freeman, 1988).

8.5.3 Key findings

8.5.3.1 Head vs heart

Maintaining good standards of equine welfare is the primary responsibility of the owner (Hemsworth *et al*., 2015) and was frequently acknowledged by all participants within this study. However, both

veterinary surgeons and owners highlighted the significant impact the horse-human relationship could have on emergency decision-making. Interpretation of colic severity was frequently based on the personal connection between horse and owner, with the horse deemed to 'inform' the owner when they were severely unwell. Additionally, the desire to pursue intensive veterinary treatment was often in conflict with available financial support. Though evidence supporting a strong attachment between horse and owner is currently lacking (Clough *et al*., 2019, Payne *et al*., 2016), these results indicate that an owner's perceived 'bond' with their horse could have severe implications for informed decision-making. Therefore, as this concept has been a common theme throughout this thesis, it will be discussed further in Chapter Nine.

Perceived owner capability was considered by veterinary surgeons as an important factor in the triage of potential colic cases. If an owner was well known or considered a 'professional' with sufficient knowledge and experience, then advice from veterinary surgeons was generally limited. Additionally, a vet's interpretation of case severity prior to arrival was often based on their knowledge of the owner. Whilst informational continuity, that being the retention of knowledge specific to a patient's background (Haggerty *et al*., 2003), can help to ensure that services are tailored to individual needs, reliance on owner proficiency is alarming. Whilst many owners may have an appropriate response to colic, an under-reporting of clinical signs (Ireland *et al*., 2012, Ireland *et*

al., 2013) and the inability to recognise potential ‘red-flag’ indicators (Bowden *et al*., 2020) have been noted within the horse owning population. Therefore, congruent with the preceding chapters within this study, these results highlight the need for a standardised approach to the triage of colic cases.

An owners familiarity with the attending veterinary surgeon was also highlighted as an influential factor on decision making, with the attendance of a known veterinary surgeon offering owners an additional sense of security. Rapport has been identified as an essential aspect of veterinary consultations, facilitating both the extraction of information and the development of the vet-client relationship (Best, 2015, Kanji *et al*., 2012, Kleen *et al*., 2011, Lue *et al*., 2008). Additionally, continuity of care has been shown to elicit improved levels of understanding, compliance and trust between human patients and their physician (Freeman and Hjortdahl, 1997, McWhinney, 1975). However, given that choice of practitioner is not always possible in the event of an emergency, it was concerning that some owners appeared to lack confidence in the competence of unfamiliar veterinary surgeons. Trust is a fundamental aspect of the doctor-patient relationship (Freeman and Hjortdahl, 1997, Gabel *et al*., 1993, Goold and Klipp, 2002, Gore and Ogden, 1998, Roberge *et al*., 2001, Tarrant *et al*., 2003, von Bültzingslöwen *et al*., 2006) and has recently been identified as an important factor in vet-client interactions (Corah *et al*., 2019). However, the development of trust is complex (Pearson and Raeke, 2000) and

can be affected by a multitude of factors. Empathy, for instance, has been shown to enhance levels of trust between a vet and their client (Adams and Frankel, 2007) and was a characteristic highly valued by horse owners within this study. Consequently, bad experiences were frequently associated with an apparent lack of situational compassion. However, a poor 'bed side manner' was also found to affect owner opinions regarding veterinary competency and care, despite a good outcome. Though disappointing, this finding coincides with the results of a study by Scantlebury *et al*. (2014) in which owners' views on veterinary assistance during a colic episode were not only influenced by the medical approach taken, but the veterinary surgeon's manner. 'Warmth', or the perceived 'trustworthiness', of an individual is frequently judged based on their manner rather than their professional competency (Fiske *et al*., 2007). Therefore, it could be argued that first impressions, especially during an emergency, are an essential aspect in the formation of trust. Given the decision-making benefits of trust, especially during emotive situations or times of uncertainty (Corah *et al*., 2019), these findings highlight the need for veterinary surgeons to adopt a relationship-centred approach with *every* client. However, it has been noted that patients' often form an opinion of a professional based on indirect knowledge (Ridd *et al*., 2009), with the experiences of others frequently reported to reinforce or damage the reputation of medical teams (Gabel *et al*., 1993, Gore and Ogden, 1998). These findings coincide with the view held by many participating veterinary surgeons, that the involvement of others during a colic emergency can often

impact the ability of an owner to make a rapid and informed decision. However, this view was in contrast to owners who suggested that, whilst others provided an additional source of both emotional and practical support, they had no role in their decision-making process. The role of social influences on decision-making has been a recurring theme throughout this thesis, with peer pressure and the impact of misinformation identified as potential barriers to knowledge transfer. Therefore, the implications of social norms will be explored in-depth within the final Chapter of this thesis.

8.5.3.2 Practicalities

The field assessment of horses with colic can be fraught with difficulties, with safety concerns or a lack of appropriate facilities frequently influencing choice of diagnostic test (Southwood, 2012c). Additionally, the vast array of aetiologies, and accompanying clinical signs, associated with colic can make establishing the true nature of the disease upon primary evaluation problematic (Curtis *et al*., 2015, Dukti and White, 2009). Therefore, it was unsurprising that the majority of veterinary surgeons within this study had faced practical challenges when conducting a primary colic assessment. Delays associated with the ability to travel coincide with anecdotal reports and could potentially account for time discrepancies between primary exam and hospital admission identified in Chapter Seven. Although anticipated, these findings highlight the importance of owner preparedness, with difficulties such as an absent owner or lack of transportation, being

easy to overcome should an emergency plan be in place. However, despite the importance of emergency preparedness, veterinary surgeons reported that many owners are still unable to make rapid decisions.

As discussed in Chapter Five, a lack of preparedness maybe due to the fact that some owners do not perceive themselves at risk of a colic emergency. However, given the potentially emotive nature of colic, it is reasonable to suggest that some owners may simply not want to think about the possibility of making such difficult decisions. Yet, owners in this study indicated that having pre-conceived ideas may inadvertently make decision-making more difficult. This opinion was echoed by veterinary surgeons who reported that delays in decision-making could frequently be attributed to owners being in conflict with plans they had made in advance. This was particularly apparent when participants discussed experiences in which they found deciding on euthanasia extremely difficult, despite observing their horse in significant pain. This internal struggle could be explained by the phenomenon of 'responsibility grief', whereby pet owners become consumed by the impending accountability for the death of their animal (Dawson, 2007b, Dawson, 2010). Responsibility grief could also account for the fact that some owners reported feeling as though they did not have a 'choice' in the treatment of their horse, subsequently shifting the responsibility of decision-making onto the veterinary surgeon. Owner aversion to decision-making on behalf of their pet would also coincide with research

which suggests that people tend to shy away from decisions made by proxy (Garcia-Retamero and Galesic, 2012, Stone *et al*., 2002). Conversely, a perceived lack of choice may also be construed as the owner's way of acknowledging their limitations in terms of what treatment they could financially afford.

Several studies have reported the effect of cost on owner decision-making, with a qualitative study by Scantlebury *et al*. (2014) highlighting finance as a significant influence on help seeking behaviour and surgical consent. Yet, when this finding was extrapolated to the wider equestrian community, money was not considered a major barrier to veterinary treatment. Though an element of social desirability bias (Van de Mortel, 2008) may have influenced survey responses to some extent, the opinion that finance was not the most important factor in decision-making is echoed by owners within this study population. Furthermore, this finding is supported by McGowan *et al*. (2012), who reported that although costs associated with the ongoing medical treatment of aged horses were considered significant, they were not the most important factor associated with end of life decisions.

A similar phenomenon has been noted within the companion animal literature, with Lue *et al*. (2008) reporting that decisions about veterinary care are not made based solely on cost. Alternatively, Brockman *et al*. (2008) identified that the emotional attachment between an owner and their pet can often influence decisions associated with great expense. As a result, those with a stronger

human-animal bond will make emotionally driven, rather than objective decisions. Although this concept is congruent with the opinion of participating veterinary surgeons, owners within this study frequently suggested that veterinary surgeons place greater emphasis on the financial costs of treatment, rather than the welfare of the horse. Discussions surrounding the cost of veterinary treatment can be a challenge for veterinary surgeons, as a balance between business and animal welfare must be maintained (Coe *et al*., 2007). Therefore, it is no surprise that a client's expectation that veterinary care should take precedence over cost is often not met.

A mis-match between client belief and the reality of veterinary costs has been anecdotally attributed to the existence of the National Health Service (Sinclair, 2014). Yet, despite the availability of animal insurance in lieu of a 'free' veterinary care, it was concerning that one owner deemed this protection 'a conveyer belt to treatment'. It is likely that this opinion is the result of ineffective vet-client communication, rather than the insistence of an insurance company that all treatment options are pursued. Indeed, a breakdown in communication is reportedly the most common reason for owner grievance with the RCVS (Royal College of Veterinary Surgeons, 2018). However, it must be noted that in the event of death, many insurance premiums will not be paid unless euthanasia on humane grounds is confirmed by a veterinary surgeon (Barker and Freeman, 2019). Though this in accordance with the BEVA Guidelines for the Destruction of Horses (British Equine Veterinary

Association, 2009), some cases of colic will require surgical exploration or further diagnostic tests before a judgement such as this can be made. As a consequence, immense pressure may be being placed on an owner to refer their horse, even if this is not in the animal's best interests. Additionally, given that many owners may not be aware of or understand this requirement, it falls on the attending veterinary surgeon to explain its complexity, which in an emergency situation may be construed as insensitive. Therefore, a review of current guidelines associated with the humane destruction of horses diagnosed with colic and subsequent policy claims is urgently warranted.

8.5.3.3 Impact

This study has documented that experiencing their horse have colic can have a profound and lasting effect on horse owners. In terms of practical impact, there were a number of consequences or changes identified after an owner had had a personal experience of colic. Their knowledge and awareness of potential risk factors were seen to improve and some actively explored available literature, with the desire to prevent future colic episodes frequently mentioned as a source of motivation. It could be theorised that the proactive approach to colic prevention adopted by owners is driven by a strong sense of vulnerability following such an event. This would coincide with the findings of Wiethoelter *et al*. (2017) and Garforth *et al*. (2013) who suggested that a proactive approach to disease mitigation is more

common in owners with a higher perception of risk. Given that risk perception is a strong predictor for behaviour (Brewer *et al*., 2007), it could be theorised that owners seeking advice following a colic emergency may be more receptive to the transfer of evidence-based information. This opinion was supported by participating veterinary surgeons, who indicated that owners with an interest in or prior experience of colic were more likely to attend educational events on the topic. However, though these findings highlight a potential route through which owner education can be facilitated, it raises questions regarding the ability to engage those who have not experienced colic on a personal level. It is reasonable to suggest that the inclusion of real colic case studies in the 'REACT' campaign may help to raise awareness in those who have not personally experienced this emergency. However, it must be noted that some owners became averse to discussions or situations which reminded them of colic due to the distressing nature of their experience.

Traumatic events are commonly associated with incidents involving death or severe harm (Carlson and Dalenberg, 2000). However, the requirement that an individual must fear injury or a loss of life in order for an experience to be considered 'traumatic' is a disputed concept. For example, Waelde *et al*. (2001) found that, despite a lack of mortality or physical injury, the loss of one's home was a strong predictor of post-traumatic stress disorder (PTSD) in flood victims. The notion that an experience can cause emotional pain severe enough to be considered

traumatic, in lieu of physical loss, is supported by the results of this study. Regardless of outcome, owners repeatedly referred to the mental anguish they suffered following their colic experience. Additionally, participants made frequent reference to three elements which are considered necessary for traumatization to occur: loss of control, suddenness, and a perception that the experience was highly negative (Carlson, 1997, Carlson *et al*., 1997). During a traumatic event, an individual's response can be severely compromised (Carlson and Dalenberg, 2000). Some may appear aggressive in an attempt to regain control in a seemingly uncontrollable environment (Lorenz, 2002), whilst others may 'freeze' or appear indecisive (Nijenhuis *et al*., 1998). This would coincide with the experiences of owners within this study, in which some could not make a rapid decision whilst others displayed anger towards those trying to help. Therefore, though the shock of a colic experience could theoretically be mitigated by encouraging owners to be more prepared, veterinary professionals must acknowledge the profound impact an emergency such as this can have on immediate decision-making and the different ways that owners may react. Following a traumatic event avoidance behaviour, such as the evasion of conversations or activities through fear of an emotional reprise, is a common occurrence (American Psychiatric Association, 2013). Though some owners reported a desire to learn more about colic, some reported actively avoiding discussions or situations in which colic was a main feature. This could not only have severe implications on an owner's future response to colic, but subsequent engagement

with campaigns aimed at improving awareness. Therefore, ways of reducing the negative impact of colic on those involved are needed.

One potential solution could be the creation of an online colic ‘support group’, which was alluded to by a number of participating owners. This would be especially useful for owners of horses which were euthanised as a result of colic. Previous research has identified that the loss of a pet is experienced in a similar manner to that of a human death (Field *et al*., 2009, Gerwolls and Labott, 1994, Gosse, 1989, Gosse and Barnes, 1994, Quackenbush, 1985). Additionally, grief experienced as the result of equine euthanasia has recently been explored (Clough, 2019). Congruent with the experiences of owners within this study, grief as a result of pet loss has been associated with a variety of psychological and social difficulties (Quackenbush, 1985). Additionally, owner reports of obsessive behaviours, such as constant rumination of events leading up to the colic episode, are reactions commonly experienced following the death of both human and animal companions (Cowles, 1985). Therefore, it is reasonable to suggest that owners of euthanased pets require the same degree of support as those mourning the loss of a human relative. Previous research has shown that the strength of an owner’s attachment to their pet can be a significant indicator of grief severity following the death of an animal (Brown *et al*., 1996, Gosse, 1989, Gosse and Barnes, 1994). Therefore, prior knowledge of an owner’s perceived relationship with their horse could aid veterinary surgeons in identifying those at risk and

signposting them to additional support. However, veterinary surgeons within this study highlighted that the horse-human relationship is often only evident if owners are asked directly, which in an emergency situation may cause additional distress. Additionally, though 'helplines' designed to aid horse owners through times of loss exist (e.g. the BHS 'friends at the end' initiative), owners in this study indicated that this support is not enough to help them overcome feelings of guilt. Conflicting emotions surrounding the decision to euthanise a beloved pet has been widely acknowledged within the veterinary literature (Hetts and Lagoni, 1990, Morris, 2012, Stewart *et al*., 1985). Congruent with the findings of this study, some owners often consider themselves to blame for the illness that led to the decision to euthanise (Hart *et al*., 1990), whilst others simply question whether they made the right decision (Adams *et al*., 2000). Considering this, although a network of likeminded individuals may assist owners in the weeks following a loss, it is evident that immediate support from veterinary professionals is still needed.

8.5.4 Recommendations for future work

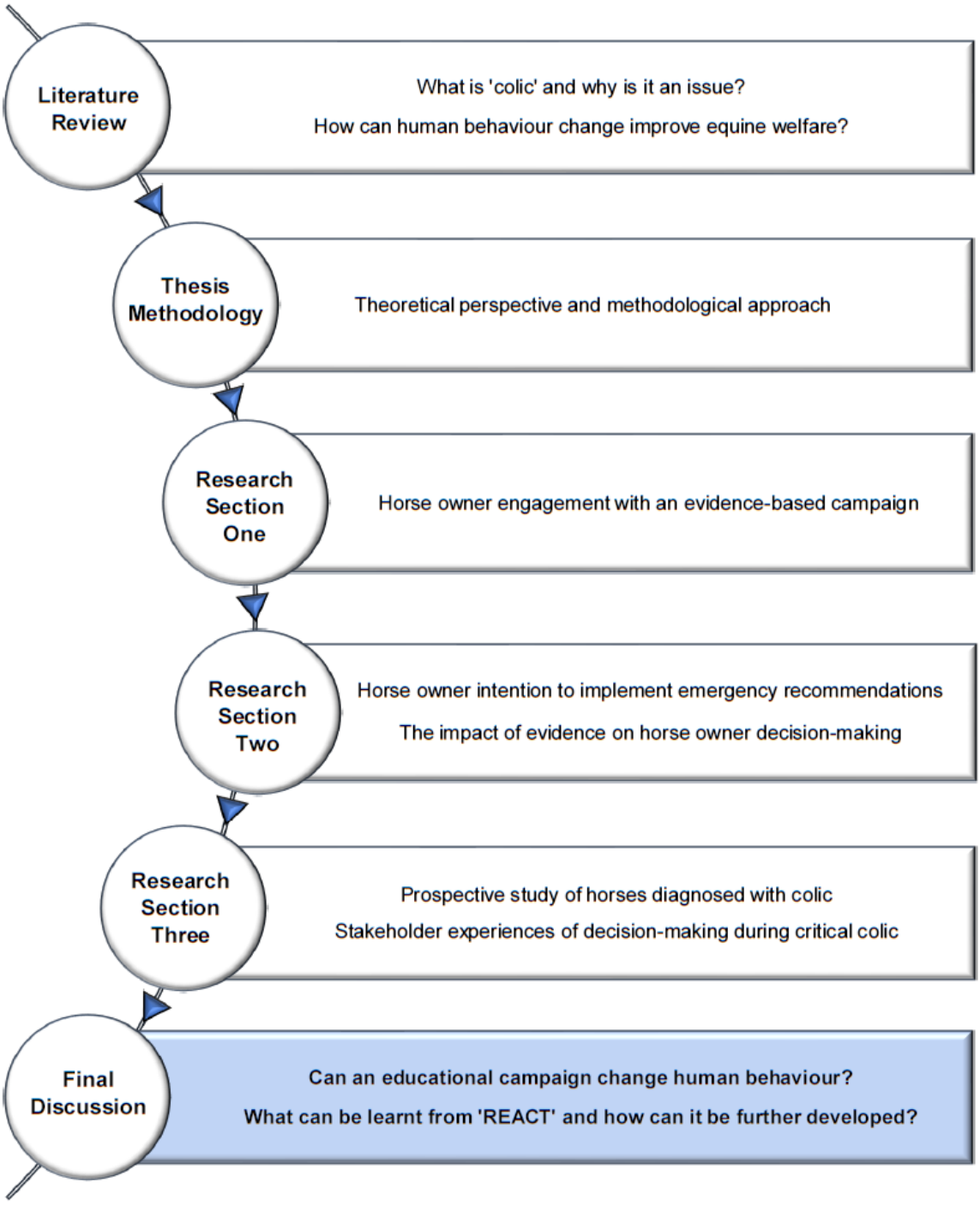
Preparing in advance for a potential veterinary emergency can assist owners in making rapid-decisions. However, the findings of this study highlight that the context in which judgements are made can often cause owners to become conflicted, especially when faced with end of

life decisions. Relationships are an important part of decision-making, with the horse-human bond again identified as a potential hinderance in emergency decision-making. However, this study also found that the quality of vet-client relationships was also deemed a significant factor in both decision-making and how owners reflected on their experience. Further exploration into vet-client interactions, especially during an emergency event, is warranted to understand the complex relationships between owners and their horses, and how the veterinary practitioners' communications and interactions can influence this. Therefore, it is recommended that future projects use observational methods and in-depth interviews in order to gain a richer perspective of vet-client interactions in context. Owners within this study reported severe emotional trauma following their colic experience, especially when it involved the euthanasia of their horse. Therefore, it is paramount that owners have access to appropriate support following such an event. Additionally, given the complex requirements for insurance premiums to be awarded following elective euthanasia, a review of current guidelines is needed to ensure the welfare of both horse and owner is not unduly compromised. Stakeholder workshops or participation in Delphi consensus surveys would ensure that all opinions are considered and potential barriers to implementation are recognised prior to guideline launch.

8.6 Conclusions

This study has shown that decision-making during a colic emergency is complex. Though prior preparation can help to facilitate rapid judgments, emotional attachments can often cause owners to become conflicted. Though the horse-human relationship was identified as a dominant influence on owner decision-making, vet-client interactions also had a significant effect on decision-making and the emotional impact of the experience on the vet and owner. The lasting impact of participants' experience was akin to that of a traumatic event, with owners reporting intense emotional pain and changes in normal behaviour. This study adds to our understanding by describing the experiences and views from both owners and veterinary surgeons involved in making critical decisions for horse with colic, and identifying key factors affecting both emergency decision-making and the transfer of future knowledge.

Chapter 9: Final discussion



9.7 Overview

The body of work contained within this thesis aimed to evaluate horse owner behaviour and knowledge transfer in response to the 'REACT' campaign. This was the first project to conduct a process evaluation of an active veterinary intervention targeting pet owners.

Congruent with previous evidence exploring public health interventions (Bray *et al*., 2015, Hodgson *et al*., 2009, Lecouturier *et al*., 2010), Chapter Four concluded that campaign awareness alone was not sufficient to facilitate behavioural change. Pre-existing knowledge and perceived risk of a colic emergency were highlighted as potential barriers to campaign engagement; therefore, further investigation of these factors was conducted in Chapters Five and Six. The studies identified that horse owners generally fall into one of two categories: no intention to adopt or already implementing emergency recommendations (Chapter Five). Beliefs surrounding the completion of emergency preparation, such as perceived personal relevance and benefit, were significantly linked to horse owners' intention to adopt emergency advice. However, lower levels of intention were found to be associated with perceived social pressure from others. Social influence was also a significant factor in the spread of inaccurate beliefs, with Chapter Six acknowledging the widespread presence of misconceptions about colic within the equestrian community. This chapter also highlighted some of the consequences of this. Owner knowledge of abdominal pain was varied, with many reluctant to

change their behaviour around colic management, critical decision-making, or thoughts on referral treatment, despite being provided with evidence-based information.

These studies also demonstrated that the horse-human relationship was a powerful influence on both an owner's decision to pursue referral treatment and adoption of proactive behaviours. 'Contextual' factors that could potentially affect campaign engagement and decision-making were further investigated in Chapters Seven and Eight. A prospective study of horses diagnosed with colic found that the decision to pursue surgery or intensive medical treatment was frequently based on the severity of clinical signs. However, non-clinical factors, such as financial constraints, horse age and owner concerns regarding equine welfare, were also significant in the decision-making process. These decision-making processes and influencing factors were further investigated through a qualitative study of stakeholder experiences in which four over-arching themes were identified: 'head', 'heart', 'practicalities' and 'impact'. Owners understood that they were responsible for their horse's welfare ('head') however, the horse-human relationship ('heart') often led to conflict during decision-making. Additionally, it was apparent that an owner's interpretation of their horses wants / needs had a major bearing on their decision to refer for colic, with the experience often resulting in feelings of guilt and a change in help seeking behaviour.

The final chapter of this thesis encompasses a holistic discussion of key findings and ways in which the 'REACT' campaign can be further

developed. Essential aspects that should be considered when designing future veterinary campaigns will also be highlighted, as will areas requiring further investigation.

9.8 Overall study design and limitations

Individual study limitations, such as sample size and recruitment, were addressed within their relevant chapters. However, the following section aims to provide an overall view of study design and limitations across the thesis as a whole.

In the human medical field, the impact of health-related interventions is often validated by comparing trends in data, such as health seeking behaviour (Gough, 2016, Kortte and Wegener, 2004) and clinical outcomes (Patel *et al*., 2010, Walker *et al*., 2016), before and after a campaign has been launched. An ideal study design to establish the impact of the 'REACT' campaign on horse welfare would have been the comparison of horse owner management, recognition, critical decision-making, and colic survival data pre and post campaign launch. Coupled with in-depth owner interviews and ethnographic observations of attending veterinary surgeons, a study such as this would have facilitated a much more detailed assessment of campaign impact. However, existing figures pertaining to the treatment and survival of horses diagnosed with colic are limited, with variations in both methodology and study populations, meaning data could not be reliably compared. Additionally, since published evidence on owner knowledge

of colic prior to the ‘REACT’ campaign is mainly limited to survey-based (Bowden *et al*., 2020) and mixed-methods (Scantlebury *et al*., 2014) investigations, both of which focused on separate populations and knowledge concepts, it would be difficult to reliably attribute the impact of the ‘REACT’ campaign on equine morbidity and mortality. Exploration of survey data to identify differences in knowledge and approach between those aware and those not aware of the ‘REACT’ campaign was considered in Chapter Four. However, following preliminary analysis it was found that engagement with campaign resources was too varied to reliably conclude that the knowledge participants held was associated with the campaign. Consequently, statistical analysis was deemed not appropriate. Additionally, as argued in Chapter Three, interventions designed to change human behaviour need time to develop, meaning short-term evaluation goals are often not reliable (Bartholomew Eldredge *et al*., 2016). Therefore, given the relative infancy of the ‘REACT’ campaign at the time of this study, it was decided that a process, rather than outcome evaluation would be a more appropriate method of assessment.

The decision to conduct a process evaluation of the ‘REACT’ campaign was discussed at length in Chapter Three, as was the application of a mixed-methodology. However, given that some studies shared a similar approach to data collection, the limitations of this method will be discussed in this section. This thesis used online questionnaires to assess current levels of campaign engagement (Chapter Four), horse

owner intention to adopt emergency recommendations (Chapter Five) and existing misconceptions about colic (Chapter Six). Though the use of online surveys as a research tool has been widely debated (Barratt *et al*., 2015, Evans and Mathur, 2005, Hunter, 2012, Lefever *et al*., 2007, Sue and Ritter, 2012, Touvier *et al*., 2010, Wright, 2005), choice of this data collection method was based on the low cost and time requirements of this approach (Evans and Mathur, 2005, Kwak and Radler, 2002, Lefever *et al*., 2007, Wright, 2005). Additionally, using an online platform to recruit participants eliminated the need for veterinary practice cooperation and access to a large database of contacts (Mellor *et al*., 1999). Yet, despite these advantages, some may suggest that online dissemination may have favoured those with access to both the internet and the specific social media platforms utilised. Although this may have resulted in some level of respondent bias, it must be noted that the study in Chapter Four utilised more tangible methods of dissemination, such as paper-based flyers and magazine articles. Additionally, given that over 90% of UK adults regularly use the internet (Office for National Statistics, 2018), it is likely that even those with limited computer access would be able to participate via friend or family member assistance. Based on this information, it is reasonable to suggest that a bias due to online survey use is limited, a fact that is further supported given that all three study populations displayed similar demographics to those reported in previous owner studies (Bowden *et al*., 2020, Hotchkiss *et al*., 2007a, Ireland *et al*., 2011b, Ireland *et al*., 2013, Scantlebury *et al*., 2014).

9.9 Key thesis findings

9.9.1 Campaigns as a tool for change

Campaigns are utilised by a multitude of professions and can be an effective way of targeting specific populations, both human and animal, in order to improve health and welfare (Coffman, 2002). However, despite their popularity, interventions of this design often fail to elicit the desired effect (Dombrowski *et al*., 2013, Dombrowski *et al*., 2015, Power and Wardle, 2015, Summerbell *et al*., 2005). Many have argued that these shortcomings are due to personal restrictions or an unwillingness to change within the target population (Cane *et al*., 2012, Grol and Wensing, 2004, Newman and Nollen, 1998). The following sections of this Chapter explore population level factors identified as barriers to the success of the 'REACT' campaign. However, failure can also be attributed to an intervention's core design and those responsible for implementing change (Kelly and Barker, 2016). Campaign success is frequently determined using outcome evaluations, which focus solely on final campaign effects. Consequently, issues associated with the *process* of implementation are often overlooked (Saunders *et al*., 2005). By conducting a process evaluation of 'REACT', it was possible to identify several issues associated with the campaigns design that can now be addressed. The findings of this thesis highlights the value of process evaluations during the design of veterinary campaigns and has enabled the following recommendations to be made.

‘REACT’ was extensively promoted through social media platforms, attendance at equestrian events and veterinary conferences. Additionally, content was developed using a co-production methodology and disseminated in a variety of formats (Burford *et al*., 2017). Consequently, 37% of horse owners surveyed were aware of the ‘REACT’ campaign following a twelve-month period of advertisement. However, despite apparent recognition, it was found that very few had actually engaged with ‘REACT’ resources (Chapter Four). As a result, knowledge levels were similar to those reported by (Bowden *et al*., 2020), suggesting that the campaign has so far had little impact on owner recognition or approach to colic. Congruent with previous evidence exploring public health interventions (Bray *et al*., 2015, Hodgson *et al*., 2009, Lecouturier *et al*., 2010), this thesis has shown that campaign awareness alone is not sufficient to facilitate behavioural change. Therefore, future campaign design and development must consider fundamental aspects of intervention design that can influence success.

When reviewing the aims of ‘REACT’ (Chapter Two), it was found that this campaign strives to encourage owners to take a proactive approach to colic through the development of an emergency plan. However, it also attempts to improve owners’ general knowledge of equine health, with dedicated resources associated with monitoring ‘normal’ values and methods of colic prevention. Consequently, Chapter Four concluded that the vast array of topics being promoted is

causing the central message of emergency preparedness to become lost. Dombrowski *et al*. (2015) suggests that a poor understanding of a campaign's message can be a significant barrier to knowledge transfer. Therefore, careful consideration must be given to message complexity during the early stages of campaign design. According to existing research, campaigns attempt to either promote a desired behaviour or prevent an unwanted one. Subsequently, content is designed to either inform the target population or persuade them to adopt or avoid a specific behaviour (Atkin and Rice, 2012). Based on this information, it is suggested that the 'REACT' campaign has so far employed an 'informational', rather than 'persuasive', campaign message. However, despite providing owners with a vast array of evidence-based resources, some horse owners still do not perceive themselves 'at-risk' of colic or in need of an emergency plan (Chapters Five). Additionally, Chapter Six identified that owners will refute evidence that does not align with their current beliefs, leading to a strengthening of misconceptions and avoidance of new information. This indicates that a more strategic or persuasive approach may be needed to encourage engagement across a range of owners who differ in their attitudes, experiences, and readiness to change. Methods of engagement are explored in subsequent sections, but a strategic, or 'phased' approach to message dissemination is recommended to overcome these issues and elevate campaign impact.

Though excessive message repetition can lead to diminished returns, the strategic provision of information has been shown to aid participant understanding and the facilitation of positive behaviours. Additionally, phased dissemination can be used to ensure equal importance is placed on each campaign element, through a controlled 'volume' being delivered to participants (Atkin and Rice, 2012). During the early 2000's, a campaign seeking to alter public perception on what constitutes 'risky' alcohol consumption was successfully implemented at Michigan State University (Atkin *et al*., 2004, Martell *et al*., 2006). Congruent with the dissemination strategy employed by 'REACT', multiple methods of delivery, including social media and paper-based advertisement, were used to convey the campaigns message. However, one of the most vital aspects of this intervention was the employment of an elaborate series of campaign phases, each coinciding with a particular event or time of year (for example sports finals, seasonal celebrations, and graduations). Supported by published data highlighting both descriptive and injunctive norms (see section 9.3.3), this phased approach resulted in a gradual decline in alcohol consumption and an increase in protective behaviours (Atkin and Rice, 2012). Therefore, it is posited that an approach such as this could help to reduce campaign complexity when attempting to deliver multiple concepts. For example, the original delivery of the 'REACT' campaign involved the dissemination of all topics, from colic recognition and the importance of an emergency plan to monitoring 'normal' health, as one unit (Chapter Four). In contrast, the author recommends that the

various facets of ‘REACT’ should be broken down into ‘bite sized’ elements and promoted according to seasonal relevance. For instance, advice pertaining to the prevention of colic could be highlighted during times of change, such as the Autumn/Winter transition of horses from pasture to stable confinement. Conversely, reviewing current emergency plans should be encouraged during times when holidays or travel are more likely. By breaking concepts down, a more comprehensive understanding of ‘REACT’s key message, that being the importance of emergency preparedness, will be facilitated.

However, the successful transfer of knowledge is not only reliant on campaign timing but the consistency of delivery. The concept of campaign ‘fidelity’ was touched upon within Chapter Four of this thesis, however due to limitations associated with time, an in-depth investigation was outside the scope of this research project. Therefore, despite knowing that campaign promotion was facilitated by members of both the BHS and University of Nottingham, the fidelity of delivery remains unknown. Fidelity is one of the most difficult aspects of process evaluations to measure as many considered it a subjective notion (Breitenstein *et al*., 2010). However, establishing whether an intervention is being delivered according to a pre-specified plan and in the manner intended, can highlight potential barriers that can be quickly resolved (Bartholomew Eldredge *et al*., 2016, Steckler *et al*., 2002). Therefore, it is this authors recommendation that future veterinary campaigns consistently monitor campaign fidelity and re-develop

approaches accordingly. Recommendations for the collection of fidelity data include the development of a checklist of core intervention components (Baranowski *et al*., 1998) or the assessment of knowledge transfer using a trained 'observer' (Resnicow *et al*., 1998). Alternatively, where approaches may be limited by finance, team members disseminating campaign messages could be asked to complete a survey designed to assess how the intervention performed (Steckler *et al*., 2002).

This section has described how barriers associated with campaign design can be overcome in order to maximise behaviour change. By implementing strategic campaign phases, comprehension of complex messages can be improved. Additionally, this approach can facilitate better assessment of message 'volume' and subsequent behavioural impacts. Finally, the importance of campaign fidelity was highlighted, along with recommended methods of assessment. The following sections refer to population level barriers that should be considered, in association with campaign design, by those seeking to change behaviour.

9.9.2 Existing knowledge: beneficial or destructive?

'Knowledge' was a recurrent theme throughout this thesis. However, rather than being solely associated with a *lack* of knowledge, the results of this project identified *existing* knowledge as a multi-faceted issue which could have a major impact on both equine welfare and campaign

success. Congruent with the findings of Bowden *et al*. (2020), Chapter Four concluded that owners still lack knowledge of 'normal' physiological values in the horse. Furthermore, understanding of the term 'colic', and subsequent approaches to help seeking is this condition is suspected, remain varied. Though this could be attributed to gaps in equine education (Chapter Six), the fact that a large proportion of owners felt confident measuring and understanding the specified values, despite providing incorrect answers is concerning. A mismatch between confidence and accuracy of submitted answers relating to equine health may be explained by the cognitive processes of procedural and conceptual knowledge. The latter process refers to an understanding shaped by both formal and informal learning. Conversely, procedural knowledge is associated with a person's understanding of what needs to be done (e.g. the physical process or steps) in order to accomplish a specific task (Kvidera and Koutstaal, 2008, McCormick, 1997, Ryle, 2009). Taking this into account, it appears that owners are assessing their confidence based on their procedural knowledge; understanding of *how* to measure health values, rather than their conceptual knowledge of *what* normal physiological values are. A similar theory was proposed by Visser and Van Wijk-Jansen (2012) when investigating the diversity of horse owners in relation to equine welfare. However, in contrast to the findings of this study, the authors suggested that a bias towards conceptual (e.g. awareness of current welfare issues), rather than procedural (e.g. how poor welfare can be avoided) knowledge could result in inadequate

levels of welfare. Nevertheless, these findings indicate that skewed knowledge, towards either conceptual or procedural understanding, may unintentionally affect the uptake of new knowledge. This notion is further supported by the COM-B model, which posits that a lack of capability (either physical or cognitive) can influence an individual's motivation to change (Michie *et al*., 2011). Therefore, those developing educational campaigns must ensure that the target population is provided not only with the knowledge of why their behaviour needs to change, but information on what they need to do to achieve it.

The provision of instructions detailing *how* an individual can change their current behaviour is a method frequently used by many public health campaigns (Croker *et al*., 2012, Kraywinkel *et al*., 2007, Resnicow *et al*., 1998, Walls *et al*., 2011). For instance, the NHS campaign 'Change4life' provides users with step by step recipes (www.nhs.uk/change4life/recipes) in order to facilitate a positive change in eating habits. However, the provision of information alone was found to be effective at raising awareness only, with little change in behaviour noted (Croker *et al*., 2012). This is congruent with the findings of this thesis, in which owner adoption of proactive behaviours, such as routine health monitoring, was limited despite being provided with written guidance. Therefore, an alternative approach is required to encourage owner adoption of 'REACT' recommendations. In the education sector, active learning has been shown to support understanding (Hake, 1998; Prince, 2004; Van Dijk *et al*., 2001) and

improve student performance (Freeman *et al*., 2014). Therefore, it is reasonable to suggest that a similar approach involving the provision of practical ‘REACT’ sessions could facilitate comparable results. As a trusted source of owner advice (Chapter Five), the author recommends that veterinary practices could provide practical campaign support in the form of interactive client events, focusing on various campaign topics. For instance, owners could be shown how to take a horse’s heart and respiratory rate, whilst being informed of their importance in the recognition of disease. As a result, campaign messages will not only become more comprehensible but *achievable*, leading to a more positive view of suggested behavioural changes. In an approach similar to that of the ‘HeadSmart’ campaign (Walker *et al*., 2015), veterinary professionals could also be recruited as ‘champions’ of ‘REACT’; becoming the ‘voice’ of the campaign and raising awareness of colic within their local area. As such, barriers concerning the accessibility of campaign information for those without BHS membership would be overcome. However, veterinary professionals have highlighted that supportive information or events are generally only accessed by those who are interested or feel that they need additional support (Chapter Eight). Consequently, this approach would only be beneficial to those who acknowledged that they currently lack sufficient knowledge and are motivated to seek help.

Although many have suggested that equine welfare issues and poor health are often the result of ignorance, rather than intentional neglect

(Hemsworth *et al*., 2015, Leckie, 2001, Witham *et al*., 1998), the fact that many participants were oblivious to their own lack of competence is concerning. However, being ignorant of one's own ignorance is not a new concept and certainly not confined to the horse owning population. The 'Dunning-Kruger' effect has been widely studied within human psychology and refers to a cognitive bias in which people who are incompetent at a task overestimate their ability (Dunning, 2011). Although complex, ways of overcoming issues associated with this phenomenon depend on an understanding of factors which can contribute to its development. The concept of 'unknown unknowns' refers to the fact that some individuals are simply not aware of deficits in their current knowledge (Alexander *et al*., 2003, Alter *et al*., 2010, Dunning, 2011). Therefore, a simple approach to engaging those who feel they 'already know everything there is to know about colic' would be 'self-assessment' (Dunning, 2011). This technique has been successfully implemented in both the domains of psychology (Caputo and Dunning, 2005) and human medicine (Barnsley *et al*., 2004, Watts *et al*., 2009) in order to facilitate personal recognition of knowledge gaps in undergraduate students. Taking this into account, it is recommended that campaigns produce a variety of 'test your knowledge' quizzes that members of the target audience can complete. Given the ability of social media to access individuals from a variety of socio-economic backgrounds (Tunnecliff *et al*., 2015), this method of dissemination would be most beneficial. Computerised tests would also enable the presentation of answer summaries on completion, which

could then direct participants to relevant campaign resources in order to improve knowledge. Self-assessment could also facilitate a personalised approach to campaign dissemination, as resources could then be tailored based on an individual's current state of readiness and attitude towards the desired behaviour (Craciun *et al*., 2012, Doda *et al*., 2018, Bartholomew Eldredge *et al*., 2016, Evers *et al*., 2006). By using a theory-based survey, such as the one utilised in Chapter Five, campaign audiences could be provided with resources specific to their current needs. For example, those who currently have no intention to change should be provided with additional information as to why the adoption of the recommended behaviour would be beneficial. Conversely, those who feel they are already performing the suggested behaviour should be directed to the self-assessment quizzes in order to review current levels of knowledge (Figure 9.1). However, Chapter Six highlighted that some owners will often refute 'actual' evidence as it does not support what they already 'know'. Therefore, the provision of information following self-assessment may not engage those driven by incorrect, but deep-rooted beliefs.

Ignorance can often be 'disguised' when an individual resides in a misguided and misinformed domain (Dunning, 2011). For example, Proffitt (1999) found that, despite a lifetime of physical interactions, many people still possess inaccurate perceptions of physics due to varied misinformation within their immediate environment.

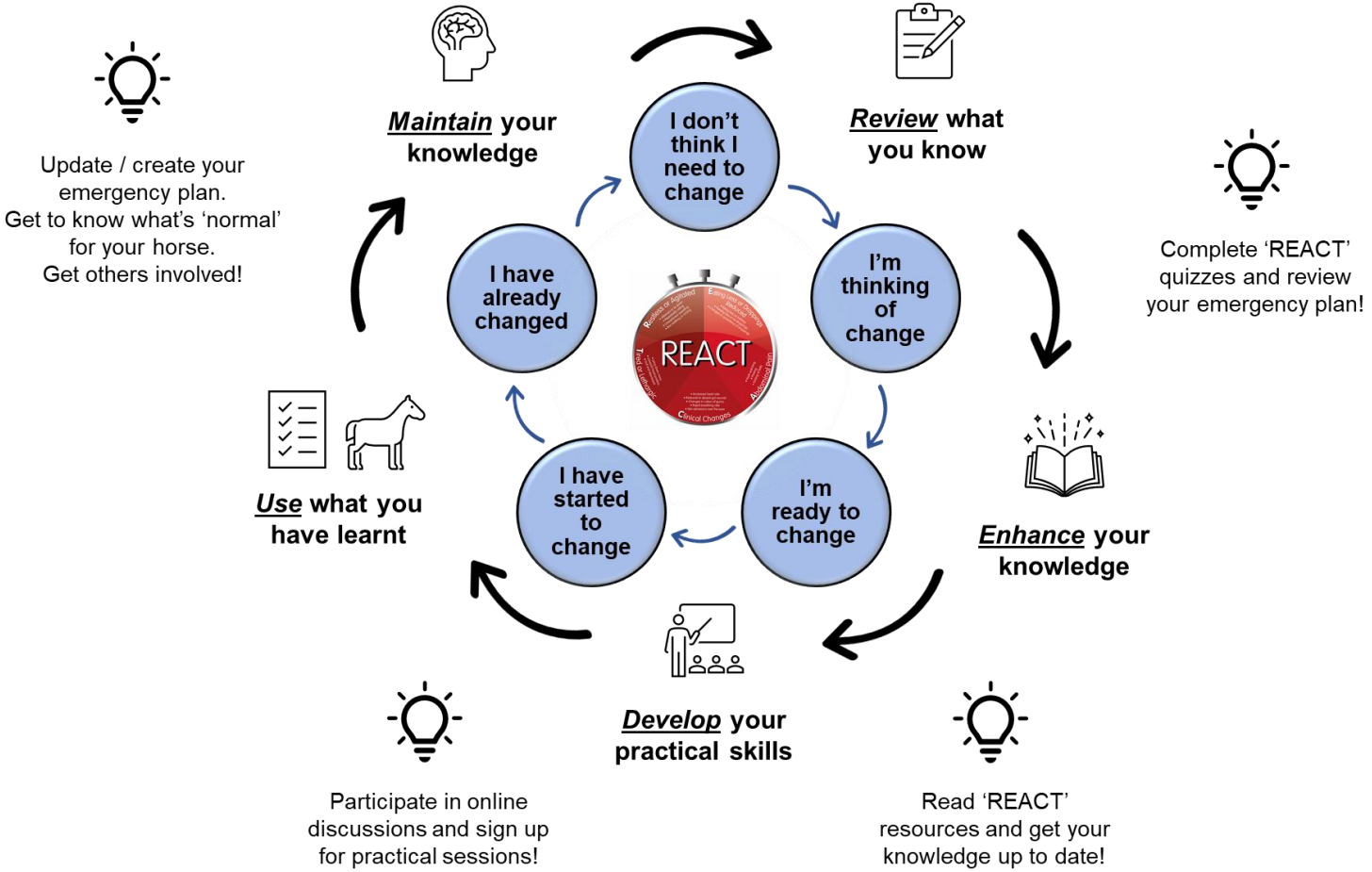


Figure 9-1: Conceptual model illustrating how campaign resources can be tailored to audience 'readiness' to change

Domain specific beliefs, such as walking a horse with colic for example, can also lead individuals to rely on existing general knowledge when responding to a question or social cue (Dunning, 2011). As a consequence, reliance on so-called 'reach-around' knowledge, can result in individuals over-claiming (Paulhus *et al*., 2003) or adhering to existing beliefs (Prasad *et al*., 2009), despite being challenged with published evidence. Given that this thesis has shown the existence of misconceptions about colic within the 'domain' of the equestrian community, it is plausible to suggest a similar effect is occurring. However, designing strategies that can engage those who vehemently deny their own ignorance is difficult. Simply pointing out a person's incompetence does not necessarily mean that they will strive to improve. Indeed, Prasad *et al*. (2009) reported that confronting those holding misbeliefs about the 9/11 tragedy with evidence refuting Saddam Hussein's involvement actually led to a reinforcement of current attitudes. Therefore, in order to engage those with alternative beliefs, intervention designers must capitalise upon the routes through which knowledge is created and maintained within the target population.

9.9.3 The power of social norms

Historically, horse ownership was a male-dominated community, with equestrian sport traditionally reserved for royalty and the social elite (Robinson, 1999). In contrast, the socio-economic status of horse owners today is vastly different (Hemsworth *et al*., 2015), with factors

such as income, age and educational background significantly linked to welfare issues in equids (Leckie, 2001, Pearson, 2003, Visser and Van Wijk-Jansen, 2012). However, though the findings of this thesis support the notion that modern day equestrians are demographically diverse, it is the authors opinion that poor equine welfare should not be attributed to individual differences alone. Horse owners throughout this thesis frequently referred to the presence of 'traditional' management practices or ideas within the equestrian community (Chapters Five, Six and Eight), with many, such as preventing a horse with colic from rolling, based on little more than anecdotal knowledge. Yet, many owners reported feeling 'pressured' by other members of their community to perform such actions, despite knowing that little evidence on their effectiveness exists. The detrimental influence of other equestrians on the decision-making behaviour of owners was also reported by participating veterinary surgeons (Chapter Eight), with 'horror' stories regarding colic referral often fuelling owners' fears of this condition.

In line with these findings, the behaviour of others has been shown to have a profound impact upon an individual's own actions (Asch, 1956, Berkowitz, 1972, Cialdini, 2005, Cialdini and Goldstein, 2004, Darley and Latane, 1970, Deutsch and Gerard, 1955, Milgram *et al*., 1969, Shariff and Norenzayan, 2007). From illicit drug use (Maxwell, 2002) to repeating things known to be untrue (Asch, 1956), the influence of perceived 'social norms' is widespread (Nolan *et al*., 2008). However,

direct observation of others is not always necessary for this concept to take effect (Terry and Hogg, 1999, Turner and Oakes, 1986). Instead, merely communicating a 'descriptive' norm – how *most* behave – via written advertisement can elicit a change in behaviour (Parks *et al*., 2001, Von Borgstede *et al*., 1999). Furthermore, the impact of social norms should not be construed as entirely 'destructive'. Many public health campaigns have successfully harnessed the power of this concept in order to change detrimental social behaviours, such as poor eating habits, smoking and excessive alcohol consumption (Schultz *et al*., 2007, Schultz *et al*., 2008). In fact, the current COVID-19 pandemic, through which this chapter is being written, has seen the successful use of social norms to encourage much of the UK population to *'Stay at home. Protect the NHS. Save lives.,'* (www.gov.uk/coronavirus). Therefore, it is suggested that veterinary campaigns consider both the constructive and destructive impacts of social norms prior to implementation. For example, walking a horse with colic in order to prevent a 'twisted gut' has been shown to be a common misconception amongst horse owners. Based on inaccurate knowledge, it is apparent that this action is being driven by peer pressure and the misperception that this behaviour is the 'norm'. However, the results of Chapter Six indicate that most owners would prefer to leave a horse with colic in a secure stable, rather than walk it. Consequently, it is this descriptive norm which should be widely communicated to horse owners in an attempted to correct this misperception. However, in order to avoid a so called 'boomerang effect' - an increase in an undesirable behaviour

amongst those currently performing it at a rate below the norm (Reno *et al*., 1993) - , injunctive norms should also be used. As a result, those less sensitive to the communication of descriptive norms (those with ingrained beliefs, for example) will instead be influenced by information on what is socially acceptable or unacceptable. However, though this thesis has produced evidence to support descriptive norms, a professional consensus on owners' approach to colic is currently lacking. Furthermore, it has highlighted the veterinary profession as a potential source of confusion, with owners indicating that 'REACT' guidance does not align with what their vet has previously advised. This notion becomes more concerning when coupled with the fact that many veterinary surgeons reported basing the need for advice on their perception of owner proficiency (Chapter Eight).

Credibility is a fundamental aspect of any campaigns message (Atkin and Salmon, 2010, Metzger *et al*., 2003) and as such, professional support is essential if misinformation is to be eradicated. Although the need for a standardised approach to the veterinary triage of colic has already been alluded to (Chapters Six and Eight), the responsibility of preventing the spread of misinformation should not be placed on this stakeholder alone. It is the authors opinion that the many facets of the equestrian industry are currently fragmented and as such, inaccurate beliefs are being allowed to manifest. Consequently, owners cannot be held accountable for a lack of comprehension if conflicting advice is being given by multiple stakeholders. In order to improve equine

welfare, behaviours performed by horse owners, good or bad, should be considered the result of social practices elicited by the equestrian industry as a whole (Figure 9.2). A similar movement has been observed within the realms of public health, with campaigns now targeting both industry practices and individual behaviours in an attempt to address determinants of poor health (Freudenberg, 2004, Freudenberg, 2005, Freudenberg and Galea, 2008, Freudenberg *et al*., 2009, Weishaar *et al*., 2016). Consequently, it is recommended that socioecological models, such as PRECEDE-PROCEED (Gielen *et al*., 2008) and Intervention mapping (Bartholomew Eldredge *et al*., 2016, Bartholomew *et al*., 1998), are used to guide the design of future animal welfare interventions.

Steps to unite the equestrian industry in the fight against the spread of misinformation have recently been seen during the UK's first ever 'Strangles Awareness Week' (www.redwings.org.uk/news-and-views/strangles-awareness-week). Organised as part of the Redwings 'Stamp Out Strangles' campaign (Vilela, 2016), this initiative attempted to overcome the 'stigma' of strangles (an illness caused by the bacteria *Streptococcus equi)* by facilitating a safe environment in which stakeholders could share their experiences and concerns. However, inappropriate behaviours and ideologies, such as the notion that strangles is caused by poor management, have been observed to transcend generations (Boggs and Szabo, 2011, Hops *et al*., 2003, Naples, 1992).

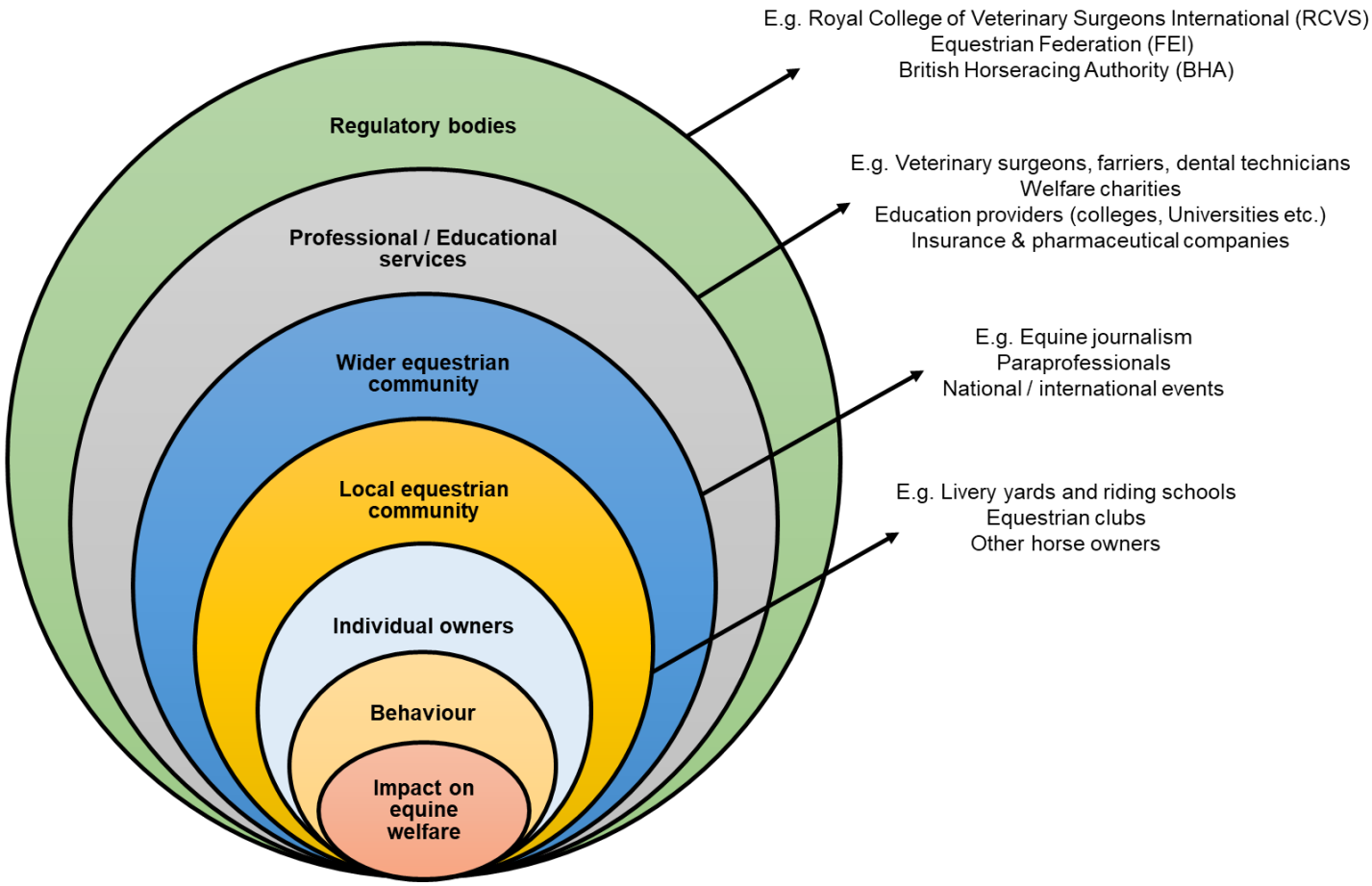
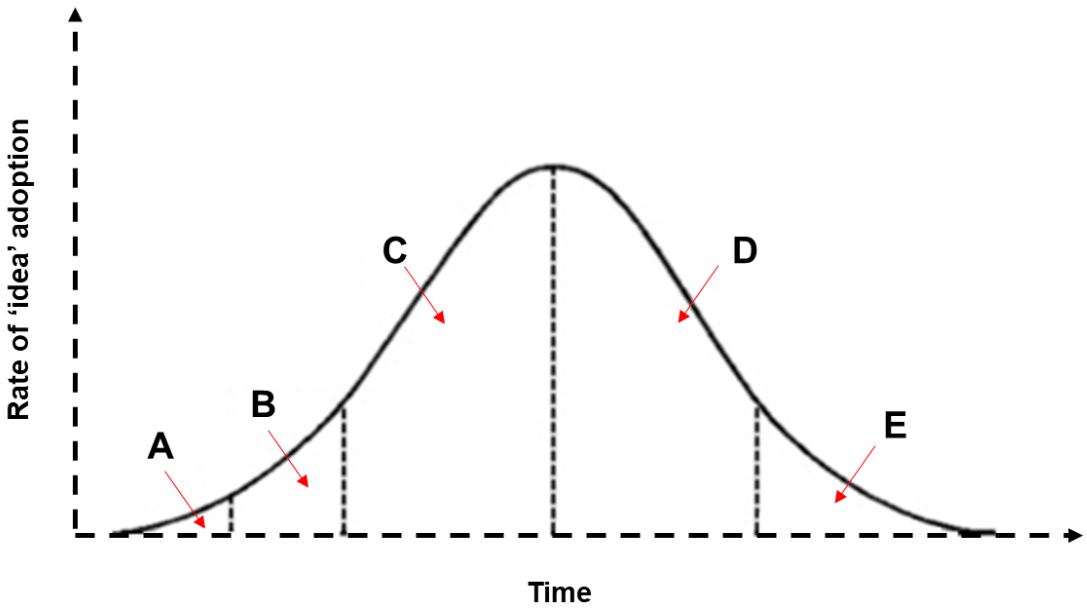


Figure 9-2: Conceptual model illustrating how equine welfare is impacted by social practices elicited by the equestrian industry as a whole

During the course of this research, participants referred to variety of owner types. From ‘traditional’ or ‘old-fashioned’ owners with a family history of equine involvement, to a new generation of ‘buy to ride’ adults with little or no prior experience. Consequently, many within this thesis contributed poor equine welfare to a lack of equestrian experience. However, it is the authors opinion that owners perceived as ‘traditional’ are more likely to refute change, share inaccurate knowledge and criticise those promoting new ideas. As such, it is no surprise that inexperienced horse owners feel compelled to ‘conform’ to the traditional ways of those perceived as more experience. In line with Rogers (1995) ‘Diffusion of Innovations’ theory, traditional horse owners may be ‘laggards’ in terms of idea adoption (Figure 9.3), though they should not be considered ‘lost causes’ in terms of behavioural change. Consequently, the aforementioned recommendations, such as a stage-matched approach to knowledge transfer (section 9.3.2) and utilisation of social norms (above), will prove vital in educating this population, but only once they are engaged. Capturing their interest in the first place will therefore rely on the diffusion of new concepts within the immediate environment. Consequently, campaigns must seek to recruit ‘innovators’ and ‘early adopters’ in order to drive the adoption of recommendations. Whilst veterinary practice ‘champions’ (section 9.3.2) and professional bodies could be considered ‘innovators’ of the ‘REACT’ message, the increasing accessibility of equestrian education presents the perfect opportunity in which ‘early adopters’ could be recruited.



A) 2.5.% of equine community will be ***'Innovators':***
- Quick to adopt new ideas
- Willing to take risks
- Easy to engage

B) 13.5.% of equine community will be ***'Early Adopters':***
- Opinion leaders
- Embrace change
- Like 'how-to' instructions

C) 34% of equine community will be the ***'Early Majority':***
- Not natural leaders
- Need to see evidence first
- Motivated by 'success' stories

D) 34% of equine community will be the ***'Late Majority':***
- Skeptical of change
- Will only change after the majority have
- Motivated by 'success' stories

E) 16% of equine community will be ***'Laggards':***
- Bound by tradition
- Hardest group to convince
- Motivated by social pressure and statistics

Figure 9-3: How idea adoption may vary between horse owners and key strategies that can be used to engage them. Based on Rogers (1995) 'Diffusion of Innovations' model

Indeed, Stull (2013) recommended a similar approach to promote end-of-life planning prior to the need for euthanasia. However, it was apparent from Chapter Six that inconsistencies in the delivery and content of equine courses currently exist, which may or may not be confined to the topic of colic. A review of current equine curricula across the UK, and worldwide, would ensure that appropriate and up-to-date knowledge is being provided to those with the potential to become 'influencers' of change. Additionally, this process would enable the importance of the horse-human relationship, and the potential implications of this phenomenon, to be conveyed to future industry stakeholders.

9.9.4 Context is key: the role of the horse-human relationship

In order to be successful, designers must acknowledge the environment to which an intervention is to be incorporated (Morgan-Trimmer, 2015). In the preceding sections of this Chapter, population level barriers to change, including existing knowledge (section 9.3.2) and the influence of others (section 9.3.3) have been discussed. However, one of the most powerful contextual factors identified was that of the horse-human relationship (HHR). Not only did this aspect of horse ownership influence the decision to pursue intensive medical or surgical treatment for colic (Chapters Five – Eight), but also affected an owner's decision to engage with information that could help them recognise signs of illness earlier (Chapters Six and Eight).

Persistent anxiety fuelled by the fear that their horse may develop an illness, is just one example of how the HHR can not only affect decision-making but campaign engagement. Although it has not yet been explored within the horse owning population, Chapter Six suggested that a similar concept to that of 'illness denial' (Weinstein and Kahn, 1955) could be driving owner reluctance to adopt 'REACT' recommendations. However, a reluctance to accept the possibility of illness poses a significant barrier to future attempts to engage this population. For example, 'fear' and the use of hard-hitting imagery or metaphors are often incorporated into campaigns (Peters *et al*., 2013) in the hope of eliciting a fear induced behaviour change. However, given an apparent aversion to even the mildest colic advice, it is likely that an approach such as this would do more harm than good to a number of owners. In fact, many suggest the use of this method often produces limited or detrimental effects (Peters *et al*., 2013, Ruiter *et al*., 2001, Witte and Allen, 2000), an opinion which can be illustrated by the 'Act FAST' campaign. Using the metaphor 'a fire within the brain' to describe the development of stroke, Dombrowski *et al*., (2013) suggested that placing the primary focus upon the 'threat' of stroke actually detracted from the main objective of increasing help-seeking behaviour. An alternative method involves the use of 'values' and may help the campaign overcome the 'head-in-the-sand' mentality of some horse owners. Values are elements of a person's identity that reflect what they deem important or worth striving for in their life. However, though different people will prioritise different ideals, the importance a

value holds for an individual will change overtime (Schwartz, 2012). Therefore, it is possible to persuade an individual into a new way of thinking by targeting personal values or 'intrinsic goals' (Grouzet *et al*., 2005). Whilst a relatively new concept amongst those in the veterinary profession, examples of this approach being used to improve animal welfare do exist. The Trap-Neuter-Return (TNR) campaign, successfully increased community motivation to report stray cats by tailoring campaign messages to individual community values (Robbins *et al*., 2018). For example, statements such as, '*we will work with you to help [cats] be healthier and happier*,' were aimed at those concerned about the welfare of stray cats. In contrast, messages such as '*help us to help your community'* were sent to individuals who liked cats but were more motivated by human concerns. A strong desire to do whatever is necessary to protect the welfare of their horse was an important value held by many owners within this thesis. Therefore, it is plausible to suggest that tailoring messages to reflect, not only a desire to preserve welfare, but the companionship owners deem important, would capture the interest of those currently not engaged. For instance, instead of associating routine health monitoring with 'illness detection', statements such as 'get to know *your* horse inside and out' or 'being proactive will help protect *your* horse' could be used to frame this activity in a new, less negative way. However, the powerful 'bond' between some owners and their horse may lead to feelings of isolation in terms of having their concerns understood. Indeed, many owners in Chapter Eight reported feeling alone following their experience of colic, despite having the

support of friends or family, because they were mourning the loss of a relationship unique to them. Furthermore, this thesis has shown that the health and well-being of horses is considered the most important aspect of emergency decision-making by the majority of owners. Consequently, although messages conveying the financial implications of colic may engage those keeping horses in a professional capacity, they will not resonate with 'regular' owners. Interestingly, the Macmillan 'Not Alone' campaign (www.macmillan.org.uk/documents/not-alone-campaign-faqs.pdf), uses the stories of real cancer patients in order to facilitate help seeking behaviour in those living with a cancer diagnosis. Congruent with this approach, Chapter Eight of this thesis suggested the development of a 'colic support group', through which owners feeling despondent following a colic experience could seek comfort. However, this initiative could also serve as an avenue through which 'real' colic stories could be collected and subsequently shared in order to create campaign salience amongst 'normal' owners. Alternatively, campaigners often use models that the target population can easily identify with. To incite those with potential symptoms of cancer to seek advice from their general practitioner (GP), images of friendly and 'normal' GP's were a predominant feature of the 'Be Clear On Cancer Campaign' (Power and Wardle, 2015). As such, it is reasonable to suggest that the recruitment of local veterinary surgeons or horse owners may elicit a similar response. However, despite the use of such strategies, public attitudes towards GP's, such as perceptions on approachability and trustworthiness, are still suggested as major

barriers to help seeking behaviour (Power and Wardle, 2015, Smith *et al*., 2016). Therefore, although a similar approach could make the campaign more salient with the beliefs of 'real' owners, perceptions associated with the veterinary profession may still prevent help seeking in the event of colic.

The human animal bond (HAB) is a widely recognise phenomenon in owners of companion animals, being described as, *'a mutually beneficial and dynamic relationship between people and animals'* (American Veterinary Medicine Association, 2020). As such, veterinary students and their professional counterparts have been frequently urged to take account of this concept when discussing treatment options with their clients (Adams *et al*., 2004, Beck and Martin, 2008, Butler *et al*., 2002, Wensley, 2008b). However, evidence acknowledging the existence of a similar concept within the horse owning population is currently lacking (Clough *et al*., 2019). Consequently, it appears that veterinary programs are tending to overlook the significant implications of the HHR, preferring instead to highlight this concept in small animal practice only. As a result, it could be theorised that this oversight has contributed towards a perceived lack of empathy or awareness of the HHR amongst some veterinary professionals (Chapter Eight). Additionally, it is in the authors opinion that, by not acknowledging the wide range of relationships that can develop between horse and owner, veterinary students are being led to believe that horses are being kept purely for competitive or financial

gains. Indeed, the author has experienced several occasions whereby students have linked their aversiveness to equine practice to the perception that horse owners are ‘elitist’, ‘cold’ or ‘unempathetic’ towards their animals. Therefore, it is recommended that veterinary educators strive to improve student awareness of the HHR. This could be achieved simply through the inclusion of owner specific scenarios within communication skills teaching or discussions surrounding the difficulties associated with equine euthanasia. Alternatively, the author proposes a novel activity in which owners are invited to share their experiences of horse ownership, both good and bad, with veterinary students. Consequently, the notion that equestrians are ‘uncaring’ can be overcome, whilst simultaneously facilitating a better understanding of the challenges horse owners face.

9.10 Recommendations for future work

This thesis has presented several opportunities for future research, with specific recommendations highlighted in each research chapter. However, the following discussion refers to campaign and industry specific work which would benefit the future welfare of equids.

9.10.1 ‘REACT Now to Beat Colic’: What next?

In regards to ‘REACT’, it is suggested that both the available content and core message of the campaign are reviewed. It is currently not clear what owners should be doing in order to ‘REACT’ to a potential case of colic therefore, a more streamlined approach is necessary. A

stage-matched approach to resource delivery and messages tailored to different owner types could also be actioned during this time. However, further ethnographic research is needed in order to classify existing owner groups / personalities. To facilitate wider campiagn engagement, the recruitment of ‘champions’ was suggested. Indeed, this is a recommendation which was recently brought to fruition through the launch of the Vet REACT Colic Champions scheme (The British Horse Society, 2019b). This initiative has seen 70 UK veterinary practices work in collaboration with the BHS, University of Nottingham and World Horse Welfare, to raise awareness of colic signs and the importance of emergency planning. In addition, the ‘REACT’ campiagn launched the first national ‘colic awareness week’ (The British Horse Society, 2019a), which encouraged owners to think about whether they were currently prepared to react to a colic emergency. However, further evaluation is required in order to establish whether these actions have been successful in eliciting change.

9.10.2 How can equine welfare be improved?

To support future welfare interventions, the development of a national veterinary database is warranted. This thesis has highlighted the need for reliable data that would facilitate pre and post intervention comparisions. However, the collection of prospective information on a study by study basis could lead to practice fatigue and a reluctance to participate in future research. Therefore, the creation of a central data base, in which practices submitted case information on a regular basis,

could streamline this process and remove the need for independent practice reliance. Such a tool would allow further research on multiple conditions, including comparisons of diagnostic tests, treatment options and presenting clinical signs, whilst also facilitating multi-centre clinical trials. Consequently, future research should seek to identify strategies in which veterinary data could be collected and managed centrally.

The role of the horse-human relationship on decision-making was apparent throughout this thesis however, evidence on this subject is currently lacking. Therefore, further research investigating the impact of a strong emotional attachment on equine welfare is warranted. For example, an ethnographic investigation of the horse-owner relationship over varying lengths of time could help shed light on factors which contribute to a strong emotional bond and how this impacts both decision-making and equine welfare. Additionally, this approach could assist in identifying owner types at most risk of intense, emotional pain following the death of their beloved companion.

A review of existing equine curricula is urgently needed to ensure the teaching of colic is standardised throughout the UK. This would not only assist in the eradication of misconceptions about colic, but also enable the recruitment of future ‘innovators’ within the equestrian industry. However, stakeholder interviews to establish the fidelity of currently content delivery, along with student perspectives, is recommended prior to curriculum changes. A similar approach should be taken within the veterinary education sector in order to identify where sessions relating

to the ‘challenges of horse ownership’ can be implemented. Additionally, though the horse-human bond was identified as a potential hinderance in emergency decision-making, the quality of vet-client relationships was also deemed a significant factor. Therefore, further exploration into vet-client interactions, especially during an emergency event, is warranted.

This thesis has argued that inappropriate behaviour is the result of the equine industry as a whole. Therefore, a united approach to knowledge promotion is needed. To ensure that the welfare of both horse and owner is not unduly compromised, the complex requirements for insurance premiums to be awarded following elective euthanasia urgently need reviewing. However, recommendations should be the result of a collaborative approach involving all relevant stakeholders (veterinary surgeons, owners, insurance companies, welfare charities etc.). Therefore, it is suggested that prior to guideline review, additional research focusing on stakeholder perceptions of animal insurance is performed. Similarly, a professional consensus on an accepted approach to colic management *prior* to veterinary assessment is warranted. Therefore, additional research is required to determine current approaches to the telephone triage of colic and the provision of owner advice. Consequently, a recent exploratory study conducted by the author indicated that the telephone triage of colic is currently unstandardised, with advice based on subjective assessments of case severity and owner proficiency (Lightfoot *et al*., 2018).

Chapter 10: Overarching conclusion

There is currently no published evidence on the success of existing educational campaigns within the veterinary industry. Consequently, this is the first study to assess owner engagement with a campaign targeting knowledge and approach to disease. Colic is a complex and highly distressing condition frequently encountered by horse owners. However, understanding of both normal equine health and signs indicative of colic remains varied amongst horse owners, with campaign awareness yet to elicit desired levels of change. Therefore, this research highlights the importance of regular campaign evaluation to ensure the desired outcome is being elicited within the target population. Consequently, campaign designers should not consider ‘awareness’ as an indication of behavioural change. This thesis has shown that owners evaluate new information against their own prior experience or knowledge, with many unwilling to adopt new approaches or ideas, with persistent false beliefs or the fear of social criticism playing a major part in this reluctance. However, owners cannot be held accountable for a lack of comprehension if conflicting advice is being given by multiple stakeholders. In order to improve equine welfare, behaviours performed by owners, good or bad, should be considered the result of social practices elicited by the industry as a whole. Therefore, the many facets of the equestrian industry must work together in order to eradicate current misconceptions and facilitate the diffusion of evidence-based knowledge. However, intention to change

will vary between individuals, with some more open to the adoption of new ideas than others. As such, it is recommended that the dissemination of campaign resources are not only stage-matched to individual states of readiness but tailored to the intrinsic values of horse owner ‘types’. Yet, this research has shown that decision-making during a colic emergency is complex. Though prior preparation can help to facilitate rapid judgment, the strength of emotional attachment can often cause owners to become conflicted. Therefore, it is paramount that both campaigners and veterinary professionals acknowledge the implications of the human-animal bond on informed decision-making.

References

ABUTARBUSH, S. M., CARMALT, J. L. & SHOEMAKER, R. W. 2005. Causes of gastrointestinal colic in horses in western Canada: 604 cases (1992 to 2002). *The Canadian Veterinary Journal,* 46**,** 800.

ADAMS, C., BONNETT, B. & MEEK, A. 2000. Client expectations of veterinarians. *Journal of the American Veterinary Medical Association,* 217**,** 1303-1309.

ADAMS, C. L., CONLON, P. D. & LONG, K. C. 2004. Professional and veterinary competencies: addressing human relations and the human–animal bond in veterinary medicine. *Journal of Veterinary Medical Education,* 31**,** 67-72.

ADAMS, C. L. & FRANKEL, R. M. 2007. It may be a dog's life but the relationship with her owners is also key to her health and well being: communication in veterinary medicine. *Veterinary Clinics: Small Animal Practice,* 37**,** 1-17.

ADAMS, S. B. & MCILWRAITH, C. W. 1978. Abdominal crisis in the horse: a comparison of pre-surgical evaluation with surgical findings and results. *Veterinary Surgery,* 7**,** 63-69.

AJZEN 1991a. The Theory of Planned Behavior.

AJZEN, I. 1991b. The theory of planned behavior. *Organizational behavior and human decision processes,* 50**,** 179-211.

AJZEN, I. & FISHBEIN, M. 1979. A theory of reasoned action: some applications and implications.

AKEY, J. E., RINTAMAKI, L. S. & KANE, T. L. 2013. Health Belief Model deterrents of social support seeking among people coping with eating disorders. *J Affect Disord,* 145**,** 246-52.

AKOBENG, A. K. 2005. Understanding randomised controlled trials. *Archives of disease in childhood,* 90**,** 840-844.

ALAHUHTA, M. A., KORKIAKANGAS, E. E., KERÄNEN, A.-M., KYNGÄS, H. A. & LAITINEN, J. H. 2011. Using pictures as vignettes to assess stages of change in weight management. *Scandinavian journal of public health,* 39**,** 403-409.

ALEXANDER, K., WILLIAM, N., SAMUEL, J. & STEVEN, M. 2003. Systems engineering: principles and practice. *Systems engineering: principles and practices.* Wiley series in systems engineering and management.

ALLEN, D., WHITE, N. A. & TYLER, D. E. 1988. Morphologic effects of experimental distention of equine small intestine. *Veterinary Surgery,* 17**,** 10-14.

ALLISON, K., TAYLOR, N. M., WILSMORE, A. J. & GARFORTH, C. 2011. Equine anthelmintics: survey of the patterns of use, beliefs and attitudes among horse owners in the UK. *Vet Rec,* 168**,** 483.

ALTER, A. L., OPPENHEIMER, D. M. & ZEMLA, J. C. 2010. Missing the trees for the forest: A construal level account of the illusion of explanatory depth. *Journal of personality and social psychology,* 99**,** 436.

AMEMORI, M., KORHONEN, T., KINNUNEN, T., MICHIE, S. & MURTOMAA, H. 2011. Enhancing implementation of tobacco use prevention and cessation counselling guideline among dental providers: a cluster randomised controlled trial. *Implementation Science,* 6**,** 13.

AMERICAN PSYCHIATRIC ASSOCIATION 2013. *Diagnostic and statistical manual of mental disorders (DSM-5®)*, American Psychiatric Pub.

AMERICAN VETERINARY MEDICINE ASSOCIATION. 2020. *Human-animal bond* [Online]. Available: https://www.avma.org/one-health/human-animal-bond [Accessed 18th May 2020].

ANGLEMYER, A., HORVATH, H. T. & BERO, L. 2014. Healthcare outcomes assessed with observational study designs compared with those assessed in randomized trials. *Cochrane Database of Systematic Reviews*.

ARCHER, D. C., COSTAIN, D. A. & SHERLOCK, C. 2014. Idiopathic focal eosinophilic enteritis (IFEE), an emerging cause of abdominal pain in horses: the effect of age, time and geographical location on risk. *PloS one,* 9**,** e112072-e112072.

ARCHER, D. C., PINCHBECK, G. L. & PROUDMAN, C. J. 2011. Factors associated with survival of epiploic foramen entrapment colic: a multicentre, international study. *Equine Vet J Suppl***,** 56-62.

ARCHER, D. C., PINCHBECK, G. L., PROUDMAN, C. J. & CLOUGH, H. E. 2006. Is equine colic seasonal? Novel application of a model based approach. *BMC Vet Res,* 2**,** 27.

ARCHER, D. C. & PROUDMAN, C. J. 2006. Epidemiological clues to preventing colic. *Vet J,* 172**,** 29-39.

ARDEN, M. A. & ARMITAGE, C. J. 2008. Predicting and explaining transtheoretical model stage transitions in relation to condom-carrying behaviour. *British journal of health psychology,* 13**,** 719-735.

ASCH, S. E. 1956. Studies of independence and conformity: I. A minority of one against a unanimous majority. *Psychological monographs: General and applied,* 70**,** 1.

ASIU, B. W., ANTONS, C. M. & FULTZ, M. L. Undergraduate perceptions of survey participation: Improving response rates and validity. annual meeting of the Association of Institutional Research, Minneapolis, Minn, 1998.

ATKIN, C., MARTELL, D., SMITH, S. & GREENAMYER, J. 2004. Specialized social norm message strategies focusing on celebratory drinking. *Report on Social Norms,* 3**,** 4-6.

ATKIN, C. & SALMON, C. 2010. Communication campaigns. *The handbook of communication science***,** 419-435.

ATKIN, C. K. & RICE, R. E. 2012. Advances in public communication campaigns. *The international encyclopedia of media studies*.

ATKINS, L., FRANCIS, J., ISLAM, R., O'CONNOR, D., PATEY, A., IVERS, N., FOY, R., DUNCAN, E. M., COLQUHOUN, H. & GRIMSHAW, J. M. 2017. A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. *Implementation Science,* 12**,** 77.

BAGOZZI, R. P. 2000. The poverty of economic explanations of consumption and an action theory alternative. *Managerial and decision economics,* 21**,** 95-109.

BAMBERGER, M. 2012. Introduction to mixed methods in impact evaluation. *Impact Evaluation Notes,* 3**,** 1-38.

BANDURA, A. 1977. Self-efficacy: toward a unifying theory of behavioral change. *Psychological review,* 84**,** 191.

BARANOWSKI, T., ANDERSON, C. & CARMACK, C. 1998. Mediating variable framework in physical activity interventions: How are we doing? How might we do better? *American journal of preventive medicine,* 15**,** 266-297.

BARKER, I. & FREEMAN, S. L. 2019. Assessment of costs and insurance policies for referral treatment of equine colic. *The Veterinary Record,* 185**,** 508.

BARNSLEY, L., LYON, P. M., RALSTON, S. J., HIBBERT, E. J., CUNNINGHAM, I., GORDON, F. C. & FIELD, M. J. 2004.

Clinical skills in junior medical officers: a comparison of self-reported confidence and observed competence. *Medical education,* 38**,** 358-367.

BARRATT, M. J., FERRIS, J. A. & LENTON, S. 2015. Hidden populations, online purposive sampling, and external validity: Taking off the blindfold. *Field Methods,* 27**,** 3-21.

BARTER, C. & RENOLD, E. 1999. The use of vignettes in qualitative research. *Social research update,* 25**,** 1-6.

BARTHOLOMEW ELDREDGE, L. K., MARKHAM, C. M., RUITER, R. A. C., FERNÁNDEZ, M. E., KOK, G. & PARCEL, G. S. 2016. *Planning Health Promotion Programs : An Intervention Mapping Approach,* Hoboken, UNITED STATES, John Wiley & Sons, Incorporated.

BARTHOLOMEW, L. K., PARCEL, G. S. & KOK, G. 1998. Intervention mapping: a process for developing theory and evidence-based health education programs. *Health education & behavior,* 25**,** 545-563.

BARTON ROSS, C. & BARON-SORENSEN, J. 2007. Pet loss and human emotion.

BASTIAENSENS, S., PABIAN, S., VANDEBOSCH, H., POELS, K., VAN CLEEMPUT, K., DESMET, A. & DE BOURDEAUDHUIJ, I. 2016. From normative influence to social pressure: How relevant others affect whether bystanders join in cyberbullying. *Social Development,* 25**,** 193-211.

BEAGLEHOLE, R. & HORTON, R. 2010. Chronic diseases: global action must match global evidence. *The Lancet,* 376**,** 1619-1621.

BECK, A. M. & MARTIN, F. 2008. Current human–animal bond course offerings in veterinary schools. *Journal of veterinary medical education,* 35**,** 483-486.

BEIER, M. E. & ACKERMAN, P. L. 2005. Age, ability, and the role of prior knowledge on the acquisition of new domain knowledge: promising results in a real-world learning environment. *Psychology and aging,* 20**,** 341.

BELANSKY, E. S., CUTFORTH, N., CHAVEZ, R. A., WATERS, E. & BARTLETT-HORCH, K. 2011. An adapted version of intervention mapping (AIM) is a tool for conducting community-based participatory research. *Health promotion practice,* 12**,** 440-455.

BELKIN, N. J. & ROBERTSON, S. E. 1976. Information science and the phenomenon of information. *Journal of the American Society for Information Science,* 27**,** 197-204.

BENSLEY, D. A. & LILIENFELD, S. O. 2015. What is a psychological misconception? Moving toward an empirical answer. *Teaching of Psychology,* 42**,** 282-292.

BERGER, R. 2015. Now I see it, now I don't: Researcher's position and reflexivity in qualitative research. *Qualitative research,* 15**,** 219-234.

BERGREN, A. L., CREDILLE, B. C., EPSTEIN, K. L. & GIGUÈRE, S. 2015. Retrospective comparison of gastrosplenic entrapment of the small intestine to other strangulating small intestinal lesions in adult horses. *Veterinary Surgery,* 44**,** 535-539.

BERKOWITZ, L. 1972. SOCIAL NORMS, FEELINGS, AND OTHER. *Advances in experimental social psychology***,** 63.

BEST, C. O. R. 2015. *Exploring the Role of Interpersonal Relationships in Equine Veterinary Practice.*

BIESTA, G. 2010. Pragmatism and the philosophical foundations of mixed methods research. *Sage handbook of mixed methods in social and behavioral research,* 2**,** 95-118.

BLAIR, P. H. 2003. *An Introduction to Anglo-Saxon England*, Cambridge University Press.

BLIKSLAGER, A. & MAIR, T. Trends in management of horses referred for evaluation of colic: 2004–2013. Eleventh International Colic Research Symposium, Dublin, Ireland, 2014.

BLIKSLAGER, A. T. 2017. Pathophysiology of Gastrointestinal Obstruction and Strangulation. *In:* BLIKSLAGER, A. T., MOORE, J. N., MAIR, T. S. & WHITE, N. A., II (eds.) *The Equine Acute Abdomen.* Newark, UNITED STATES: John Wiley & Sons, Incorporated.

BLIKSLAGER, A. T. 2019. Colic Prevention to Avoid Colic Surgery: A Surgeon's Perspective. *J Equine Vet Sci,* 76**,** 1-5.

BLIKSLAGER, A. T., ROBERTS, M. C., RHOADS, J. M. & ARGENZIO, R. A. 1997. Is reperfusion injury an important cause of mucosal damage after porcine intestinal ischemia? *Surgery,* 121**,** 526-534.

BLUMER, H. 1986. *Symbolic interactionism: Perspective and method*, Univ of California Press.

BOGGS, M. & SZABO, S. 2011. Illuminating pathways through rigor, respect, relevance, and relationships: Scaffolding cross-generational understandings. *Delta Kappa Gamma Bulletin,* 77**,** 27.

BORKOVEC, T. 1985. Worry: A potentially valuable concept. *Behaviour research and therapy,* 23**,** 481-482.

BORKOVEC, T. 1994. The nature, functions, and origins of worry.

BORKOVEC, T. D., ALCAINE, O. & BEHAR, E. 2004. Avoidance theory of worry and generalized anxiety disorder. *Generalized anxiety disorder: Advances in research and practice,* 2004.

BOWDEN, A., BRENNAN, M. L., ENGLAND, G. C. W., BURFORD, J. H. & FREEMAN, S. L. 2015. Colic: Horse Owner Knowledge and Experience. *Equine Veterinary Journal,* 47**,** 4-4.

BOWDEN, A., BURFORD, J. H., BRENNAN, M. L., ENGLAND, G. C. W. & FREEMAN, S. L. 2019. Emergency Conditions in Horses: Opinions and Decision Making of Livery Yard Owners. *Veterinary Evidence*.

BOWDEN, A., BURFORD, J. H., BRENNAN, M. L., ENGLAND, G. C. W. & FREEMAN, S. L. 2020. Horse owners' knowledge, and opinions on recognising colic in the horse. *Equine Vet J,* 52**,** 262-267.

BOWDEN, A., ENGLAND, G. C. W., BURFORD, J. H., MAIR, T., FURNESS, W. & FREEMAN, S. L. 2017. Early Indicators of Critical Outcomes in Horses Presenting With Abdominal Pain (Colic): Retrospective Study of Out-Of-Hours First-Opinion Emergency Cases From Two Practices Over a 3-Year Period (2011–2013). *Equine Veterinary Journal,* 49**,** 13-13.

BOWLING, A. 2014. *Research methods in health: investigating health and health services*, McGraw-hill education (UK).

BRADBURN, N. M., SUDMAN, S., BLAIR, E. & STOCKING, C. 1978. Question threat and response bias. *Public Opinion Quarterly,* 42**,** 221-234.

BRANNEN, J. 2017. *Mixing methods: Qualitative and quantitative research*, Routledge.

BRAUN, V. & CLARKE, V. 2006. Using thematic analysis in psychology. *Qualitative research in psychology,* 3**,** 77-101.

BRAUN, V. & CLARKE, V. 2013. *Successful qualitative research: A practical guide for beginners*, sage.

BRAUN, V., CLARKE, V., HAYFIELD, N. & TERRY, G. 2019. Thematic analysis. *Handbook of research methods in health social sciences*, 843-860.

BRAY, J. E., STRANEY, L., BARGER, B. & FINN, J. 2015. Effect of public awareness campaigns on calls to ambulance across Australia. *Stroke,* 46, 1377-1380.

BREITENSTEIN, S. M., GROSS, D., GARVEY, C. A., HILL, C., FOGG, L. & RESNICK, B. 2010. Implementation fidelity in community-based interventions. *Research in nursing & health,* 33, 164-173.

BREWER, N. T., CHAPMAN, G. B., GIBBONS, F. X., GERRARD, M., MCCAUL, K. D. & WEINSTEIN, N. D. 2007. Meta-analysis of the relationship between risk perception and health behavior: the example of vaccination. *Health psychology,* 26, 136.

BRITISH EQUINE VETERINARY ASSOCIATION. 2009. A guide to best practice for veterinary surgeons when considering euthanasia on humane grounds: where horses are insured under an all risks of mortality insurance policy. Available: https://www.beva.org.uk/Portals/0/Documents/ResourcesForVets/Humane%20Destruction.pdf [Accessed 05/05/2020].

BROCKMAN, B. K., TAYLOR, V. A. & BROCKMAN, C. M. 2008. The price of unconditional love: Consumer decision making for high-dollar veterinary care. *Journal of Business Research,* 61, 397-405.

BROUWERS, M. C., KHO, M. E., BROWMAN, G. P., BURGERS, J. S., CLUZEAU, F., FEDER, G., FERVERS, B., GRAHAM, I. D., GRIMSHAW, J., HANNA, S. E., LITTLEJOHNS, P., MAKARSKI, J., ZITZELSBERGER, L. & CONSORTIUM, A. N. S. 2010. AGREE II: advancing guideline development, reporting and evaluation in health care. *J Clin Epidemiol,* 63, 1308-11.

BROUWERS, M. C., KHO, M. E., BROWMAN, G. P., BURGERS, J. S., CLUZEAU, F., FEDER, G., FERVERS, B., GRAHAM, I. D., GRIMSHAW, J., HANNA, S. E., LITTLEJOHNS, P., MAKARSKI, J., ZITZELSBERGER, L. & CONSORTIUM, A. N. S. 2012. The Global Rating Scale complements the AGREE II in advancing the quality of practice guidelines. *J Clin Epidemiol,* 65, 526-34.

BROWN, B. H., RICHARDS, H. C. & WILSON, C. A. 1996. Pet bonding and pet bereavement among adolescents. *Journal of Counseling & Development,* 74, 505-509.

BROWN, L. T. 1983. Some more misconceptions about psychology among introductory psychology students. *Teaching of Psychology,* 10, 207-210.

BRUSCO, N. K. & WATTS, J. J. 2015. Empirical evidence of recall bias for primary health care visits. *BMC health services research,* 15**,** 381.

BUCKLEY, P., DUNN, T. & MORE, S. J. 2004. Owners' perceptions of the health and performance of Pony Club horses in Australia. *Prev Vet Med,* 63**,** 121-33.

BURFORD, J. H. 2016. Factors affecting the development of postoperative colic following surgical intervention. 15 / 02 / 2016 ed.

BURFORD, J. H., BOWDEN, A., CURTIS, L., HANNELLY, E., ENGLAND, G. C. W. & FREEMAN, S. L. 2017. Development of a Research-Based Owner Educational Campaign On The Recognition And Assessment Of Equine Colic. *Equine Veterinary Education,* 29**,** 19-19.

BURNARD, P. 1994. The telephone interview as a data collection method. *Nurse education today,* 14**,** 67-72.

BUSSIÈRES, G., JACQUES, C., LAINAY, O., BEAUCHAMP, G., LEBLOND, A., CADORÉ, J. L., DESMAIZIÈRES, L. M., CUVELLIEZ, S. G. & TRONCY, E. 2008. Development of a composite orthopaedic pain scale in horses. *Research in Veterinary Science,* 85**,** 294-306.

BUTLER, C., WILLIAMS, S. & KOLL, S. 2002. Perceptions of fourth-year veterinary students regarding emotional support of clients in veterinary practice in the veterinary college curriculum. *Journal of the American Veterinary Medical Association,* 221**,** 360-363.

CAMPBELL, M., FITZPATRICK, R., HAINES, A., KINMONTH, A. L., SANDERCOCK, P., SPIEGELHALTER, D. & TYRER, P. 2000. Framework for design and evaluation of complex interventions to improve health. *Bmj,* 321**,** 694-696.

CANE, J., O'CONNOR, D. & MICHIE, S. 2012. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Science*.

CAPUTO, D. & DUNNING, D. 2005. What you don’t know: The role played by errors of omission in imperfect self-assessments. *Journal of Experimental Social Psychology,* 41**,** 488-505.

CARLSON, E. B. 1997. *Trauma assessments: A clinician's guide*, Guilford Press.

CARLSON, E. B. & DALENBERG, C. J. 2000. A conceptual framework for the impact of traumatic experiences. *Trauma, violence, & abuse,* 1**,** 4-28.

CARLSON, E. B., FURBY, L., ARMSTRONG, J. & SHLAES, J. 1997. A conceptual framework for the long-term psychological effects of traumatic childhood abuse. *Child maltreatment,* 2**,** 272-295.

CARROLL, C. & HUNTINGTON, P. 1988. Body condition scoring and weight estimation of horses. *Equine veterinary journal,* 20**,** 41-45.

CATANIA, J. A., KEGELES, S. M. & COATES, T. J. 1990. Towards an understanding of risk behavior: An AIDS risk reduction model (ARRM). *Health education quarterly,* 17**,** 53-72.

CHAPLIN, G. & WYTON, P. 2014. Student engagement with sustainability: Understanding the value–action gap. *International Journal of Sustainability in Higher Education*.

CHAPPLE, A. 1999. The use of telephone interviewing for qualitiative research. *Nurse Researcher (through 2013),* 6**,** 85.

CHARMAZ, K. & BELGRAVE, L. L. 2007. Grounded theory. *The Blackwell encyclopedia of sociology*.

CHATTERTON, T. 2016. An introduction to theories of behaviour. *In:* SPOTSWOOD, F. (ed.) *Beyond behaviour change : key issues, interdisciplinary approaches and future directions.* Bristol : Policy Press.

CHIESI, H. L., SPILICH, G. J. & VOSS, J. F. 1979. Acquisition of domain-related information in relation to high and low domain knowledge. *Journal of verbal learning and verbal behavior,* 18**,** 257-273.

CHRISTOPHERSEN, M. T., DUPONT, N., BERG-SØRENSEN, K. S., KONNERUP, C., PIHL, T. H. & ANDERSEN, P. H. 2014. Short-term survival and mortality rates in a retrospective study of colic in 1588 Danish horses. *Acta Veterinaria Scandinavica***,** 20.

CHRISTOPHERSEN, M. T., TNIBAR, A., PIHL, T. H., ANDERSEN, P. H. & EKSTROM, C. T. 2011. Sporting activity following colic surgery in horses: a retrospective study. *Equine Vet J Suppl***,** 3-6.

CIALDINI, R. B. 2005. Basic social influence is underestimated. *Psychological inquiry,* 16**,** 158-161.

CIALDINI, R. B. & GOLDSTEIN, N. J. 2004. Social influence: Compliance and conformity. *Annu. Rev. Psychol.,* 55**,** 591-621.

CLOUGH, H., BURFORD, J., ROSHIER, A., ENGLAND, G. & FREEMAN, S. L. 2019. A scoping review of the current literature exploring the nature of the horse-human relationship. *Veterinary Evidence,* 4.

CLOUGH, H. G. R. 2019. Exploring the horse-human relationship.

COE, J. B., ADAMS, C. L. & BONNETT, B. N. 2007. A focus group study of veterinarians' and pet owners' perceptions of the monetary aspects of veterinary care. *Journal of the American Veterinary Medical Association,* 231**,** 1510-1518.

COFFMAN, J. 2002. Public communication campaign evaluation. *Communications Consortium Media Center, Washington, DC*.

COHEN, N., GIBBS, P. & WOODS, A. M. 1999. Dietary and other management factors associated with equine colic. *In AAEP Proceedings* 45**,** 96-98.

COHEN, N. & PELOSO, J. 1996a. Risk factors for history of previous colic and for chronic, intermittent colic in a population of horses. *Journal of the American Veterinary Medical Association,* 208**,** 697-703.

COHEN, N. D., MATEJKA, P. L., HONNAS, C. M. & HOOPER, R. N. 1995. Case-Control Study of the Association between Various Management Factors and Development of Colic in Horses. *Journal of the American Veterinary Medical Association,* 206**,** 667-673.

COHEN, N. D. & PELOSO, J. G. 1996b. Risk factors for history of previous colic and for chronic, intermittent colic in a population of horses. *J Am Vet Med Assoc,* 208**,** 697-703.

COHEN, N. D., VONTUR, C. A. & RAKESTRAW, P. C. 2000. Risk factors for enterolithiasis among horses in Texas. *Journal of the American Veterinary Medical Association,* 216**,** 1787-1794.

COHEN, S. P. 2002. Can pets function as family members? *Western Journal of Nursing Research,* 24**,** 621-638.

COLEMAN, T. 2010. Do financial incentives for delivering health promotion counselling work? Analysis of smoking cessation activities stimulated by the quality and outcomes framework. *BMC public health,* 10**,** 167.

CONNERS, S. E. EQUINE BUSINESS MANAGEMENT MODEL CURRICULUM. Academy of Educational Leadership, 2009. 10.

CONVERSE, J. M. 1984. Strong arguments and weak evidence: The open/closed questioning controversy of the 1940s. *Public Opinion Quarterly,* 48**,** 267-282.

CONVERSE, J. M. & PRESSER, S. 1986. *Survey questions: Handcrafting the standardized questionnaire*, Sage.

COOK, V. L. & HASSEL, D. M. 2014. Evaluation of the Colic in Horses: Decision for Referral. *Veterinary Clinics of North America: Equine Practice,* 30**,** 383-398.

CORAH, L., MOSSOP, L., DEAN, R. & COBB, K. "Trust me I'ma vet…" Vet-client trust in small animal consultations: a mixed methods approach. BSAVA Congress Proceedings 2019, 2019. BSAVA Library, 464-464.

CORLEY, K. 2002. Fluid therapy for horses with gastrointestinal diseases. *Large animal internal medicine,* 3**,** 682-693.

COUËTIL, L., CARDWELL, J., GERBER, V., LAVOIE, J. P., LÉGUILLETTE, R. & RICHARD, E. 2016. Inflammatory airway disease of horses—revised consensus statement. *Journal of veterinary internal medicine,* 30**,** 503-515.

COWLES, K. V. 1985. The death of a pet: Human responses to the breaking of the bond. *Marriage & Family Review,* 8**,** 135-148.

CRACIUN, C., SCHUZ, N., LIPPKE, S. & SCHWARZER, R. 2012. A mediator model of sunscreen use: a longitudinal analysis of social-cognitive predictors and mediators. *Int J Behav Med,* 19**,** 65-72.

CROKER, H., LUCAS, R. & WARDLE, J. 2012. Cluster-randomised trial to evaluate the 'Change for Life'mass media/social marketing campaign in the UK. *BMC Public Health,* 12**,** 404.

CROOG, S. H., SHAPIRO, D. S. & LEVINE, S. 1971. Denial among male heart patients: An empirical study. *Psychosomatic Medicine*.

CROTTY, M. 1998. *The foundations of social research: Meaning and perspective in the research process*, Sage.

CURTIS, L., BURFORD, J. H., ENGLAND, G. C. W. & FREEMAN, S. L. 2019. Risk factors for acute abdominal pain (colic) in the adult horse: A scoping review of risk factors, and a systematic review of the effect of management-related changes. *PLoS One,* 14**,** e0219307.

CURTIS, L., BURFORD, J. H., THOMAS, J. S. M., CURRAN, M. L., BAYES, T. C., ENGLAND, G. C. W. & FREEMAN, S. L. 2015.

Prospective study of the primary evaluation of 1016 horses with clinical signs of abdominal pain by veterinary practitioners, and the differentiation of critical and non-critical cases. *Acta Veterinaria Scandinavica,* 57**,** 69.

DABAREINER, R., SULLINS, K., SNYDER, J. & GARDNER, I. 1993. Evaluation of the microcirculation of the equine small intestine after intraluminal distention and subsequent decompression. *American journal of veterinary research,* 54**,** 1673-1682.

DABAREINER, R. & WHITE, N. 1995a. Large colon impaction in horses: 147 cases (1985-1991). *Journal of the American Veterinary Medical Association,* 206**,** 679-685.

DABAREINER, R. M., SULLINS, K. E., WHITE, N. A. & SNYDER, J. R. 2001. Serosal injury in the equine jejunum and ascending colon after ischemia-reperfusion or intraluminal distention and decompression. *Veterinary Surgery,* 30**,** 114-125.

DABAREINER, R. M. & WHITE, N. A. 1995b. Large colon impaction in horses: 147 cases (1985-1991). *J Am Vet Med Assoc,* 206**,** 679-85.

DARLEY, J. M. & LATANE, B. 1970. Norms and normative behavior: Field studies of social interdependence. *Altruism and helping behavior***,** 83-102.

DAVIES, P., WALKER, A. E. & GRIMSHAW, J. M. 2010. A systematic review of the use of theory in the design of guideline dissemination and implementation strategies and interpretation of the results of rigorous evaluations. *Implementation Science,* 5**,** 14.

DAVIS, W., FOGLE, C. A., GERARD, M. P., LEVINE, J. F. & BLIKSLAGER, A. T. 2013. Return to use and performance following exploratory celiotomy for colic in horses: 195 cases (2003-2010). *Equine Vet J,* 45**,** 224-8.

DAWSON, S. 2007a. Dealing with death. *Veterinary Nursing Journal,* 22**,** 21-24.

DAWSON, S. 2008. Bond Centred Practice: New perspectives in Veterinary Nursing. *Veterinary Nursing Journal,* 23**,** 25-28.

DAWSON, S. E. 2007b. *Companion animal euthanasia: the lived paradox of the human-companion animal bond.* Manchester Metropolitan University.

DAWSON, S. E. 2010. Compassionate communication: working with grief. *Handbook of veterinary communication skills***,** 62-99.

DE GRAUW, J. C. & VAN LOON, J. P. 2016. Systematic pain assessment in horses. *Vet J,* 209**,** 14-22.

DE VAUS, D. & DE VAUS, D. 2013. *Surveys in social research*, Routledge.

DECI, E. L. & RYAN, R. M. 2012. Self-determination theory.

DENFORD, S., ABRAHAM, C., SMITH, J., R., MORGAN-TRIMMER, S., LLOYD, J. & WYATT, K. 2016. Intervention design and evaluation: behaviour imperatives. *In:* SPOTSWOOD, F. (ed.) *Beyond behaviour change: Key issues, interdisciplinary approaches and future directions.* Bristol: Policy Press.

DERVIN, B. & NILAN, M. 1986. Information needs and uses. *Annual review of information science and technology,* 21**,** 3-33.

DESAI, V. & POTTER, R. B. 2013. *The companion to development studies*, Routledge.

DESROCHERS, A. & WHITE, N. A. 2017. Diagnostic Approach to Colic. *In:* BLIKSLAGER, A. T., MOORE, J. N., MAIR, T. S. & WHITE, N. A., II (eds.) *The Equine Acute Abdomen.* Newark, UNITED STATES: John Wiley & Sons, Incorporated.

DEUTSCH, M. & GERARD, H. B. 1955. A study of normative and informational social influences upon individual judgment. *The journal of abnormal and social psychology,* 51**,** 629.

DISESSA, A. A. 2014. A history of conceptual change research: Threads and fault lines. *The Cambridge Handbook of the Learning Sciences* Second Edition ed. UC Berkeley.

DODA, A., NEGI, G., GAUR, D. S. & HARSH, M. 2018. Human immunodeficiency virus/acquired immune deficiency syndrome: A survey on the knowledge, attitude, and practice among medical professionals at a tertiary health-care institution in Uttarakhand, India. *Asian journal of transfusion science,* 12**,** 21.

DOLAN, P., HALLSWORTH, M., HALPERN, D., KING, D. & VLAEV, I. 2010. MINDSPACE: influencing behaviour for public policy.

DOLENTE, B. A., LINDBORG, S., RUSSELL, G. & SOUTHWOOD, L. L. 2008. Emergency case admissions at a large animal tertiary university referral hospital during a 12-month period. *Journal of Veterinary Emergency and Critical Care,* 18**,** 298-305.

DOMBROWSKI, S. U., MACKINTOSH, J. E., SNIEHOTTA, F. F., ARAUJO-SOARES, V., RODGERS, H., THOMSON, R. G., MURTAGH, M. J., FORD, G. A., ECCLES, M. P. & WHITE, M. 2013. The impact of the UK 'Act FAST'stroke awareness

campaign: content analysis of patients, witness and primary care clinicians' perceptions. *BMC public health,* 13**,** 915.

DOMBROWSKI, S. U., SNIEHOTTA, F. F., AVENELL, A., JOHNSTON, M., MACLENNAN, G. & ARAÚJO-SOARES, V. 2012. Identifying active ingredients in complex behavioural interventions for obese adults with obesity-related co-morbidities or additional risk factors for co-morbidities: a systematic review. *Health Psychology Review,* 6**,** 7-32.

DOMBROWSKI, S. U., WHITE, M., MACKINTOSH, J. E., GELLERT, P., ARAUJO-SOARES, V., THOMSON, R. G., RODGERS, H., FORD, G. A. & SNIEHOTTA, F. F. 2015. The stroke 'Act FAST'campaign: Remembered but not understood? *International Journal of Stroke,* 10**,** 324-330.

DUCHARME, N., PASCOE, P. J., LUMSDEN, J. & DUCHARME, G. 1989. A computer-derived protocol to aid in selecting medical versus surgical treatment of horses with abdominal pain. *Equine veterinary journal,* 21**,** 447-450.

DUCHARME, N. G., HACKETT, R. P., DUCHARME, G. R. & LONG, S. 1983. Surgical-Treatment of Colic - Results in 181 Horses. *Veterinary Surgery,* 12**,** 206-209.

DUGDALE, A. H. 2014. Progress in equine pain assessment? *Vet J,* 200**,** 210-1.

DUJARDIN, C. 2011. Pain recognition and treatment in the horse: a survey of equine veterinarians in The Netherlands and Belgium. *Tijdschrift voor diergeneeskunde,* 136**,** 715-724.

DUKTI, S. & WHITE, N. A. 2009. Prognosticating equine colic. *Vet Clin North Am Equine Pract,* 25**,** 217-31.

DUNNING, D. 2011. The Dunning–Kruger effect: On being ignorant of one's own ignorance. *Advances in experimental social psychology.* Elsevier.

DURKHEIM, E. & SUICIDE, A. 1952. *A study in sociology*, Routledge & K. Paul London.

DYSON, J., LAWTON, R., JACKSON, C. & CHEATER, F. 2011. Does the use of a theoretical approach tell us more about hand hygiene behaviour? The barriers and levers to hand hygiene. *Journal of Infection Prevention,* 12**,** 17-24.

EDWARDS, G. 2000. Duodenitis-proximal jejunitis (anterior enteritis) as a surgical problem. *Equine Veterinary Education,* 12**,** 318-321.

EDWARDS, G. B. & PROUDMAN, C. 1994. An analysis of 75 cases of intestinal obstruction caused by pedunculated lipomas.

EHRHARDT, E. & LOWE, J. 1990. Observer variation in equine abdominal auscultation. *Equine veterinary journal,* 22**,** 182-185.

EL FEKY, A., GILLIES, K., GARDNER, H., FRASER, C. & TREWEEK, S. 2018. A protocol for a systematic review of non-randomised evaluations of strategies to increase participant retention to randomised controlled trials. *Systematic reviews,* 7**,** 30.

ESCALONA, E. E., OKELL, C. N. & ARCHER, D. C. 2014. Prevalence of and risk factors for colic in horses that display crib-biting behaviour. *BMC Veterinary Research,* 10**,** S3.

ESPINOSA, P., LE JEUNE, S. S., CENANI, A., KASS, P. H. & BROSNAN, R. J. 2017. Investigation of perioperative and anesthetic variables affecting short-term survival of horses with small intestinal strangulating lesions. *Veterinary Surgery,* 46**,** 345-353.

EUSER, A. M., ZOCCALI, C., JAGER, K. J. & DEKKER, F. W. 2009. Cohort Studies: Prospective versus Retrospective. *Nephron Clinical Practice,* 113**,** c214-c217.

EVANS, J. R. & MATHUR, A. 2005. The value of online surveys. *Internet research*.

EVERS, W. J., BROUWERS, A. & TOMIC, W. 2006. A quasi-experimental study on management coaching effectiveness. *Consulting Psychology Journal: Practice and Research,* 58**,** 174.

FAN, W. & YAN, Z. 2010. Factors affecting response rates of the web survey: A systematic review. *Computers in human behavior,* 26**,** 132-139.

FETTERMAN, D. M., RODRÍGUEZ-CAMPOS, L. & ZUKOSKI, A. P. 2017. *Collaborative, participatory, and empowerment evaluation: stakeholder involvement approaches*, Guilford Publications.

FEYERABEND, P. 1985. *Problems of Empiricism: Volume 2: Philosophical Papers*, Cambridge University Press.

FIELD, N. P., ORSINI, L., GAVISH, R. & PACKMAN, W. 2009. Role of attachment in response to pet loss. *Death studies,* 33**,** 334-355.

FIRESTONE, W. A. 1987. Meaning in method: The rhetoric of quantitative and qualitative research. *Educational researcher,* 16**,** 16-21.

FISHBEIN, M. & AJZEN, I. 1977. Belief, attitude, intention, and behavior: An introduction to theory and research.

FISHBEIN, M. & AJZEN, I. 1980. Understanding attitudes and predicting social behavior.

FISKE, S. T., CUDDY, A. J. & GLICK, P. 2007. Universal dimensions of social cognition: Warmth and competence. *Trends in cognitive sciences,* 11**,** 77-83.

FLAY, B. R. & PETRAITIS, J. 1994. A new theory of health behavior with implications for preventive interventions. *Advances in medical sociology,* 4**,** 19-44.

FLETCHER-MORGAN, C. & LEYLAND, K. 2010. Making people more responsible: The Blair governments' programme for changing citizens' behaviour. *Political studies,* 58**,** 427-449.

FLETCHER, A., JAMAL, F., MOORE, G., EVANS, R. E., MURPHY, S. & BONELL, C. 2016. Realist complex intervention science: applying realist principles across all phases of the Medical Research Council framework for developing and evaluating complex interventions. *Evaluation,* 22**,** 286-303.

FOWKES, F. & FULTON, P. 1991. Critical appraisal of published research: introductory guidelines. *BMJ: British Medical Journal,* 302**,** 1136.

FOX, C. 1983. Information and misinformation. an investigation of the notions of information, misinformation, informing, and misinforming.

FRANCIS, J. J., STOCKTON, C., ECCLES, M. P., JOHNSTON, M., CUTHBERTSON, B. H., GRIMSHAW, J. M., HYDE, C., TINMOUTH, A. & STANWORTH, S. J. 2009a. Evidence-based selection of theories for designing behaviour change interventions: Using methods based on theoretical construct domains to understand clinicians' blood transfusion behaviour. *British journal of health psychology,* 14**,** 625-646.

FRANCIS, J. J., TINMOUTH, A., STANWORTH, S. J., GRIMSHAW, J. M., JOHNSTON, M., HYDE, C., STOCKTON, C., BREHAUT, J. C., FERGUSSON, D. & ECCLES, M. P. 2009b. Using theories of behaviour to understand transfusion prescribing in three clinical contexts in two countries: development work for an implementation trial. *Implementation Science,* 4**,** 70.

FREEMAN, D. 2018a. Fifty years of colic surgery. *Equine veterinary journal,* 50**,** 423-435.

FREEMAN, D., HAMMOCK, P., BAKER, G., GOETZ, T., FOREMAN, J. H., SCHAEFFER, D., RICHTER, R. A., INOUE, O. & MAGID, J. 2000. Short-and long-term survival and prevalence of postoperative ileus after small intestinal surgery in the horse. *Equine Veterinary Journal,* 32**,** 42-51.

FREEMAN, D. & SCHAEFFER, D. 2005. Short-term survival after surgery for epiploic foramen entrapment compared with other strangulating diseases of the small intestine in horses. *Equine veterinary journal,* 37**,** 292-295.

FREEMAN, D., SCHAEFFER, D. & CLEARY, O. 2014. Long-term survival in horses with strangulating obstruction of the small intestine managed without resection. *Equine veterinary journal,* 46**,** 711-717.

FREEMAN, D. E. 2000. Duodenitis-proximal jejunitis. *Equine veterinary education,* 12**,** 322-332.

FREEMAN, D. E. 2018b. Fifty years of colic surgery. *Equine Vet J,* 50**,** 423-435.

FREEMAN, G. & HJORTDAHL, P. 1997. What future for continuity of care in general practice? *Bmj,* 314**,** 1870.

FRENCH, S. D., GREEN, S. E., O'CONNOR, D. A., MCKENZIE, J. E., FRANCIS, J. J., MICHIE, S., BUCHBINDER, R., SCHATTNER, P., SPIKE, N. & GRIMSHAW, J. M. 2012. Developing theory-informed behaviour change interventions to implement evidence into practice: a systematic approach using the Theoretical Domains Framework. *Implementation Science,* 7**,** 38.

FREUD, A. 1946. The Ego and the Mechanisms of Defense. New York (International Universities Press) 1946.

FREUDENBERG, N. 2004. Community capacity for environmental health promotion: determinants and implications for practice. *Health Education & Behavior,* 31**,** 472-490.

FREUDENBERG, N. 2005. Public health advocacy to change corporate practices: implications for health education practice and research. *Health Education & Behavior,* 32**,** 298-319.

FREUDENBERG, N. & GALEA, S. 2008. The impact of corporate practices on health: implications for health policy. *Journal of public health policy,* 29**,** 86-104.

FREUDENBERG, N., PICARD BRADLEY, S. & SERRANO, M. 2009. Public health campaigns to change industry practices that

damage health: an analysis of 12 case studies. *Health Education & Behavior,* 36**,** 230-249.

FULTZ, L. E., PELOSO, J. G., GIGUÈRE, S. & ADAMS, A. R. 2013. Comparison of phenylephrine administration and exercise versus phenylephrine administration and a rolling procedure for the correction of nephrosplenic entrapment of the large colon in horses: 88 cases (2004–2010). *Journal of the American Veterinary Medical Association,* 242**,** 1146-1151.

FURR, M. O., LESSARD, P. & WHITE, N. A. 1995. Development of a colic severity score for predicting the outcome of equine colic. *Veterinary Surgery,* 24**,** 97-101.

GABEL, L. L., LUCAS, J. B. & WESTBURY, R. C. 1993. Why do patients continue to see the same physician? *Family Practice Research Journal,* 13**,** 133-147.

GARCIA-RETAMERO, R. & GALESIC, M. 2012. Doc, what would you do if you were me? On self–other discrepancies in medical decision making. *Journal of Experimental Psychology: Applied,* 18**,** 38.

GARDNER, R. M. & DALSING, S. 1986. Misconceptions about psychology among college students. *Teaching of Psychology,* 13**,** 32-34.

GARFORTH, C. J., BAILEY, A. P. & TRANTER, R. B. 2013. Farmers' attitudes to disease risk management in England: a comparative analysis of sheep and pig farmers. *Preventive veterinary medicine,* 110**,** 456-466.

GAYLE, J. M. M., BLIKSLAGER, A. T. & BOWMAN, K. F. 2000. Mesenteric rents as a source of small intestinal strangulation in horses: 15 cases (1990–1997). *Journal of the American Veterinary Medical Association,* 216**,** 1446-1449.

GAZZERRO, D. M., SOUTHWOOD, L. L. & LINDBORG, S. 2015. Short-Term Complications After Colic Surgery in Geriatric Versus Mature Non-Geriatric Horses. *Veterinary Surgery,* 44**,** 256-264.

GELLER, E. S., BERRY, T. D., LUDWIG, T. D., EVANS, R. E., GILMORE, M. R. & CLARKE, S. W. 1990. A conceptual framework for developing and evaluating behavior change interventions for injury control. *Health Education Research,* 5**,** 125-137.

GENTRY, W. D. 1978. Prehospital behavior after a heart attack. *Psychiatric Annals,* 8**,** 26-30.

GENTRY, W. D., FOSTER, S. & HANEY, T. 1972. Denial as a determinant of anxiety and perceived health status in the coronary care unit. *Psychosomatic Medicine*.

GERARD, M. P., BLIKSLAGER, A. T., ROBERTS, M. C., TATE JR., L. P. & ARGENZIO, R. A. 1999. The characteristics of intestinal injury peripheral to strangulating obstruction lesions in the equine small intestine. *Equine Veterinary Journal,* 31**,** 331-335.

GERWOLLS, M. K. & LABOTT, S. M. 1994. Adjustment to the death of a companion animal. *Anthrozoös,* 7**,** 172-187.

GIELEN, A. C., MCDONALD, E. M., GARY, T. L. & BONE, L. R. 2008. Using the precede-proceed model to apply health behavior theories. *Health behavior and health education: Theory, research, and practice,* 4**,** 407-29.

GIGERENZER, G. 2010. Personal reflections on theory and psychology. *Theory & Psychology,* 20**,** 733-743.

GLASGOW, R. E., VOGT, T. M. & BOLES, S. M. 1999. Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *American journal of public health,* 89**,** 1322-1327.

GLEERUP, K. & LINDEGAARD, C. 2016. Recognition and quantification of pain in horses: a tutorial review. *Equine Veterinary Education,* 28**,** 47-57.

GLEERUP, K. B., FORKMAN, B., LINDEGAARD, C. & ANDERSEN, P. H. 2015. An equine pain face. *Vet Anaesth Analg,* 42**,** 103-14.

GOOLD, S. D. & KLIPP, G. 2002. Managed care members talk about trust. *Social science & medicine,* 54**,** 879-888.

GORE, J. & OGDEN, J. 1998. Developing, validating and consolidating the doctor-patient relationship: the patients' views of a dynamic process. *Br J Gen Pract,* 48**,** 1391-1394.

GOSSE, G. 1989. Factors associated with the human grief experience as a result of the death of a pet.

GOSSE, G. H. & BARNES, M. J. 1994. Human grief resulting from the death of a pet. *Anthrozoös,* 7**,** 103-112.

GOUGH, B. 2016. Men's depression talk online: A qualitative analysis of accountability and authenticity in help-seeking and support formulations. *Psychology of Men & Masculinity,* 17**,** 156.

GRAUBNER, C., GERBER, V., DOHERR, M. & SPADAVECCHIA, C. 2011. Clinical application and reliability of a post abdominal

surgery pain assessment scale (PASPAS) in horses. *Vet J,* 188**,** 178-83.

GRAY, C. & MOFFETT, J. 2013. *Handbook of veterinary communication skills*, John Wiley & Sons.

GREEN, L. W. & MERCER, S. L. 2001. Can public health researchers and agencies reconcile the push from funding bodies and the pull from communities? *American journal of public health,* 91**,** 1926-1929.

GREENE, J. C. & CARACELLI, V. J. 1997. *Advances in mixed-method evaluation: The challenges and benefits of integrating diverse paradigms*, Jossey-Bass Publishers San Francisco, CA.

GRIGGS, R. A. & RANSDELL, S. E. 1987. Misconceptions tests or misconceived tests? *Teaching of Psychology,* 14**,** 210-214.

GRIMSHAW, J., SHIRRAN, L., THOMAS, R., MOWATT, G., FRASER, C., BERO, L., GRILLI, R., HARVEY, E., OXMAN, A. & O'BRIEN, M. A. 2002. Changing provider behaviour: an overview of systematic reviews of interventions to promote implementation of research findings by healthcare professionals. *Getting research findings into practice***,** 29-67.

GRIMSHAW, J. M., ZWARENSTEIN, M., TETROE, J. M., GODIN, G., GRAHAM, I. D., LEMYRE, L., ECCLES, M. P., JOHNSTON, M., FRANCIS, J. J. & HUX, J. 2007. Looking inside the black box: a theory-based process evaluation alongside a randomised controlled trial of printed educational materials (the Ontario printed educational message, OPEM) to improve referral and prescribing practices in primary care in Ontario, Canada. *Implementation Science,* 2**,** 38.

GROL, R. & GRIMSHAW, J. 2003. From best evidence to best practice: effective implementation of change in patients' care. *The Lancet,* 362**,** 1225-1230.

GROL, R. & WENSING, M. 2004. What drives change? Barriers to and incentives for achieving evidence-based practice. *Medical Journal of Australia,* 180**,** S57-S60.

GROUZET, F. M., KASSER, T., AHUVIA, A., DOLS, J. M. F., KIM, Y., LAU, S., RYAN, R. M., SAUNDERS, S., SCHMUCK, P. & SHELDON, K. M. 2005. The structure of goal contents across 15 cultures. *Journal of personality and social psychology,* 89**,** 800.

GRULKE, S., OLLE, E., DETILLEUX, J., GANGL, M., CAUDRON, I. & SERTEYN, D. 2001. Determination of a gravity and shock score

for prognosis in equine surgical colic. *J Vet Med A Physiol Pathol Clin Med,* 48**,** 465-73.

GUBA, E. G. 1981. Criteria for assessing the trustworthiness of naturalistic inquiries. *Ectj,* 29**,** 75.

GUEST, G., BUNCE, A. & JOHNSON, L. 2006. How many interviews are enough? An experiment with data saturation and variability. *Field methods,* 18**,** 59-82.

HACKER, D. J., DUNLOSKY, J. & GRAESSER, A. C. 1998. Influence of knowledge activation and context on comprehension monitoring of science texts. *Metacognition in educational theory and practice.* Routledge.

HACKETT, E. S. 2012. Specific causes of colic. *In:* SOUTHWOOD, L. L. (ed.) *Practical guide to equine colic* Ames, IA: Ames, IA : Wiley-Blackwell.

HACKETT, E. S., EMBERTSON, R. M., HOPPER, S. A., WOODIE, J. B. & RUGGLES, A. J. 2015. Duration of disease influences survival to discharge of Thoroughbred mares with surgically treated large colon volvulus. *Equine Veterinary Journal,* 47**,** 650-654.

HAGGERTY, J. L., REID, R. J., FREEMAN, G. K., STARFIELD, B. H., ADAIR, C. E. & MCKENDRY, R. 2003. Continuity of care: a multidisciplinary review. *BMJ (Clinical research ed.),* 327**,** 1219-1221.

HALLSWORTH, M. & SANDERS, M. 2016. Nudge: Recent developments in behavioural science and public policy. *In:* SPOTSWOOD, F. (ed.) *Beyond behaviour change: Key issues, interdisciplinary approaches and future directions.* Policy Press.

HAMBRICK, D. Z. & ENGLE, R. W. 2002. Effects of domain knowledge, working memory capacity, and age on cognitive performance: An investigation of the knowledge-is-power hypothesis. *Cognitive psychology,* 44**,** 339-387.

HANDWERK, P. G., CARSON, C. & BLACKWELL, K. M. On-line vs. paper-and-pencil surveying of students: A case study. 40th Annual Meeting of the Association of Institutional Research, 2000.

HARACHI, T. W., ABBOTT, R. D., CATALANO, R. F., HAGGERTY, K. P. & FLEMING, C. B. 1999. Opening the black box: using process evaluation measures to assess implementation and theory building. *American journal of community psychology,* 27**,** 711-731.

HARDY, J., MINTON, M., ROBERTSON, J., BEARD, W. & BEARD, L. 2000. Nephrosplenic entrapment in the horse: a retrospective study of 174 cases. *Equine Veterinary Journal,* 32**,** 95-97.

HARITON, E. & LOCASCIO, J. J. 2018. Randomised controlled trials—The gold standard for effectiveness research. *BJOG: an international journal of obstetrics and gynaecology,* 125**,** 1716.

HARRISON, I. W. 1988. Equine large intestinal volvulus a review of 124 cases. *Veterinary surgery,* 17**,** 77-81.

HART, L. A., HART, B. L. & MADER, B. 1990. Humane euthanasia and companion animal death: caring for the animal, the client, and the veterinarian. *Journal of the American Veterinary Medical Association,* 197**,** 1292-1299.

HART, S. K., SOUTHWOOD, L. L. & ACETO, H. W. 2014. Impact of colic surgery on return to function in racing Thoroughbreds: 59 cases (1996–2009). *Journal of the American Veterinary Medical Association,* 244**,** 205-211.

HASSAN, E. 2006. Recall Bias can be a Threat to Retrospective and Prospective Research Designs. *Internet Journal of Epidemiology,* 3**,** 4.

HASSEL, D. M., LANGER, D. L., SNYDER, J. R., DRAKE, C. M., GOODELL, M. L. & WYLE, A. 1999. Evaluation of enterolithiasis in equids: 900 cases (1973-1996). *J Am Vet Med Assoc,* 214**,** 233-7.

HAUSBERGER, M., ROCHE, H., HENRY, S. & VISSER, E. K. 2008. A review of the human–horse relationship. *Applied animal behaviour science,* 109**,** 1-24.

HAWE, P., SHIELL, A., RILEY, T. & GOLD, L. 2004. Methods for exploring implementation variation and local context within a cluster randomised community intervention trial. *Journal of Epidemiology & Community Health,* 58**,** 788-793.

HEALE, R. & TWYCROSS, A. 2015. Validity and reliability in quantitative studies. *Evidence-based nursing,* 18**,** 66-67.

HEMSWORTH, L. M., JONGMAN, E. & COLEMAN, G. J. 2015. Recreational horse welfare: The relationships between recreational horse owner attributes and recreational horse welfare. *Applied Animal Behaviour Science,* 165**,** 1-16.

HERLITZ, J., BLOHM, M., HARTFORD, M., HJALMARSSON, Å., HOLMBERG, S. & KARLSON, B. 1989. Delay time in suspected

acute myocardial infarction and the importance of its modification. *Clinical cardiology,* 12**,** 370-374.

HETTS, S. & LAGONI, L. 1990. The owner of the pet with cancer. *Veterinary Clinics of North America: Small Animal Practice,* 20**,** 879-896.

HILLYER, M. & WRIGHT, C. 1997. Peritonitis in the horse. *Equine Veterinary Education,* 9**,** 136-142.

HILLYER, M. H., TAYLOR, F. G. & FRENCH, N. P. 2001. A cross-sectional study of colic in horses on thoroughbred training premises in the British Isles in 1997. *Equine Vet J,* 33**,** 380-5.

HILLYER, M. H., TAYLOR, F. G., PROUDMAN, C. J., EDWARDS, G. B., SMITH, J. E. & FRENCH, N. P. 2002. Case control study to identify risk factors for simple colonic obstruction and distension colic in horses. *Equine Vet J,* 34**,** 455-63.

HINCHCLIFF, K. W., RUSH, B. R. & FARRIS, J. W. 2005. Evaluation of plasma catecholamine and serum cortisol concentrations in horses with colic. *Journal of the American Veterinary Medical Association,* 227**,** 276.

HIRSCH, C. R. & MATHEWS, A. 2012. A cognitive model of pathological worry. *Behaviour Research and Therapy,* 50**,** 636-646.

HOCKENHULL, J., BIRKE, L. & CREIGHTON, E. 2010. The horse's tale: Narratives of caring for/about horses. *Society & Animals,* 18**,** 331-347.

HOCKENHULL, J. & CREIGHTON, E. 2013. A brief note on the information-seeking behavior of UK leisure horse owners. *Journal of Veterinary Behavior,* 8**,** 106-110.

HODGSON, C., LINDSAY, P. & RUBINI, F. 2009. Using mass media to teach the warning signs of stroke: the long and the short of it. *Health promotion journal of Australia,* 20**,** 58-64.

HOE, J. & HOARE, Z. 2012. Understanding quantitative research: part 1. *Nursing standard (Royal College of Nursing (Great Britain) : 1987),* 27**,** 52.

HOPS, H., DAVIS, B., LEVE, C. & SHEEBER, L. 2003. Cross-generational transmission of aggressive parent behavior: A prospective, mediational examination. *Journal of abnormal child psychology,* 31**,** 161-169.

HORN, K., MCCRACKEN, L., DINO, G. & BRAYBOY, M. 2008. Applying community-based participatory research principles to

the development of a smoking-cessation program for American Indian teens:“Telling our story”. *Health Education & Behavior,* 35**,** 44-69.

HOTCHKISS, J. W., REID, S. W. & CHRISTLEY, R. M. 2007a. A survey of horse owners in Great Britain regarding horses in their care. Part 1: Horse demographic characteristics and management. *Equine Vet J,* 39**,** 294-300.

HOTCHKISS, J. W., REID, S. W. & CHRISTLEY, R. M. 2007b. A survey of horse owners in Great Britain regarding horses in their care. Part 2: Risk factors for recurrent airway obstruction. *Equine Vet J,* 39**,** 301-8.

HOUDMONT, J., MADGWICK, P. & RANDALL, R. 2016. Sun safety in construction: a U.K. intervention study. *Occup Med (Lond),* 66**,** 20-6.

HUDSON, J. M., COHEN, N. D., GIBBS, P. G. & THOMPSON, J. A. 2001. Feeding practices associated with colic in horses. *Journal of the American Veterinary Medical Association,* 219**,** 1419-1425.

HUGHES, R. & HUBY, M. 2012. The construction and interpretation of vignettes in social research. *Social Work and Social Sciences Review,* 11**,** 36-51.

HUNTER, L. 2012. Challenging the reported disadvantages of e-questionnaires and addressing methodological issues of online data collection. *Nurse researcher,* 20.

HUSKAMP, B. & SCHEIDEMANN, W. 2000. Diagnosis and treatment of chronic recurrent caecal impaction. *Equine Vet J Suppl***,** 65-8.

IHLER, C. F., VENGER, J. L. & SKJERVE, E. 2004. Evaluation of clinical and laboratory variables as prognostic indicators in hospitalised gastrointestinal colic horses. *Acta Veterinaria Scandinavica,* 45**,** 109-118.

IMMONEN, I. A., KARIKOSKI, N., MYKKANEN, A., NIEMELA, T., JUNNILA, J. & TULAMO, R. M. 2017. Long-term follow-up on recovery, return to use and sporting activity: a retrospective study of 236 operated colic horses in Finland (2006-2012). *Acta Vet Scand,* 59**,** 5.

IRELAND, J. L., CLEGG, P. D., MCGOWAN, C. M., MCKANE, S. A., CHANDLER, K. J. & PINCHBECK, G. L. 2012. Comparison of owner-reported health problems with veterinary assessment of geriatric horses in the United Kingdom. *Equine Vet J,* 44**,** 94-100.

IRELAND, J. L., CLEGG, P. D., MCGOWAN, C. M., MCKANE, S. A. & PINCHBECK, G. L. 2011a. A cross-sectional study of geriatric horses in the United Kingdom. Part 2: Health care and disease. *Equine Vet J,* 43**,** 37-44.

IRELAND, J. L., CLEGG, P. D., MCGOWAN, C. M., PLATT, L. & PINCHBECK, G. L. 2011b. Factors associated with mortality of geriatric horses in the United Kingdom. *Prev Vet Med,* 101**,** 204-18.

IRELAND, J. L., WYLIE, C. E., COLLINS, S. N., VERHEYEN, K. L. & NEWTON, J. R. 2013. Preventive health care and owner-reported disease prevalence of horses and ponies in Great Britain. *Res Vet Sci,* 95**,** 418-24.

ISRAEL, B., SCHULZ, A., PARKER, E. & BECKER, A. 2001. Community-based participatory research: policy recommendations for promoting a partnership approach in health research. *Education for health,* 14**,** 182-197.

ISRAEL, B. A., SCHULZ, A. J., PARKER, E. A. & BECKER, A. B. 1998. Review of community-based research: assessing partnership approaches to improve public health. *Annual review of public health,* 19**,** 173-202.

ISRAEL, B. A., SCHULZ, A. J., PARKER, E. A., BECKER, A. B., ALLEN, A. J., GUZMAN, J. R. & LICHTENSTEIN, R. 2017. Critical issues in developing and following CBPR principles. *Community-based participatory research for health: Advancing social and health equity***,** 31-46.

ISSAOUI, L. 2012. Equine practitioner participation required for colic survey. *Vet Rec,* 171**,** 430.

JANZ, N. K. & BECKER, M. H. 1984. The health belief model: A decade later. *Health education quarterly,* 11**,** 1-47.

JENNINGS, K. M., CURTIS, L., BURFORD, J. H. & FREEMAN, S. L. 2014. Prospective survey of veterinary practitioners' primary assessment of equine colic: clinical features, diagnoses, and treatment of 120 cases of large colon impaction. *BMC veterinary research,* 10**,** S2.

JOHNSON, A. & KELLER, H. 2005. Results of treatments of 1.431 colic horses with special regard to 285 surgically treated horses from 1990 to 1997 at the Clinic for horses, General surgery and Radiology of the Freie Universitat Berlin. *Pferdeheilkunde,* 21**,** 427-+.

JOHNSON, B. & GRAY, R. 2010. A history of philosophical and theoretical issues for mixed methods research. *Sage handbook of mixed methods in social and behavioral research,* 2**,** 69-94.

JOHNSON, R. B. & ONWUEGBUZIE, A. J. 2004. Mixed methods research: A research paradigm whose time has come. *Educational researcher,* 33**,** 14-26.

JOHNSTON, M. & DIXON, D. 2008. Current issues and new directions in psychology and health: What happened to behaviour in the decade of behaviour? *Psychology and health,* 23**,** 509-513.

JUST, D. R. & WANSINK, B. 2009. Smarter lunchrooms: using behavioral economics to improve meal selection. *Choices,* 24**,** 1-7.

KALSBEEK, H. C. 1973. Indications for laparotomy in horses with colic. *Tijdschr Diergeneeskd,* 98**,** 963-7.

KALSBEEK, H. C. 1975. Indications for surgical intervention in equine colic. *J S Afr Vet Assoc,* 46**,** 101-5.

KANEENE, J. B., MILLER, R., ROSS, W. A., GALLAGHER, K., MARTENIUK, J. & ROOK, J. 1997. Risk factors for colic in the Michigan (USA) equine population. *Prev Vet Med,* 30**,** 23-36.

KANJI, N., COE, J. B., ADAMS, C. L. & SHAW, J. R. 2012. Effect of veterinarian-client-patient interactions on client adherence to dentistry and surgery recommendations in companion-animal practice. *Journal of the American Veterinary Medical Association,* 240**,** 427-436.

KAPLAN, S. A. & GARRETT, K. E. 2005. The use of logic models by community-based initiatives. *Evaluation and program planning,* 28**,** 167-172.

KAPTCHUK, T. J. 2001. The double-blind, randomized, placebo-controlled trial: gold standard or golden calf? *Journal of clinical epidemiology,* 54**,** 541-549.

KARLOVA, N. A. & FISHER, K. E. 2013. A social diffusion model of misinformation and disinformation for understanding human information behaviour.

KAYA, G., SOMMERFELD-STUR, I. & IBEN, C. 2009. Risk factors of colic in horses in Austria. *J Anim Physiol Anim Nutr (Berl),* 93**,** 339-49.

KELLY, M. P. 2016. The Politics of behaviour chnage. *In:* SPOTSWOOD, F. (ed.) *Beyond behaviour change: Key issues, interdisciplinary approaches and future directions.* Policy Press.

KELLY, M. P. & BARKER, M. 2016. Why is changing health-related behaviour so difficult? *Public Health,* 136**,** 109-16.

KING, M. F. & BRUNER, G. C. 2000. Social desirability bias: A neglected aspect of validity testing. *Psychology & Marketing,* 17**,** 79-103.

KLEEN, J. L., ATKINSON, O. & NOORDHUIZEN, J. P. 2011. Communication in production animal medicine: modelling a complex interaction with the example of dairy herd health medicine. *Irish veterinary journal,* 64**,** 8.

KLOHNEN, A., VACHON, A. & FISCHER, J. A. 1996. Use of diagnostic ultrasonography in horses with signs of acute abdominal pain. *Journal of the American Veterinary Medical Association,* 209**,** 1597-1601.

KLÜVER, J. 2011. A mathematical theory of communication: Meaning, information, and topology. *Complexity,* 16**,** 10-26.

KNOTT, D., MUERS, S. & ALDRIDGE, S. 2008. *Achieving Culture Change: a Policy Framework: a Discussion Paper by the Strategy Unit*, Cabinet Office, Strategy Unit.

KOGAN, L. R. 2010. The Internet and pet health information: perceptions and behaviors of pet owners and veterinarians. *Internet Journal of Veterinary Medicine,* 8.

KOPF, N. 1997. Rectal examination of the colic patient. *Current therapy in equine medicine,* 4**,** 170-174.

KORTTE, K. B. & WEGENER, S. T. 2004. Denial of Illness in Medical Rehabilitation Populations: Theory, Research, and Definition. *Rehabilitation Psychology,* 49**,** 187-199.

KRAYWINKEL, K., HEIDRICH, J., HEUSCHMANN, P. U., WAGNER, M. & BERGER, K. 2007. Stroke risk perception among participants of a stroke awareness campaign. *BMC public health,* 7**,** 39.

KREFTING, L. 1991. Rigor in Qualitative Research: The Assessment of Trustworthiness. *American Journal of Occupational Therapy,* 45**,** 214-222.

KRIEGER, J., ALLEN, C., CHEADLE, A., CISKE, S., SCHIER, J. K., SENTURIA, K. & SULLIVAN, M. 2002. Using community-based participatory research to address social determinants of health: lessons learned from Seattle Partners for Healthy Communities. *Health Education & Behavior,* 29**,** 361-382.

KRISTA, K. M. & KUEBELBECK, K. L. 2009. Comparison of survival rates for geriatric horses versus nongeriatric horses following exploratory celiotomy for colic. *Journal of the American Veterinary Medical Association,* 235**,** 1069-1072.

KRUMPAL, I. 2013. Determinants of social desirability bias in sensitive surveys: a literature review. *Quality & Quantity,* 47**,** 2025-2047.

KUHLE, B. X., BARBER, J. M. & BRISTOL, A. S. 2009. Predicting students' performance in introductory psychology from their psychology misconceptions. *Journal of Instructional Psychology,* 36**,** 119.

KVIDERA, S. & KOUTSTAAL, W. 2008. Confidence and decision type under matched stimulus conditions: Overconfidence in perceptual but not conceptual decisions. *Journal of Behavioral Decision Making,* 21**,** 253-281.

KWAK, N. & RADLER, B. 2002. A comparison between mail and web surveys: Response pattern, respondent profile, and data quality. *Journal of official statistics,* 18**,** 257.

LAMAL, P. A. 1979. College students' common beliefs about psychology. *Teaching of Psychology,* 6**,** 155-158.

LANDAU, J. D. & BAVARIA, A. J. 2003. Does deliberate source monitoring reduce students' misconceptions about psychology? *Teaching of Psychology*.

LANZA, M. L., ZEISS, R. A. & RIERDAN, J. 2009. Multiple Perspectives on Assault: The 360-Degree Interview. *Journal of the American Psychiatric Nurses Association,* 14**,** 413-420.

LAUMEN, E., DOHERR, M. G. & GERBER, V. 2010. Relationship of horse owner assessed respiratory signs index to characteristics of recurrent airway obstruction in two Warmblood families. *Equine Vet J,* 42**,** 142-8.

LECKIE, E. J. 2001. The equine population in the UK. *A report for the International League for the Protection of Horses (ILPH). World Horse Welfare, Anne Colvin House, Ada Cole Avenue, Snetterton, Norfolk, NR16 2LR, UK*.

LECOUTURIER, J., RODGERS, H., MURTAGH, M. J., WHITE, M., FORD, G. A. & THOMSON, R. G. 2010. Systematic review of mass media interventions designed to improve public recognition of stroke symptoms, emergency response and early treatment. *BMC public health,* 10**,** 784.

LEFEBVRE, D., PIRIE, R. S., HANDEL, I. G., ELCE, Y. A., LECLERE, M. & HUDSON, N. P. 2017. Colic in the Domesticated Horse Population: Factors Affecting The Owners' Decision To Pursue Treatment And Impact On Emergency Veterinary Care Outcomes. *Equine Veterinary Education,* 29**,** 20-20.

LEFEVER, S., DAL, M. & MATTHIASDOTTIR, A. 2007. Online data collection in academic research: advantages and limitations. *British Journal of Educational Technology,* 38**,** 574-582.

LEVINE, J., WARRENBURG, S., KERNS, R., SCHWARTZ, G., DELANEY, R., FONTANA, A., GRADMAN, A., SMITH, S., ALLEN, S. & CASCIONE, R. 1987. The role of denial in recovery from coronary heart disease. *Psychosomatic Medicine*.

LEWIN, S., GLENTON, C. & OXMAN, A. D. 2009. Use of qualitative methods alongside randomised controlled trials of complex healthcare interventions: methodological study. *Bmj,* 339**,** b3496.

LIGHTFOOT, K. L., BURFORD, J. H., ENGLAND, G. C. W., BOWEN, M. & FREEMAN, S. L. 2018. Investigation into the telephone triage of colic cases within UK veterinary practice. *Equine Veterinary Journal,* 50**,** 7-8.

LINDEGAARD, C., EKSTROM, C. T., WULF, S. B., VENDELBO, J. M. & ANDERSEN, P. H. 2011. Nephrosplenic entrapment of the large colon in 142 horses (2000-2009): analysis of factors associated with decision of treatment and short-term survival. *Equine Vet J Suppl***,** 63-8.

LIPSON, M. Y. 1982. Learning new information from text: The role of prior knowledge and reading ability. *Journal of Reading Behavior,* 14**,** 243-261.

LITTLE, D., TOMLINSON, J. E. & BLIKSLAGER, A. T. 2005. Post operative neutrophilic inflammation in equine small intestine after manipulation and ischaemia. *Equine Veterinary Journal,* 37**,** 329-335.

LOFGREN, E. A., SHULTZ, A. M. & PORR, C. S. 2015. Social Media and Equine Science: The Effect of LinkedIn on In-Class Engagement of Equine Higher Education Students 1. *NACTA Journal,* 59**,** 208.

LONG, R. E. & MORGAN, A. C. 2010. The Elements of Two-Year Equine Degree Programs in the Mid-Western US: A Delphi Study. *NACTA Journal,* 54.

LORENZ, K. 2002. *On aggression*, Psychology Press.

LUE, T. W., PANTENBURG, D. P. & CRAWFORD, P. M. 2008. Impact of the owner-pet and client-veterinarian bond on the care that pets receive. *Journal of the American Veterinary Medical Association,* 232**,** 531-540.

LUNDIN, C., SULLINS, K., WHITE, N., CLEM, M., DEBOWES, R. & PFEIFFER, C. 1989. Induction of peritoneal adhesions with small intestinal ischaemia and distention in the foal. *Equine veterinary journal,* 21**,** 451-458.

MACDONALD, M. H., PASCOE, J. R., STOVER, S. M. & MEAGHER, D. M. 1990. Survival after small intestine resection and anastomosis in horses. *Veterinary Surgery,* 18**,** 415-423.

MACKAY, R. 1992. Endotoxemia. *Large animal internal medicine,* 4**,** 711-23.

MAHER, O., PUCHALSKI, S. M., DRAKE, C. M. & LE JEUNE, S. 2011. Abdominal computed radiography for the diagnosis of enterolithiasis in horses: 142 cases (2003–2007). *Journal of the American Veterinary Medical Association,* 239**,** 1483-1485.

MAIO, G. R. 2011. Don't mind the gap between values and action.

MAIR, T. & HILLYER, M. 1997. Chronic colic in the mature horse: a retrospective review of 106 cases. *Equine veterinary journal,* 29**,** 415-420.

MAIR, T. S. & SMITH, L. J. 2005a. Survival and complication rates in 300 horses undergoing surgical treatment of colic. Part 1: Short-term survival following a single laparotomy. *Equine Vet J,* 37**,** 296-302.

MAIR, T. S. & SMITH, L. J. 2005b. Survival and complication rates in 300 horses undergoing surgical treatment of colic. Part 2: Short-term complications. *Equine Vet J,* 37**,** 303-9.

MAIR, T. S. & SMITH, L. J. 2005c. Survival and complication rates in 300 horses undergoing surgical treatment of colic. Part 3: Long-term complications and survival. *Equine Vet J,* 37**,** 310-4.

MARTEAU, T. M., HOLLANDS, G. J. & KELLY, M. P. 2015. Changing population behavior and reducing health disparities: Exploring the potential of "choice architecture" interventions. *Emerging behavioral and social science perspectives on population health. Bethesda, MD: National Institutes of Health/Agency For Healthcare Research and Quality,* 2015**,** 105-126.

MARTEAU, T. M., OGILVIE, D., ROLAND, M., SUHRCKE, M. & KELLY, M. P. 2011. Judging nudging: can nudging improve population health? *BMJ,* 342**,** d228.

MARTELL, D., ATKIN, C. K., HEMBROFF, L. A., SMITH, S., BAUMER, A. J. & GREENAMYER, J. 2006. College students and "celebration drinking". *Social Norms Review,* 1**,** 10-17.

MARTIN, W. E. & BRIDGMON, K. D. 2012. *Quantitative and statistical research methods: From hypothesis to results*, John Wiley & Sons.

MATHEWS, A. 1990. Why worry? The cognitive function of anxiety. *Behaviour research and therapy,* 28**,** 455-468.

MATTHEWS, K. 2006. Sepsis/Septic shock. *W: Veterinary Emergency and Critical Care Manual. Edit: Mathews K., A Lifelearn Publication***,** 588-596.

MATTHEWS, S., DART, A. J., REID, S. W. J., DOWLING, B. A. & HODGSON, D. R. 2002. Predictive values, sensitivity and specificity of abdominal fluid variables in determining the need for surgery in horses with an acute abdominal crisis. *Australian Veterinary Journal,* 80**,** 132-136.

MAXWELL, K. A. 2002. Friends: The role of peer influence across adolescent risk behaviors. *Journal of Youth and adolescence,* 31**,** 267-277.

MAYS, N. & POPE, C. 2000. Assessing quality in qualitative research. *Bmj,* 320**,** 50-52.

MCANULTY, J. & STONE, W. 1997. The effects of ischemia and reperfusion on mucosal respiratory function, adenosine triphosphate, electrolyte, and water content in the ascending colon of ponies. *Veterinary Surgery,* 26**,** 172-181.

MCCARTHY, H. E., PROUDMAN, C. & FRENCH, N. 2001. Epidemiology of equine grass sickness: a literature review (1909–1999). *Veterinary Record,* 149**,** 293-300.

MCCORMICK, R. 1997. Conceptual and procedural knowledge. *International journal of technology and design education,* 7**,** 141-159.

MCCOY, A. M., HACKETT, E. S., WAGNER, A. E., MAMA, K. R. & HENDRICKSON, D. A. 2011. Pulmonary gas exchange and plasma lactate in horses with gastrointestinal disease undergoing emergency exploratory laparotomy: a comparison

with an elective surgery horse population. *Veterinary surgery : VS,* 40**,** 601.

MCGOWAN, T. W., PHILLIPS, C. J., HODGSON, D. R., PERKINS, N. & MCGOWAN, C. M. 2012. Euthanasia in aged horses: relationship between the owner's personality and their opinions on, and experience of, euthanasia of horses. *Anthrozoös,* 25**,** 261-275.

MCKENZIE, J. E., O'CONNOR, D. A., PAGE, M. J., MORTIMER, D. S., FRENCH, S. D., WALKER, B. F., KEATING, J. L., GRIMSHAW, J. M., MICHIE, S. & FRANCIS, J. J. 2010. Improving the care for people with acute low-back pain by allied health professionals (the ALIGN trial): a cluster randomised trial protocol. *Implementation Science,* 5**,** 86.

MCWHINNEY, I. 1975. Continuity of care in family practice. Part 2: implications of continuity. *The Journal of family practice,* 2**,** 373-374.

MELDRUM, M. L. 2000. A brief history of the randomized controlled trial: From oranges and lemons to the gold standard. *Hematology/oncology clinics of North America,* 14**,** 745-760.

MELLOR, D., LOVE, S., GETTINBY, G. & REID, S. 1999. Demographic characteristics of the equine population of northern Britain. *Veterinary Record,* 145**,** 299-304.

MELLOR, D. J., REID, S. W. J., LOVE, S., WALKER, R. & GETTINBY, G. 2001. Sentinel practice-based survey of the management and health of horses in northern Britain. *Veterinary Record,* 149**,** 417.

MERCER, S. L., DEVINNEY, B. J., FINE, L. J., GREEN, L. W. & DOUGHERTY, D. 2007. Study designs for effectiveness and translation research: identifying trade-offs. *American journal of preventive medicine,* 33**,** 139-154. e2.

METZGER, M. J., FLANAGIN, A. J., EYAL, K., LEMUS, D. R. & MCCANN, R. M. 2003. Credibility for the 21st century: Integrating perspectives on source, message, and media credibility in the contemporary media environment. *Annals of the International Communication Association,* 27**,** 293-335.

MICHIE, S. 2014. *The behaviour change wheel : a guide to designing interventions*, Sutton, Surrey : Silverback.

MICHIE, S., FIXSEN, D., GRIMSHAW, J. M. & ECCLES, M. P. 2009. Specifying and reporting complex behaviour change interventions: the need for a scientific method. BioMed Central.

MICHIE, S., JOHNSTON, M., ABRAHAM, C., LAWTON, R., PARKER, D. & WALKER, A. 2005. Making psychological theory useful for implementing evidence based practice: a consensus approach. *BMJ Quality & Safety,* 14**,** 26-33.

MICHIE, S., PILLING, S., GARETY, P., WHITTY, P., ECCLES, M. P., JOHNSTON, M. & SIMMONS, J. 2007. Difficulties implementing a mental health guideline: an exploratory investigation using psychological theory. *Implementation Science,* 2**,** 8.

MICHIE, S. & PRESTWICH, A. 2010. Are interventions theory-based? Development of a Theory Coding Scheme.

MICHIE, S., VAN STRALEN, M. M. & WEST, R. 2011. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation science,* 6**,** 42.

MICHIE, S., WEST, R., CAMPBELL, R., BROWN, J. & GAINFORTH, H. 2014. *ABC of behaviour change theories*, Silverback publishing.

MILES, M. B., HUBERMAN, A. M. & SALDAÑA, J. 2014. Qualitative data analysis: A methods sourcebook. 3rd. *ed: Thousand Oaks, CA: Sage*.

MILGRAM, S., BICKMAN, L. & BERKOWITZ, L. 1969. Note on the drawing power of crowds of different size. *Journal of personality and social psychology,* 13**,** 79.

MILLER, N. E. & DOLLARD, J. 1941. Social learning and imitation.

MINKLER, M. 2004. Ethical challenges for the “outside” researcher in community-based participatory research. *Health Education & Behavior,* 31**,** 684-697.

MINKLER, M. 2005. Community-based research partnerships: challenges and opportunities. *Journal of urban health,* 82**,** ii3-ii12.

MINKLER, M., THOMPSON, M., BELL, J., ROSE, K. & REDMAN, D. 2002. Using community involvement strategies in the fight against infant mortality: lessons from a multisite study of the national Healthy Start experience. *Health Promotion Practice,* 3**,** 176-187.

MONTANARO, E. A. & BRYAN, A. D. 2014. Comparing theory-based condom interventions: health belief model versus theory of planned behavior. *Health Psychology,* 33**,** 1251.

MOON, K. & BLACKMAN, D. 2014. A guide to understanding social science research for natural scientists. *Conservation Biology,* 28**,** 1167-1177.

MOORE, R., HARDY, J. & MUIR, W. 1995. Mural blood flow distribution in the large colon of horses during low-flow ischemia and reperfusion. *American journal of veterinary research,* 56**,** 812-818.

MOREIRA, M. T., SMITH, L. A. & FOXCROFT, D. 2009. Social norms interventions to reduce alcohol misuse in university or college students. *Cochrane Database of Systematic Reviews*.

MORGAN-TRIMMER, S. 2015. Improving process evaluations of health behavior interventions: learning from the social sciences. *Evaluation & the health professions,* 38**,** 295-314.

MORGAN, D. L. 1998. Practical strategies for combining qualitative and quantitative methods: Applications to health research. *Qualitative health research,* 8**,** 362-376.

MORGAN, D. L. 2007. Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of mixed methods research,* 1**,** 48-76.

MORRIS, P. 2012. Managing pet owners' guilt and grief in veterinary euthanasia encounters. *Journal of Contemporary Ethnography,* 41**,** 337-365.

MORSE, J. M. 1991. Approaches to qualitative-quantitative methodological triangulation. *Nursing research,* 40**,** 120-123.

MORTON, A. 1996. Philosophy in practice: an introduction to the main questions.

MORTON, A. J. & BLIKSLAGER, A. T. 2002. Surgical and postoperative factors influencing short-term survival of horses following small intestinal resection: 92 cases (1994-2001). *Equine Vet J,* 34**,** 450-4.

MOSES, J. & KNUTSEN, T. 2012. *Ways of knowing: Competing methodologies in social and political research*, Macmillan International Higher Education.

MULILIS, J. P. A. L., R 1990. Behavioral Change in Earthquake Preparedness Due to Negative Threat Appeals: A Test of Protection Motivation Theory.

MUNDAY, J. S., LÖHR, C. V. & KIUPEL, M. 2016. Tumors of the Alimentary Tract. *Tumors in Domestic Animals.*

NAPLES, N. A. 1992. Activist mothering: Cross-generational continuity in the community work of women from low-income urban neighborhoods. *Gender & Society,* 6**,** 441-463.

NAYLOR, R., TAYLOR, A., KNOWLES, E., WILFORD, S., LINNENKOHL, W., MAIR, T. & JOHNS, I. 2014. Comparison of flunixin meglumine and meloxicam for post operative management of horses with strangulating small intestinal lesions. *Equine veterinary journal,* 46**,** 427-434.

NEUMAN, W. L. 2013. *Social Research Methods: Pearson New International Edition,* Harlow, United Kingdom, UNITED KINGDOM, Pearson Education Limited.

NEWCOMER, K. E., HATRY, H. P. & WHOLEY, J. S. 2015. *Handbook of practical program evaluation*, Wiley Online Library.

NEWMAN, K. & NOLLEN, S. 1998. *Radical organizational change*, Thousand Oaks, CA: Sage.

NEWMAN, M. G. & LLERA, S. J. 2011. A novel theory of experiential avoidance in generalized anxiety disorder: A review and synthesis of research supporting a contrast avoidance model of worry. *Clinical psychology review,* 31**,** 371-382.

NIGG, C. R., ALLEGRANTE, J. P. & ORY, M. 2002. Theory-comparison and multiple-behavior research: common themes advancing health behavior research. *Health Education Research,* 17**,** 670-679.

NIJENHUIS, E. R., VANDERLINDEN, J. & SPINHOVEN, P. 1998. Animal defensive reactions as a model for trauma-induced dissociative reactions. *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies,* 11**,** 243-260.

NOLAN, J. M., SCHULTZ, P. W., CIALDINI, R. B., GOLDSTEIN, N. J. & GRISKEVICIUS, V. 2008. Normative social influence is underdetected. *Pers Soc Psychol Bull,* 34**,** 913-23.

NOLEN-WALSTON, R., PAXSON, J. & RAMEY, D. W. 2007. Evidence-based gastrointestinal medicine in horses: it's not about your gut instincts. *Vet Clin North Am Equine Pract,* 23**,** 243-66.

NOORDHUIZEN, J. P. T. M., FRANKENA, K., THRUSFIELD, M. V. & GRAAT, E. 2001. *Application of quantitative methods in veterinary epidemiology*, Wageningen Pers.

NOVICK, G. 2008. Is there a bias against telephone interviews in qualitative research? *Research in nursing & health,* 31**,** 391-398.

NUNNALLY, J. C. 1994. The assessment of reliability. *Psychometric theory*.

O'CARROLL, R., SMITH, K., GRUBB, N., FOX, K. & MASTERTON, G. 2001. Psychological factors associated with delay in attending hospital following a myocardial infarction. *Journal of psychosomatic research,* 51**,** 611-614.

OAKLEY, A., STRANGE, V., BONELL, C., ALLEN, E. & STEPHENSON, J. 2006. Process evaluation in randomised controlled trials of complex interventions. *Bmj,* 332**,** 413-416.

OLANDER, F. & THØGERSEN, J. 1995. Understanding of consumer behaviour as a prerequisite for environmental protection. *Journal of consumer policy,* 18**,** 345-385.

ORSINI, J., ELSER, A., GALLIGAN, D., DONAWICK, W. & KRONFELD, D. 1988. Prognostic index for acute abdominal crisis (colic) in horses. *American journal of veterinary research,* 49**,** 1969-1971.

ORSINI, J. A. 2011. A Fresh Look at the Process of Arriving at a Clinical Prognosis Part 2: Colic. *Journal of Equine Veterinary Science,* 31**,** 370-378.

OXFORD ENGLISH DICTIONARY *"misinformation, n."*, Oxford University Press.

PANTER-BRICK, C., CLARKE, S. E., LOMAS, H., PINDER, M. & LINDSAY, S. W. 2006. Culturally compelling strategies for behaviour change: a social ecology model and case study in malaria prevention. *Social science & medicine,* 62**,** 2810-2825.

PARKS, C. D., SANNA, L. J. & BEREL, S. R. 2001. Actions of similar others as inducements to cooperate in social dilemmas. *Personality and Social Psychology Bulletin,* 27**,** 345-354.

PARRY, B. W., GAY, C. C. & ANDERSON, G. A. 1983. Assessment of the necessity for surgical intervention in cases of equine colic: a retrospective study. *Equine Vet J,* 15**,** 216-21.

PASCOE, P. J., DUCHARME, N. G., DUCHARME, G. R. & LUMSDEN, J. H. 1990. A Computer-Derived Protocol Using Recursive Partitioning to Aid in Estimating Prognosis of Horses with Abdominal-Pain in Referral Hospitals. *Canadian Journal of Veterinary Research-Revue Canadienne De Recherche Veterinaire,* 54**,** 373-378.

PASCOE, P. J., MCDONELL, W. N., TRIM, C. M. & VAN GORDER, J. 1983. Mortality rates and associated factors in equine colic

operations - a retrospective study of 341 operations. *Can Vet J,* 24**,** 76-85.

PATEL, G. W., RODERMAN, N., GEHRING, H., SAAD, J. & BARTEK, W. 2010. Assessing the effect of the Surviving Sepsis Campaign treatment guidelines on clinical outcomes in a community hospital. *Annals of Pharmacotherapy,* 44**,** 1733-1738.

PATTON, M. Q. 2017. *Principles-focused evaluation: The GUIDE*, Guilford Publications.

PAULHUS, D. L., HARMS, P. D., BRUCE, M. N. & LYSY, D. C. 2003. The over-claiming technique: Measuring self-enhancement independent of ability. *Journal of personality and social psychology,* 84**,** 890.

PAYNE, E., DEARAUGO, J., BENNETT, P. & MCGREEVY, P. 2016. Exploring the existence and potential underpinnings of dog–human and horse–human attachment bonds. *Behavioural processes,* 125**,** 114-121.

PEARSON, N. Y. 2003. *A study of horse ownership and management in Victoria, Australia.* Masters, University of Melbourne.

PEARSON, S. D. & RAEKE, L. H. 2000. Patients' trust in physicians: many theories, few measures, and little data. *Journal of general internal medicine,* 15**,** 509-513.

PELOSO, J. G. & COHEN, N. D. 2012. Use of serial measurements of peritoneal fluid lactate concentration to identify strangulating intestinal lesions in referred horses with signs of colic. *Javma-Journal of the American Veterinary Medical Association,* 240**,** 1208-1217.

PERKINS, H. W. & BERKOWITZ, A. D. 1986. Perceiving the community norms of alcohol use among students: Some research implications for campus alcohol education programming. *International journal of the Addictions,* 21**,** 961-976.

PETERS, G. J., RUITER, R. A. & KOK, G. 2013. Threatening communication: a critical re-analysis and a revised meta-analytic test of fear appeal theory. *Health Psychol Rev,* 7**,** S8-S31.

PIHL, T. H., ANDERSEN, P. H., KJELGAARD-HANSEN, M., MORCK, N. B. & JACOBSEN, S. 2013. Serum amyloid A and haptoglobin concentrations in serum and peritoneal fluid of healthy horses and horses with acute abdominal pain. *Vet Clin Pathol,* 42**,** 177-83.

PINKER, S. 2011. *The better angels of our nature: The decline of violence in history and its causes*, Penguin uk.

POLLARD, D., WYLIE, C. E., VERHEYEN, K. L. P. & NEWTON, J. R. 2017. Assessment of horse owners' ability to recognise equine laminitis: A cross-sectional study of 93 veterinary diagnosed cases in Great Britain. *Equine Vet J,* 49**,** 759-766.

PORTER, S. R. & WHITCOMB, M. E. 2003. The impact of contact type on web survey response rates. *The Public Opinion Quarterly,* 67**,** 579-588.

POWER, E. & WARDLE, J. 2015. Change in public awareness of symptoms and perceived barriers to seeing a doctor following Be Clear on Cancer campaigns in England. *Br J Cancer,* 112 Suppl 1**,** S22-6.

PRASAD, M., PERRIN, A. J., BEZILA, K., HOFFMAN, S. G., KINDLEBERGER, K., MANTURUK, K. & POWERS, A. S. 2009. "There must be a reason": Osama, Saddam, and inferred justification. *Sociological Inquiry,* 79**,** 142-162.

PRATT, S., HASSEL, D., DRAKE, C. & SNYDER, J. Clinical characteristics of horses with gastrointestinal ruptures revealed during initial diagnostic evaluation: 149 cases (1990-2002). 49th Annual Convention of the American Association of Equine Practitioners, New Orleans, Louisiana.[fecha de acceso 11 de marzo de 2010], 2003.

PRENTICE-DUNN, S. & ROGERS, R. W. 1986. Protection motivation theory and preventive health: Beyond the health belief model. *Health education research,* 1**,** 153-161.

PRICE, J., MARQUES, J. M., WELSH, E. M. & WARAN, N. K. 2002. Pilot epidemiological study of attitudes towards pain in horses. *Vet Rec,* 151**,** 570-5.

PRITCHETT, L. C., ULIBARRI, C., ROBERTS, M. C., SCHNEIDER, R. K. & SELLON, D. C. 2003. Identification of potential physiological and behavioral indicators of postoperative pain in horses after exploratory celiotomy for colic. *Applied Animal Behaviour Science,* 80**,** 31-43.

PROCHASKA, D. A. 1982. SELF-CHANGE AND THERAPY CHANGE OF SMOKING BEHAVIOR: A COMPARISON OF PROCESSES OF CHANGE IN CESSATION AND MAINTENANCE.

PROCHASKA, J. O., JOHNSON, S. & LEE, P. 1998. The transtheoretical model of behavior change.

PROFFITT, D. 1999. Naive physics. *The MIT encyclopedia of the cognitive sciences***,** 577-579.

PROUDMAN, C., DUGDALE, A., SENIOR, J., EDWARDS, G., SMITH, J., LEUWER, M. & FRENCH, N. 2006. Pre-operative and anaesthesia-related risk factors for mortality in equine colic cases. *The veterinary journal,* 171**,** 89-97.

PROUDMAN, C. J., EDWARDS, G. B., BARNES, J. & FRENCH, N. P. 2005a. Modelling long-term survival of horses following surgery for large intestinal disease. *Equine Vet J,* 37**,** 366-70.

PROUDMAN, C. J., EDWARDS, G. B., BARNES, J. & FRENCH, N. R. 2005b. Factors affecting long-term survival of horses recovering from surgery of the small intestine. *Equine Vet J,* 37**,** 360-5.

PROUDMAN, C. J., SMITH, J. E., EDWARDS, G. B. & FRENCH, N. P. 2002a. Long-term survival of equine surgical colic cases. Part 1: patterns of mortality and morbidity. *Equine Vet J,* 34**,** 432-7.

PROUDMAN, C. J., SMITH, J. E., EDWARDS, G. B. & FRENCH, N. P. 2002b. Long-term survival of equine surgical colic cases. Part 2: modelling postoperative survival. *Equine Vet J,* 34**,** 438-43.

PUOTUNENREINERT, A. 1986. Study of Variables Commonly Used in Examination of Equine Colic Cases to Assess Prognostic Value. *Equine Veterinary Journal,* 18**,** 275-277.

QUACKENBUSH, J. 1985. The death of a pet. How it can affect owners. *The Veterinary Clinics of North America. Small Animal Practice,* 15**,** 395-402.

RAGLE, C. A., MEAGHER, D. M., LACROIX, C. A. & HONNAS, C. M. 1989. Surgical treatment of sand colic results in 40 horses. *Veterinary surgery,* 18**,** 48-51.

RAHM, E. & DO, H. H. 2000. Data cleaning: Problems and current approaches. *IEEE Data Eng. Bull.,* 23**,** 3-13.

REEVES, B. C., HIGGINS, J. P., RAMSAY, C., SHEA, B., TUGWELL, P. & WELLS, G. A. 2013. An introduction to methodological issues when including non-randomised studies in systematic reviews on the effects of interventions. *Research Synthesis Methods,* 4**,** 1-11.

REEVES, J., VANSTEENHOUSE, J., STASHAK, T., YOVICH, J. & COCKERELL, G. 1990a. Failure to demonstrate reperfusion injury following ischaemia of the equine large colon using dimethyl sulphoxide. *Equine veterinary journal,* 22**,** 126-132.

REEVES, M., CURTIS, C., SALMAN, M., STASHAK, T. & REIF, J. Descriptive epidemiology and risk factors indicating the need for surgery and evaluation of prognosis. The Morris Animal Foundation Colic Study. Proceedings of the annual convention of the American Association of Equine Practitioners (USA), 1988.

REEVES, M. J., CURTIS, C. R., SALMAN, M. D. & HILBERT, B. J. 1989. Prognosis in Equine Colic Patients Using Multivariable Analysis. *Canadian Journal of Veterinary Research-Revue Canadienne De Recherche Veterinaire,* 53**,** 87-94.

REEVES, M. J., CURTIS, C. R., SALMAN, M. D., REIF, J. S. & STASHAK, T. S. 1990b. A Multivariable Prognostic Model for Equine Colic Patients. *Preventive Veterinary Medicine,* 9**,** 241-257.

REEVES, M. J., CURTIS, C. R., SALMAN, M. D., STASHAK, T. S. & REIF, J. S. 1992. Validation of Logistic-Regression Models Used in the Assessment of Prognosis and the Need for Surgery in Equine Colic Patients. *Preventive Veterinary Medicine,* 13**,** 155-172.

REEVES, M. J., SALMAN, M. D. & SMITH, G. 1996. Risk factors for equine acute abdominal disease (colic): Results from a multi-center case-control study. *Preventive Veterinary Medicine,* 26**,** 285-301.

REJA, U., MANFREDA, K. L., HLEBEC, V. & VEHOVAR, V. 2003. Open-ended vs. close-ended questions in web questionnaires. *Developments in applied statistics,* 19**,** 159-177.

RENO, R. R., CIALDINI, R. B. & KALLGREN, C. A. 1993. The transsituational influence of social norms. *Journal of personality and social psychology,* 64**,** 104.

RESNICOW, K., DAVIS, M., SMITH, M., LAZARUS-YAROCH, A., BARANOWSKI, T., BARANOWSKI, J., DOYLE, C. & WANG, D. T. 1998. How best to measure implementation of school health curricula: a comparison of three measures. *Health Education Research,* 13**,** 239-250.

RETTMER, H., HOFFMAN, A., LANZ, S., OERTLY, M. & GERBER, V. 2015. Owner-reported coughing and nasal discharge are associated with clinical findings, arterial oxygen tension, mucus score and bronchoprovocation in horses with recurrent airway obstruction in a field setting. *Equine veterinary journal,* 47**,** 291-295.

RICHENS, I. F., HOUDMONT, J., WAPENAAR, W., SHORTALL, O., KALER, J., O'CONNOR, H. & BRENNAN, M. L. 2018.

Application of multiple behaviour change models to identify determinants of farmers' biosecurity attitudes and behaviours. *Prev Vet Med,* 155**,** 61-74.

RIDD, M., SHAW, A., LEWIS, G. & SALISBURY, C. 2009. The patient–doctor relationship: a synthesis of the qualitative literature on patients' perspectives. *British Journal of General Practice,* 59**,** e116.

RIETMANN, T., STAUFFACHER, M., BERNASCONI, P., AUER, J. A. & WEISHAUPT, M. A. 2004. The association between heart rate, heart rate variability, endocrine and behavioural pain measures in horses suffering from laminitis. *Journal of Veterinary Medicine Series A,* 51**,** 218-225.

ROBBINS, H. J., CASEY, R. A., CLEMENTS, J., GRUFFYDD-JONES, T. & MURRAY, J. K. 2018. Assessing the impact of a regional UK feline neutering campaign. *Veterinary Record,* 182**,** 291-291.

ROBERGE, D., BEAULIEU, M.-D., HADDAD, S., LEBEAU, R. & PINEAULT, R. 2001. Loyalty to the regular care provider: patients' and physicians' views. *Family Practice,* 18**,** 53-59.

ROBINSON, I. 1999. The human-horse relationship: how much do we know? *Equine Veterinary Journal,* 31**,** 42-45.

ROBINSON, N. E., BERNEY, C., EBERHART, S., DEFEIJTER-RUPP, H. L., JEFCOAT, A. M., CORNELISSE, C. J., GERBER, V. M. & DERKSEN, F. J. 2003. Coughing, mucus accumulation, airway obstruction, and airway inflammation in control horses and horses affected with recurrent airway obstruction. *American journal of veterinary research,* 64**,** 550-557.

ROGERS, E. M. 1995. Diffusion of Innovations: modifications of a model for telecommunications. *Die diffusion von innovationen in der telekommunikation.* Springer.

ROGERS, R. W. 1975. A protection motivation theory of fear appeals and attitude change1. *The journal of psychology,* 91**,** 93-114.

ROGERS, R. W. & PRENTICE-DUNN, S. 1997. Protection motivation theory.

ROSENSTOCK, I. 1966. Why people use health services. The Milbank Memorial Fund Quarterly, 44, 94–127.

ROSENSTOCK, I. M. 1960. What research in motivation suggests for public health. *American Journal of Public Health and the Nations Health,* 50**,** 295-302.

ROSENSTOCK, I. M., STRECHER, V. J. & BECKER, M. H. 1988. Social learning theory and the health belief model. *Health education quarterly,* 15**,** 175-183.

ROSS, C. B. 2013. *Pet loss and human emotion: A guide to recovery*, Taylor & Francis.

ROSS, L. & BERKOWITZ, L. 1977. Advances in experimental social psychology. *The Intuitive Psychologist and His Shortcomings: Distortions in the Attribution Process,* 10**,** 173-220.

ROSSI, P. H., LIPSEY, M. W. & HENRY, G. T. 2018. *Evaluation: A systematic approach*, Sage publications.

ROTHENBUHLER, R., HAWKINS, J. F., ADAMS, S. B., LESCUN, T. B., WEIL, A. B., GLICKMAN, L. T., FESSLER, J. F. & GLICKMAN, N. G. 2006. Evaluation of surgical treatment for signs of acute abdominal pain in draft horses: 72 cases (1983–2002). *Journal of the American Veterinary Medical Association,* 228**,** 1546-1550.

ROYAL COLLEGE OF VETERINARY SURGEONS. 2018. RCVS Facts. Available: https://www.rcvs.org.uk/news-and-views/publications/?filter-keyword=RCVS+FACTS&filter-type=&filter-month=&filter-year=&filter=Filter [Accessed 05/05/2020].

RUITER, R. A., ABRAHAM, C. & KOK, G. 2001. Scary warnings and rational precautions: A review of the psychology of fear appeals. *Psychology and health,* 16**,** 613-630.

RYLE, G. 2009. *The concept of mind*, Routledge.

SALEM, S. E., PROUDMAN, C. J. & ARCHER, D. C. 2016. Prevention of post operative complications following surgical treatment of equine colic: Current evidence. *Equine Vet J,* 48**,** 143-51.

SAMPSON, H. & JOHANNESSEN, I. A. 2020. Turning on the tap: the benefits of using 'real-life'vignettes in qualitative research interviews. *Qualitative Research,* 20**,** 56-72.

SANCHEZ, L. & MERRITT, A. 2005. Colorectal distention in the horse: visceral sensitivity, rectal compliance and effect of iv xylazine or intrarectal lidocaine. *Equine veterinary journal,* 37**,** 70-74.

SANDELOWSKI, M. 2000. Combining Qualitative and Quantitative Sampling, Data Collection, and Analysis Techniques in Mixed-Method Studies. *Research in Nursing & Health,* 23**,** 246-255.

SANSON-FISHER, R. W., BONEVSKI, B., GREEN, L. W. & D'ESTE, C. 2007. Limitations of the randomized controlled trial in evaluating

population-based health interventions. *American journal of preventive medicine,* 33**,** 155-161.

SAUNDERS, R. P., EVANS, M. H. & JOSHI, P. 2005. Developing a process-evaluation plan for assessing health promotion program implementation: a how-to guide. *Health promotion practice,* 6**,** 134-147.

SCANTLEBURY, C. E., ARCHER, D. C., PROUDMAN, C. J. & PINCHBECK, G. L. 2011. Recurrent colic in the horse: incidence and risk factors for recurrence in the general practice population. *Equine Vet J Suppl***,** 81-8.

SCANTLEBURY, C. E., ARCHER, D. C., PROUDMAN, C. J. & PINCHBECK, G. L. 2015. Management and horse-level risk factors for recurrent colic in the UK general equine practice population. *Equine Vet J,* 47**,** 202-6.

SCANTLEBURY, C. E., PERKINS, E., PINCHBECK, G. L., ARCHER, D. C. & CHRISTLEY, R. M. 2014. Could it be colic? Horse-owner decision making and practices in response to equine colic. *BMC Vet Res,* 10 Suppl 1**,** S1.

SCHEMANN, K., FIRESTONE, S. M., TAYLOR, M. R., TORIBIO, J.-A., WARD, M. P. & DHAND, N. K. 2012. Horse owners'/managers' perceptions about effectiveness of biosecurity measures based on their experiences during the 2007 equine influenza outbreak in Australia. *Preventive veterinary medicine,* 106**,** 97-107.

SCHULTZ, P. W., NOLAN, J. M., CIALDINI, R. B., GOLDSTEIN, N. J. & GRISKEVICIUS, V. 2007. The constructive, destructive, and reconstructive power of social norms. *Psychological science,* 18**,** 429-434.

SCHULTZ, P. W., NOLAN, J. M., CIALDINI, R. B., GOLDSTEIN, N. J., AND GRISKEVICIUS, V 2007. The Constructive, Destructive, and Reconstructive Power of Social Norms.

SCHULTZ, W. P., KHAZIAN, A. M. & ZALESKI, A. C. 2008. Using normative social influence to promote conservation among hotel guests. *Social influence,* 3**,** 4-23.

SCHUMAN, H. & PRESSER, S. 1979. The open and closed question. *American sociological review***,** 692-712.

SCHWARTZ, S. H. 2012. An overview of the Schwartz theory of basic values. *Online readings in Psychology and Culture,* 2**,** 2307-0919.1116.

SEDGWICK, P. 2013. Prospective cohort studies: advantages and disadvantages. *Bmj,* 347**,** f6726.

SEDGWICK, P. 2014. Retrospective cohort studies: advantages and disadvantages. *Bmj,* 348**,** g1072.

SELLON, D. C., ROBERTS, M. C., BLIKSLAGER, A. T., ULIBARRI, C. & PAPICH, M. G. 2004. Effects of Continuous Rate Intravenous Infusion of Butorphanol on Physiologic and Outcome Variables in Horses after Celiotomy. *Journal of Veterinary Internal Medicine,* 18**,** 555-563.

SEMEVOLOS, S. A., DUCHARME, N. G. & HACKETT, R. P. 2002. Clinical assessment and outcome of three techniques for jejunal resection and anastomosis in horses: 59 cases (1989–2000). *Journal of the American Veterinary Medical Association,* 220**,** 215-218.

SHANNON, C. E. 1948. A Mathematical Theory of Communication. *Bell System Technical Journal,* 27**,** 379-423.

SHAPIRO, S. & ROSENBERG, L. 2014. Bias in Case–Control Studies. *Wiley StatsRef: Statistics Reference Online*.

SHARIFF, A. F. & NORENZAYAN, A. 2007. God is watching you: Priming God concepts increases prosocial behavior in an anonymous economic game. *Psychological science,* 18**,** 803-809.

SHAW, R. E., COHEN, F., DOYLE, B. & PALESKY, J. 1985. The impact of denial and repressive style on information gain and rehabilitation outcomes in myocardial infarction patients. *Psychosomatic Medicine*.

SHUY, R. 2003. In-person versus telephone interviewing In JA Holstein & JF Gubrium (Eds.), Inside interviewing: New lenses, new concerns (pp. 175-193). Thousand Oaks: Sage.

SIEVANEN, L., CAMPBELL, L. M. & LESLIE, H. M. 2012. Challenges to interdisciplinary research in ecosystem-based management. *Conservation Biology,* 26**,** 315-323.

SILVERMAN, D. 2015. *Interpreting qualitative data*, Sage.

SINCLAIR, J. 2014. I blame the NHS. *Vet Times.*

SINGER, E. & SMITH, M. 2002. Examination of the horse with colic: is it medical or surgical? *Equine Veterinary Education,* 14**,** 87-96.

SKINNER, B. 1948. Walden two. New York: Macmillan.

SKINNER, B. 1969. Contingency and reinforcement. *A theoretical analysis. Appleton-Century-Crofts, New York*.

SKINNER, B. 1971. Beyond freedom and dignity. New York, NY, US. Knopf/Random House.

SKINNER, B. F. 1957. *Verbal behavior*, New York: Appleton-Century-Crofts.

SKINNER, B. F. 1965. *Science and human behavior*, Simon and Schuster.

SKIVINGTON, K., MATTHEWS, L., CRAIG, P., SIMPSON, S. & MOORE, L. 2018. Developing and evaluating complex interventions: updating Medical Research Council guidance to take account of new methodological and theoretical approaches. *The Lancet,* 392**,** S2.

SLATER, M. D. 1999. Integrating Application of Media Effects, Persuasion, and Behavior Change Theories to Communication Campaigns: A Stages-of-Change Framework. *Health Communication,* 11**,** 335-354.

SMITH, J. A. Evolving issues for qualitative psychology. 1996. British Psychological Society.

SMITH, J. A. & SHINEBOURNE, P. 2012. *Interpretative phenomenological analysis*, American Psychological Association.

SMITH, S. G., OSBORNE, K., TRING, S., GEORGE, H. & POWER, E. 2016. Evaluating the impact of a community-based cancer awareness roadshow on awareness, attitudes and behaviors. *Prev Med,* 87**,** 138-143.

SNYDER, J., OLANDER, H., PASCOE, J., HOLLAND, M. & KURPERSHOEK, C. 1988. Morphologic alterations observed during experimental ischemia of the equine large colon. *American journal of veterinary research,* 49**,** 801-809.

SOUTHWOOD, L., GASSERT, T. & LINDBORG, S. 2010. Colic in geriatric compared to mature nongeriatric horses. Part 2: treatment, diagnosis and short-term survival. *Equine veterinary journal,* 42**,** 628-635.

SOUTHWOOD, L. L. 2004. Postoperative management of the large colon volvulus patient. *Vet Clin North Am Equine Pract,* 20**,** 167-97.

SOUTHWOOD, L. L. 2012a. Medical versus surgical treatment of the horse with colic. *In:* SOUTHWOOD, L. L. (ed.) *Practical guide to equine colic with illustrations by Joanne Fehr*

Ames, IA: Ames, IA : Wiley-Blackwell.

SOUTHWOOD, L. L. 2012b. Patient signalment and history. *In:* SOUTHWOOD, L. L. (ed.) *Practical guide to equine colic with illustrations by Joanne Fehr*

Ames, IA: Ames, IA : Wiley-Blackwell.

SOUTHWOOD, L. L. 2012c. Physical examination. *In:* SOUTHWOOD, L. (ed.) *Practical guide to equine colic with illustrations by Joanne Fehr*

Ames, IA: Ames, IA : Wiley-Blackwell.

SOUTHWOOD, L. L. & FEHR, J. 2012. Referral of the horse with colic. *In:* SOUTHWOOD, L. L. (ed.) *Practical guide to equine colic*

Ames, IA: Ames, IA : Wiley-Blackwell.

SPAARGAREN, G. 2003. Sustainable consumption: a theoretical and environmental policy perspective. *Society &Natural Resources,* 16**,** 687-701.

SPALDING, N. J. & PHILLIPS, T. 2007. Exploring the use of vignettes: From validity to trustworthiness. *Qualitative health research,* 17**,** 954-962.

SPIRKIN, A. G. 1983. *Dialectical materialism*, Progress Publishers.

SPLAN, R. K., BROOKS, R. M. & PORR, C. S. 2016. Student Reflections on Personal and Professional Growth After a 16-week Immersive, Experiential Learning Program in Equine Science 1. *NACTA journal,* 60**,** 60.

SPRATT, T. 2000. Decision making by senior social workers at point of first referral. *British Journal of Social Work,* 30**,** 597-618.

STAME, N. 2004. Theory-based evaluation and types of complexity. *Evaluation,* 10**,** 58-76.

STECKLER, A. B., LINNAN, L. & ISRAEL, B. 2002. *Process evaluation for public health interventions and research*, Jossey-Bass San Francisco, CA.

STEPHEN, J. O., CORLEY, K. T., JOHNSTON, J. K. & PFEIFFER, D. 2004. Factors associated with mortality and morbidity in small intestinal volvulus in horses. *Veterinary Surgery,* 33**,** 340-348.

STEWART, C. S., THRUSH, J. C., PAULUS, G. S. & HAFNER, P. 1985. The elderly's adjustment to the loss of a companion animal: People-pet dependency. *Death Studies,* 9**,** 383-393.

STEWART, S., SOUTHWOOD, L. & ACETO, H. 2014. Comparison of short-and long-term complications and survival following jejunojejunostomy, jejunoileostomy and jejunocaecostomy in 112 horses: 2005–2010. *Equine veterinary journal,* 46**,** 333-338.

STOKES, G. 1998. Popper: Philosophy, politics and scientific method.

STONE, E. R., YATES, A. J. & CARUTHERS, A. S. 2002. Risk Taking in Decision Making for Others Versus the Self 1. *Journal of Applied Social Psychology,* 32**,** 1797-1824.

STONE, S., GALLAGHER, R., STORR, J. & TANNER, G. 2011. Campaigns and continuity. *The Lancet Infectious Diseases,* 11**,** 340-341.

STRACK, F. & DEUTSCH, R. 2004. Reflective and impulsive determinants of social behavior. *Personality and social psychology review,* 8**,** 220-247.

STULL, C. L. 2013. Death and euthanasia as contemporary topics in equine curricula. *Journal of Equine Veterinary Science,* 33**,** 309-314.

STURGES, J. E. & HANRAHAN, K. J. 2004. Comparing telephone and face-to-face qualitative interviewing: a research note. *Qualitative research,* 4**,** 107-118.

SUE, V. M. & RITTER, L. A. 2012. *Conducting online surveys*, Sage.

SUMMERBELL, C. D., WATERS, E., EDMUNDS, L., KELLY, S. A., BROWN, T. & CAMPBELL, K. J. 2005. Interventions for preventing obesity in children. *Cochrane database of systematic reviews*.

SUTHERS, J., PINCHBECK, G., PROUDMAN, C. & ARCHER, D. 2013. Risk factors for large colon volvulus in the UK. *Equine veterinary journal,* 45**,** 558-563.

SUTTON, G. A., ATAMNA, R., STEINMAN, A. & MAIR, T. S. 2019. Comparison of three acute colic pain scales: Reliability, validity and usability. *Vet J,* 246**,** 71-77.

SUTTON, G. A., DAHAN, R., TURNER, D. & PALTIEL, O. 2013a. A behaviour-based pain scale for horses with acute colic: scale construction. *Vet J,* 196**,** 394-401.

SUTTON, G. A., ERTZMAN-GINSBURG, R., STEINMAN, A. & MILGRAM, J. 2009. Initial investigation of mortality rates and prognostic indicators in horses with colic in Israel: a retrospective study. *Equine Vet J,* 41**,** 482-6.

SUTTON, G. A., PALTIEL, O., SOFFER, M. & TURNER, D. 2013b. Validation of two behaviour-based pain scales for horses with acute colic. *Vet J,* 197**,** 646-50.

SWEET, L. 2002. Telephone interviewing: is it compatible with interpretive phenomenological research? *Contemporary Nurse,* 12**,** 58-63.

TAFFAREL, M. O., LUNA, S. P., DE OLIVEIRA, F. A., CARDOSO, G. S., ALONSO JDE, M., PANTOJA, J. C., BRONDANI, J. T., LOVE, E., TAYLOR, P., WHITE, K. & MURRELL, J. C. 2015. Refinement and partial validation of the UNESP-Botucatu multidimensional composite pain scale for assessing postoperative pain in horses. *BMC Vet Res,* 11**,** 83.

TARRANT, C., WINDRIDGE, K., BOULTON, M., BAKER, R. & FREEMAN, G. 2003. Qualitative study of the meaning of personal care in general practice. *Bmj,* 326**,** 1310.

TASHAKKORI, A. & TEDDLIE, C. 2010. *Sage handbook of mixed methods in social & behavioral research*, sage.

TAUSIG, J. E. & FREEMAN, E. W. 1988. The next best thing to being there: Conducting the clinical research interview by telephone. *American Journal of Orthopsychiatry,* 58**,** 418-427.

TAYLOR, A. K. & KOWALSKI, P. 2004. Naive psychological science: The prevalence, strength, and sources of misconceptions. *The Psychological Record,* 54**,** 15-25.

TAYLOR, A. K. & KOWALSKI, P. 2014. Student misconceptions: Where do they come from and what can we do? *Applying science of learning in education: Infusing psychological science into the curriculum.* Washington, DC, US: Society for the Teaching of Psychology.

TAYLOR, R. S. 1962. The process of asking questions. *American documentation,* 13**,** 391-396.

TERRY, D. J. & HOGG, M. A. 1999. *Attitudes, behavior, and social context: The role of norms and group membership*, Psychology Press.

THALER, R. H. & SUNSTEIN, C. R. 2008. Nudge: improving decisions about health. *Wealth, and Happiness,* 6.

THE BRITISH HORSE SOCIETY 2017. Unpublished statistics relating to the dissemination of the 'REACT Now to Beat Colic' campaign September 2016 - September 2017.

THE BRITISH HORSE SOCIETY. 2019a. *'REACT Now to Beat Colic' awareness week 2019* [Online]. Available: https://www.bhs.org.uk/our-charity/press-centre/news/2019/march/the-british-horse-society-and-university-of-nottingham-launch-their-first-ever-colic-awareness-week [Accessed].

THE BRITISH HORSE SOCIETY. 2019b. *Vet REACT Colic Champions Scheme* [Online]. Available: https://www.bhs.org.uk/our-work/welfare/our-campaigns/react/vet-react-colic-champions [Accessed].

THOEFNER, M., ERSBØLL, A. K., JENSEN, A. L. & HESSELHOLT, M. 2001. Factor analysis of the interrelationships between clinical variables in horses with colic. *Preventive Veterinary Medicine,* 48**,** 201-214.

THOEFNER, M. B., ERSBØLL, B. K., JANSSON, N. & HESSELHOLT, M. 2003. Diagnostic decision rule for support in clinical assessment of the need for surgical intervention in horses with acute abdominal pain. *Canadian journal of veterinary research,* 67**,** 20.

THOMPSON, K. R., HAIGH, L. & SMITH, B. P. 2018. Planned and ultimate actions of horse owners facing a bushfire threat: Implications for natural disaster preparedness and survivability. *International Journal of Disaster Risk Reduction,* 27**,** 490-498.

THORNDIKE, E. L. 2013. *Education Psychology: briefer course*, Routledge.

TINKER, M. K., WHITE, N. A., LESSARD, P., THATCHER, C. D., PELZER, K. D., DAVIS, B. & CARMEL, D. K. 1997a. Prospective study of equine colic incidence and mortality. *Equine Vet J,* 29**,** 448-53.

TINKER, M. K., WHITE, N. A., LESSARD, P., THATCHER, C. D., PELZER, K. D., DAVIS, B. & CARMEL, D. K. 1997b. Prospective study of equine colic risk factors. *Equine Veterinary Journal,* 29**,** 454-458.

TOMLINSON, J. E., BOSTON, R. C. & BRAUER, T. 2013. Evaluation of racing performance after colic surgery in Thoroughbreds: 85 cases (1996–2010). *Journal of the American Veterinary Medical Association,* 243**,** 532-537.

TONG, A., SAINSBURY, P. & CRAIG, J. 2007. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International journal for quality in health care,* 19**,** 349-357.

TONGCO, M. D. C. 2007. Purposive sampling as a tool for informant selection. *Ethnobotany Research and applications,* 5**,** 147-158.

TOUVIER, M., MÉJEAN, C., KESSE-GUYOT, E., POLLET, C., MALON, A., CASTETBON, K. & HERCBERG, S. 2010. Comparison between web-based and paper versions of a self-administered anthropometric questionnaire. *European journal of epidemiology,* 25**,** 287-296.

TRAUB-DARGATZ, J. L., KOPRAL, C. A., SEITZINGER, A. H., GARBER, L. P., FORDE, K. & WHITE, N. A. 2001. Estimate of the national incidence of and operation-level risk factors for colic among horses in the United States, spring 1998 to spring 1999. *Journal of the American Veterinary Medical Association,* 219**,** 67-71.

TUNNECLIFF, J., ILIC, D., MORGAN, P., KEATING, J., GAIDA, J. E., CLEARIHAN, L., SADASIVAN, S., DAVIES, D., GANESH, S., MOHANTY, P., WEINER, J., REYNOLDS, J. & MALONEY, S. 2015. The acceptability among health researchers and clinicians of social media to translate research evidence to clinical practice: mixed-methods survey and interview study. *J Med Internet Res,* 17**,** e119.

TUOMINEN, K. & SAVOLAINEN, R. A social constructionist approach to the study of information use as discursive action. Proceedings of an international conference on Information seeking in context, 1997. 81-96.

TURNER, J. C. & OAKES, P. J. 1986. The significance of the social identity concept for social psychology with reference to individualism, interactionism and social influence. *British Journal of Social Psychology,* 25**,** 237-252.

UHLINGER, C. 1992. Investigations into the incidence of field colic. *Equine Veterinary Journal,* 24**,** 16-18.

UNDERWOOD, C., SOUTHWOOD, L., MCKEOWN, K. & KNIGHT, D. 2008. Complications and survival associated with surgical compared with medical management of horses with duodenitis-proximal jejunitis. *Equine veterinary journal,* 40**,** 373-378.

VAN DE MORTEL, T. F. 2008. Faking it: social desirability response bias in self-report research. *Australian Journal of Advanced Nursing, The,* 25**,** 40.

VAN DEN BOOM, R. & VAN DER VELDEN, M. A. 2001. Surgery: Short- and long-term evaluation of surgical treatment of strangulating obstructions of the small intestine in horses: A review of 224 cases. *Veterinary Quarterly,* 23**,** 109-115.

VAN DER LINDEN, M. A., LAFFONT, C. M. & SLOET VAN OLDRUITENBORGH-OOSTERBAAN, M. M. 2003. Prognosis in equine medical and surgical colic. *J Vet Intern Med,* 17**,** 343-8.

VAN HOOGMOED, L., SNYDER, J. R., PASCOE, J. R. & OLANDER, H. 2000. Use of Pelvic Flexure Biopsies to Predict Survival After Large Colon Torsion in Horses. *Veterinary Surgery,* 29**,** 572-577.

VAN LOON, J. P., JONCKHEER-SHEEHY, V. S., BACK, W., VAN WEEREN, P. R. & HELLEBREKERS, L. J. 2014. Monitoring equine visceral pain with a composite pain scale score and correlation with survival after emergency gastrointestinal surgery. *The Veterinary Journal,* 200**,** 109-115.

VANDENBROUCKE, J. P. 2008. Observational research, randomised trials, and two views of medical science. *PLoS medicine,* 5**,** e67-e67.

VATISTAS, N. J., SNYDER, J. R., NIETO, J., HILDEBRAND, S., WOLINER, M. J., HARMON, F. A., BARRY, S. J. & DRAKE, C. 1998. Morphologic changes and xanthine oxidase activity in the equine jejunum during low flow ischemia and reperfusion. *American journal of veterinary research,* 59**,** 772-776.

VAUGHAN, E. D. 1977. Misconceptions about psychology among introductory psychology students. *Teaching of psychology,* 4**,** 138-141.

VILELA, A. 2016. Time to stamp out strangles. *Equine Health,* 2016**,** 50-52.

VILLALOBOS, A. & KAPLAN, L. 2017. *Canine and Feline Geriatric Oncology : Honoring the Human-Animal Bond,* Newark, UNITED STATES, John Wiley & Sons, Incorporated.

VISSER, E. K. & VAN WIJK-JANSEN, E. E. 2012. Diversity in horse enthusiasts with respect to horse welfare: An explorative study. *Journal of veterinary behavior,* 7**,** 295-304.

VOIGT, A., SAULEZ, M. N., DONNELLAN, C. & GUMMOW, B. 2009. Causes of gastrointestinal colic at an equine referral hospital in South Africa (1998-2007). *Journal of the South African Veterinary Association,* 80**,** 192-198.

VON BORELL, E., LANGBEIN, J., DESPRÉS, G., HANSEN, S., LETERRIER, C., MARCHANT-FORDE, J., MARCHANT-FORDE, R., MINERO, M., MOHR, E. & PRUNIER, A. 2007. Heart rate variability as a measure of autonomic regulation of cardiac activity for assessing stress and welfare in farm animals—A review. *Physiology & behavior,* 92**,** 293-316.

VON BORGSTEDE, C., DAHLSTRAND, U. & BIEL, A. 1999. *From ought to is: Moral norms in large-scale social dilemmas*, Göteborg University.

VON BÜLTZINGSLÖWEN, I., ELIASSON, G., SARVIMÄKI, A., MATTSSON, B. & HJORTDAHL, P. 2006. Patients' views on interpersonal continuity in primary care: a sense of security based on four core foundations. *Family practice,* 23**,** 210-219.

VOSNIADOU, S. 2001. What can persuasion research tell us about conceptual change that we did not already know? *International Journal of Educational Research,* 35**,** 731-737.

VRIES, H. D. & MUDDE, A. N. 1998. Predicting stage transitions for smoking cessation applying the attitude-social influence-efficacy model. *Psychology and Health,* 13**,** 369-385.

WAELDE, L. C., KOOPMAN, C., RIERDAN, J. & VID SPIEGEL, D. 2001. Symptoms of acute stress disorder and posttraumatic stress disorder following exposure to disastrous flooding. *Journal of Trauma & Dissociation,* 2**,** 37-52.

WAGNER, A. E. 2010. Effects of stress on pain in horses and incorporating pain scales for equine practice. *Vet Clin North Am Equine Pract,* 26**,** 481-92.

WAGNER, J., BURG, M. & SIROIS, B. 2004. Social support and the transtheoretical model: Relationship of social support to smoking cessation stage, decisional balance, process use, and temptation. *Addict Behav,* 29**,** 1039-43.

WAIBLINGER, S., BOIVIN, X., PEDERSEN, V., TOSI, M.-V., JANCZAK, A. M., VISSER, E. K. & JONES, R. B. 2006. Assessing the human–animal relationship in farmed species: a critical review. *Applied Animal Behaviour Science,* 101**,** 185-242.

WALKER, D., LIU, J., MERPHY, L. & WILNE, S. 2016. G361 (P) Delayed diagnosis of paediatric brain tumours–HEADSMART be brain tumour aware (www. headsmart. org. uk). BMJ Publishing Group Ltd.

WALKER, D., WILNE, S., GRUNDY, R., KENNEDY, C., NEIL, DICKSON, A., LINDSELL, S. & TRUSLER, J. 2015. A new

clinical guideline from the Royal College of Paediatrics and Child Health with a national awareness campaign accelerates brain tumor diagnosis in UK children—"HeadSmart: Be Brain Tumour Aware". *Neuro-oncology,* 18**,** 445-454.

WALLERSTEIN, N. B. & DURAN, B. 2006. Using community-based participatory research to address health disparities. *Health promotion practice,* 7**,** 312-323.

WALLS, H. L., PEETERS, A., PROIETTO, J. & MCNEIL, J. J. 2011. Public health campaigns and obesity-a critique. *BMC public health,* 11**,** 136.

WALTER, I., NUTLEY, S. & DAVIES, H. 2003. Developing a taxonomy of interventions used to increase the impact of research. *Unpublished discussion paper, Research Unit for Research Utilisation, Department of Management, University of St. Andrews, Scotland. Available at: http://www. standrews. ac. uk/cppm/Taxonomy% 20development% 20paper,* 20070103.

WATTS, W. E., RUSH, K. & WRIGHT, M. 2009. Evaluating first-year nursing students' ability to self-assess psychomotor skills using videotape. *Nursing education perspectives,* 30**,** 214-219.

WEIGEL, R. H. & NEWMAN, L. S. 1976. Increasing attitude-behavior correspondence by broadening the scope of the behavioral measure. *Journal of personality and social psychology,* 33**,** 793.

WEINSTEIN, E. A. & KAHN, R. L. 1955. Denial of illness: Symbolic and physiological aspects.

WEINSTEIN, N. D. 1993. Testing four competing theories of health-protective behavior. *Health psychology,* 12**,** 324.

WEISHAAR, H., DORFMAN, L., FREUDENBERG, N., HAWKINS, B., SMITH, K., RAZUM, O. & HILTON, S. 2016. Why media representations of corporations matter for public health policy: a scoping review. *BMC public health,* 16**,** 899.

WENSLEY, S. P. 2008a. Animal welfare and the human-animal bond: considerations for veterinary faculty, students, and practitioners. *Journal of veterinary medical education,* 35**,** 532.

WENSLEY, S. P. 2008b. Animal welfare and the human–animal bond: considerations for veterinary faculty, students, and practitioners. *Journal of Veterinary Medical Education,* 35**,** 532-539.

WEST, S. G., DUAN, N., PEQUEGNAT, W., GAIST, P., DES JARLAIS, D. C., HOLTGRAVE, D., SZAPOCZNIK, J., FISHBEIN, M.,

RAPKIN, B. & CLATTS, M. 2008. Alternatives to the randomized controlled trial. *American journal of public health,* 98**,** 1359-1366.

WHITE, N. A. 1990. Epidemiology and etiology of colic. *The equine acute abdomen.*

WHITE, N. A. 2009. Colic Prevalence, Risk Factors and Prevention. *Advances in Equine Nutrition Iv***,** 313-326.

WHITE, N. A. 2017a. Decision for Surgery and Referral. *In:* BLIKSLAGER, A. T., MOORE, J. N., MAIR, T. S. & WHITE, N. A., II (eds.) *The Equine Acute Abdomen.* Newark, UNITED STATES: John Wiley & Sons, Incorporated.

WHITE, N. A. 2017b. Prognosticating Equine Colic. *In:* BLIKSLAGER, A. T., MOORE, J. N., MAIR, T. S. & WHITE, N. A., II (eds.) *The Equine Acute Abdomen.* Newark, UNITED STATES: John Wiley & Sons, Incorporated.

WHITE, N. A., ELWARD, A., MOGA, K. S., WARD, D. L. & SAMPSON, D. M. 2005. Use of web-based data collection to evaluate analgesic administration and the decision for surgery in horses with colic. *Equine Veterinary Journal,* 37**,** 347-350.

WIETHOELTER, A. K., SAWFORD, K., SCHEMBRI, N., TAYLOR, M. R., DHAND, N. K., MOLONEY, B., WRIGHT, T., KUNG, N., FIELD, H. E. & TORIBIO, J.-A. L. M. L. 2017. “We’ve learned to live with it”—A qualitative study of Australian horse owners’ attitudes, perceptions and practices in response to Hendra virus. *Preventive Veterinary Medicine,* 140**,** 67-77.

WILD, I. V., BURFORD, J. H., ENGLAND, G. C. W., BOWEN, M. & FREEMAN, S. L. 2017a. Barriers to Knowledge Transfer in Equine Practice: Thematic Analysis Of Interviews and Online Questionnaire. *Equine Veterinary Journal,* 49**,** 11-11.

WILD, I. V., BURFORD, J. H., ENGLAND, G. C. W., BOWEN, M. & FREEMAN, S. L. 2017b. Delphi Consensus Study On The Primary Assessment Of Horses With Clinical Signs Of Colic. *Equine Veterinary Journal,* 49**,** 14-14.

WILKINSON, S. The role of reflexivity in feminist psychology. Women's Studies International Forum, 1988. Elsevier, 493-502.

WILLIAMS, J. M., JONES, D. & THORNTON, C. 2017. Owners' perception of veterinary medical emergencies. *Vet Rec*.

WILLIAMS, S., HORNER, J., ORTON, E., GREEN, M., MCMULLEN, S., MOBASHERI, A. & FREEMAN, S. L. 2015. Water intake, faecal output and intestinal motility in horses moved from pasture

to a stabled management regime with controlled exercise. *Equine Vet J,* 47**,** 96-100.

WITHAM, C. L., STULL, C. L. & HIRD, D. W. 1998. A California survey concerning chronic equine malnutrition. *Journal of Equine Veterinary Science,* 1**,** 6-7.

WITTE, K. & ALLEN, M. 2000. A meta-analysis of fear appeals: Implications for effective public health campaigns. *Health education & behavior,* 27**,** 591-615.

WONG, L. 2008. Data analysis in qualitative research: A brief guide to using NVivo. *Malaysian family physician: the official journal of the Academy of Family Physicians of Malaysia,* 3**,** 14.

WORMSTRAND, B. H., IHLER, C. F., DIESEN, R. & KRONTVEIT, R. I. 2014. Surgical treatment of equine colic-a retrospective study of 297 surgeries in Norway 2005–2011. *Acta Veterinaria Scandinavica,* 56**,** 38.

WRIGHT, K. B. 2005. Researching Internet-based populations: Advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services. *Journal of computer-mediated communication,* 10**,** JCMC1034.

WYLIE, C. E., IRELAND, J. L., COLLINS, S. N., VERHEYEN, K. L. & NEWTON, J. R. 2013. Demographics and management practices of horses and ponies in Great Britain: a cross-sectional study. *Res Vet Sci,* 95**,** 410-7.

YEOMAN, S., BOWDEN, A., BURFORD, J. H., ENGLAND, G. C. W. & FREEMAN, S. L. 2017. Horse Owners' Opinion On The Recognition And Diagnosis Of Colic: Outcomes From A Delphi Consensus Process. *Equine Veterinary Education,* 29**,** 33-33.

YILMAZ, K. 2013. Comparison of Quantitative and Qualitative Research Traditions: epistemological, theoretical, and methodological differences. *European Journal of Education,* 48**,** 311-325.

YOO, S., WEED, N. E., LEMPA, M. L., MBONDO, M., SHADA, R. E. & GOODMAN, R. M. 2004. Collaborative community empowerment: An illustration of a six-step process. *Health Promotion Practice,* 5**,** 256-265.

Appendix I: Image attribution

All icons available from www.flaticon.com

Page/s	Figure / Table	Icon/s made by … (creator / s)
10	2-1	Darius Dan Freepik Smashicons
14	2-2	Freepik Smashicons Vitaly Gorbachev
21	2-4	Freepik Smashicons Vitaly Gorbachev Wanicon
23-24	2-2	Darius Dan
34	2-5	Freepik
36	2-6	Darius Dan Nikita Golubev
92	4-1	Freepik Geotatah Prettycons Wanicon
273	7-3	Freepik
280	7-5	Freepik Smashicons Wanicon
316	8-4	Freepik Icongeek26 Kiranshastry
337	8-7	Kiranshastry
346	8-8	Freepik Icongeek26

Appendix II: Published theories of behaviour

Theory	Author / Theorist	Main aim or concept
An Action Theory Model of Consumption	Bagozzi (2000)	Explains processes involved in purchasing an item or service
Affective Events Theory	Weiss (1996)	Explains how affective experiences affect job satisfaction and performance
AIDS Risk Reduction Model	Catania (1990)	Explains and facilitate study of HIV-protective behaviours
Attitude-Social Influence-Efficacy Model	DeVries (1998)	To identify psychological and social determinants of behaviour
Behavioural Ecological Model of AIDS Prevention	Hovell (1994)	To guide strategies to change adolescent sexual behaviour
Change Theory	Lewin (1943)	To describe the three-stage process of social change
Classical Conditioning	Pavlov (1927)	To describe how innate responses to stimuli can become elicited by a previously 'irrelevant' stimulus
COM-B Model	Michie (2011)	Describes how behaviour can only occur if there is capability, opportunity, and motivation
Consumption of Social Practices	Spaargaren (2000)	Explains consumer behaviour, particularly pro-environmental domestic behaviour
Containment Theory	Reckless (1961)	Describes how people are subjects to both inner and outer control systems which regulate deviant behaviour
Control Theory	Carver (1981/1982)	Describes how behaviour is controlled by a negative feedback loop
Diffusion of Innovations	Rogers (1983)	Explains how individuals or social groups adopt or reject a new behaviour
Differential Association Theory	Sutherland (1947)	Describes how people engaging in criminal behaviour do so because of their life experiences, presence of facilitating situations and associates

Ecological Model of Diabetes Prevention	Burnet (2002)	Describes the need to target individual and environmental factors, as well as social influences when tackling diabetes
Extended Information Processing Model	Flay (1980)	Explains the processes underlying attitude and behavioural change as a result of mass media campaigns
Extended Parallel Process Model	Witte (1992)	Explains the cognitive processes and behavioural outcomes as a result of fear appeals
Feedback Intervention Theory	Kluger (1996)	Explains how feedback can influence performance
Focus Theory of Normative Conduct	Cialdini (1991)	Explains how 'norms', that being what is commonly done or accepted, can influence behaviour
General Theory of Crime	Goffredson (1990)	Explain what causes people to engage in criminal behaviour
General Theory of Deviant Behaviour	Kaplan (1972)	
Goal Directed Theory	Bagozzi (1992)	To describe the factors that influence the performance of goal-directed behaviours
Goal Framing Theory	Lindenberg (2007)	Describes how goals direct people's attention to specific forms of information
Goal Setting Theory	Locke (1968)	Explains the mechanisms by which goal-setting affects the level of task performance and factors which can moderate it.
Health Action Process Approach	Schwarzer (1992)	Describes a causal model for the initiation and maintenance of health-related behaviours
Health Behaviour Goal Model	Gerbhardt (2001)	Describes how behaviour change is most likely if goals are seen as important and compatible with life
Health Behaviour Internalisation Model	Bellg (2003)	Describes how behaviour is regulated along a continuum from external regulation to internal self-regulation
Health Belief Model	Rosenstock (1966)	Describes how preventative behaviours are more likely to be performed if a threat is perceived
Health Promotion Model	Pender (1982)	Describes the importance of person-environment interactions in motivating behaviour change

Information-Motivation-Behavioural (IMB) Skills Model	Fisher (1992)	Describes how motivation, information and behavioural skills must be present in order for change to occur
IMB Model of ART Adherence (extension of IMB),	Fisher (2008)	Aims to explain and predict adherence to anti-retroviral therapy (ART)
Integrative Factors influencing smoking behaviour model	Flay (1983)	Identifies the determinants of smoking behaviour during adolescence
Integrative model of health and attitude behaviour change	Flay (1983)	Describes how mass media health promotion campaigns can lead to changes in health-related attitudes and behaviours
Integrating factors influencing smoking, attitude, and health behaviour change	Flay (1983)	Aims to explain (1) the factors influencing adolescent smoking and (2) the processes by which smoking related attitudes and behaviours can change
Integrative Model of Behavioural Prediction	Fishbein (2000)	Describes the importance of environmental constraints and skills / ability on the influence of behaviour
Integrated Theory of Drinking Behaviour	Wagennar (1994)	Aims to identify the factors which determine alcohol consumption in young people
Integrated Theoretical Model for Alcohol and Drug Prevention	Gonzalez (1989)	Describes the importance of intrapersonal and environmental factors when facilitating behaviour change
Integrative Theory of Health Behaviour Change	Ryan (2009)	Aims to explain the adoption of self-management behaviours
Model of Pro-environmental Behaviour	Kolmuss (2002)	Describes intrapersonal and external factors that can contribute to environmentally 'friendly' behaviours
Motivation Opportunity Abilities Model	Olander (1995)	Describes consumer engagement in pro-environmental behaviours and their dependence on the presence of motivation, opportunity, and ability
Needs Opportunities Abilities (NOA) Model	Gatersleben (1998)	Aims to identify factors that can determine consumer behaviour
Norm Activation Theory	Schwartz (1977)	Describes the decision-making processes in altruistic behaviours
Operant Learning Theory	Skinner (1954)	Describes how behaviours can be modified through increased frequency and negative or positive reinforcement
Precaution Adoption Process Model	Weinstein (1988)	Describes the seven-stage process of health-protective behaviour adoption

Pressure System Model	Katz (2001)	Describes behaviour change as being determined by opposing forces of motivation and resistance
PRIME Theory	West (2006)	Describes the five 'sub-systems' of human motivation
Problem Behaviour Theory	Jessor (1977)	Aims to identify factors which cause deviant behaviours in adolescence
Prospect Theory	Kahneman (1979)	Describes how people make decisions under uncertainty
Protection Motivation Theory	Rogers (1975)	Describes a model of the cognitive processes that occur in response to heath threats
Prototype Willingness Model	Gibbons (1995)	Describes decision-making processes involved in adolescent risk behaviour
Rational Addiction Model	Becker (1988)	Describes an economic model of addiction based on rational preferences
Reflective Impulsive Model/Dual Process Theory	Strack (2004)	Describes two different functions of behaviour: the reflective system and the impulsive system
Regulatory Fit Theory	Higgins (2000)	Explains that if a person's motivational orientation is congruent with the methods they are using to achieve their goal, they will be more motivated to succeed
Relapse Prevention Theory	Marlatt (1980)	Describes factors that determine the risk of relapse during abstinence from an addictive substance
Risks as Feelings Model	Lowenstein (2001)	Aims to explain decision-making in 'risky' situations and the influence of emotional and cognitive evaluations of potential risks
Self-determination Theory	Deci (2000)	Describes a framework which can be used to study motivation, personality, and behaviour
Self-efficacy Theory	Bandura (1977)	Suggests that a central concept underpinning behaviour change in an individual's belief that they are capable of changing
Self-regulation Theory	Kanfer (1970)	Describes cognitive processes that control a person's own behaviour

Six Staged Model of Communication Effects	Vaughan (2000)	Describes how mass media campaigns elicit change through interpersonal communication
Social Action Theory	Ewart (1991)	Describes a framework for promoting change at the population level
Social Action Theory	Weber (1991)	Describes the importance of distinguishing social action from other types
Social Change Theory	Thompson (1990)	Suggests that the external environment influences behaviour at a community level, which then influences social norms that cause changes at an individual level
Social Cognitive Theory	Bandura (1986)	Describes a framework which can be used to study human thought and behaviour
Social Consensus Model of Health Education	Romer (1992)	Describes how change can only be elicited using educational methods if it is targeted at the broader societal level
Social Development Model	Hawkins (1985)	Describes the importance of social bonding in the prevention of crime in young adults
Social Identity Theory	Tajfel (1979)	Explains how behaviour within social groups is influenced by group members desire to differentiate themselves positively from other groups
Social Influence Model of Virtual Community Participation	Dholakia (2004)	Describes two different kinds of virtual consumer communities: network-based and small-group-based
Social Ecological Model of Walking	Alfonzo (2005)	Describes a model of the decision-making process associated with walking behaviour
Social Ecological Model of Behaviour Change	Panter-Brick (2006)	Describes the importance of ensuring interventions designed to elicit change embed their methods in both social and ecological settings
Social Learning Theory	Miller (1941)	Describes how people learn through the imitation of others
Social Norms Theory	Perkins (1986)	Describes how inaccurate perceptions of the thoughts and behaviours of others within a social group can influence individual behaviour
Systems Model of Health Behaviour Change	Kershell (1985)	Describes a framework for the development of health education curricula
Technology Acceptance Models 1, 2 and 3	Venkatesh (1989 2000, 2008)	Describes factors that can influence the acceptance and usage of technology

Temporal Self-regulation Theory	Hall (2007)	Provides a framework for understanding irrational human behaviour
Terror Management Health Model	Goldenberg (2008)	Describes how conscious and non-conscious thoughts about mortality play a major role in determining motivation
Terror Management Theory	Greenberg (1986)	Explains why humans have a need for self-esteem and how this can influence behaviour
Theory of Interpersonal Behaviour	Triandis (1977)	Aims to describe and predict the chances of people engaging in social behaviours
Theory of Normative Social Behaviour	Rimal (2005)	Describes the mechanisms by which normative beliefs influence behaviour
Theory of Planned Behaviour/Reasoned Action	Ajzen (19850)	Describes a model of human intention, which is determined by personal attitudes, subjective norms, and perceived behavioural control
Theory of Triadic Influence	Flay (1994)	Describes three 'streams of influence' which flow through five 'levels of causation' in order to explain health-related behaviours
Transcontextual Model of Motivation	Hagger (2003)	Describes how support of autonomy and motivation in an educational context can influence these elements in other contexts
Transtheoretical/Stages of Change Model	Prochaska (1983)	Describes how behaviour change occurs in five stages and identifies the transitional processes between each stage
Value Belief Norm Theory	Stern (1999)	Aims to explain required support for social changes, such as the pro-environmental movement

Appendix III: Personal reflexivity statement

I am a white, female post-graduate student studying at the University of Nottingham's School of Veterinary Medicine and Science. I grew up in the East Midlands and attended state school until the age of 16. After gaining a Diploma in Animal Management, I worked as an apprentice in the horse racing industry before being employed in customer services.

I entered the veterinary industry in my early twenties, with my first role being that of a Veterinary Receptionist in a small animal practice located in the East Midlands. I relished working in the fast paced environment of first-opinion practice and developed a keen interest in veterinary nursing and client education. Although I thoroughly enjoyed my time at this practice, my passion for horses ultimately led me to complete an undergraduate degree in Equine Sports Science. Alongside my studies, I worked part time as an equine nursing assistant in a first-opinion veterinary practice, as well as a curriculum support advisor at a local agricultural college.

During my time as a nursing assistant I witnessed many horse owners faced with the decision of caring for a severely ill or injured horse, with colic having the potential to be particularly distressing. These experiences, though difficult at times, provided me with an important insight into the horse-owner relationship, as well as a fundamental understanding of emergency veterinary care.

As a result, I undertook this PhD project to gain a better understanding of horse owner behaviour and the challenges they face during emergency situations. It is plausible to suggest that my experience in veterinary practice may have had some bearing on my interpretation of participant responses. However, I also have personal experience of caring for horses on a day to day basis. Additionally, although not a horse owner, I do care for a neurotic greyhound, who suffers from multiple health-related issues, who I adore. Having made numerous trips to veterinary establishments, both on a routine and emergency basis, I have experienced making difficult decisions as an animal owner. This, I believe, gives me the ability to not only understand the need for urgency in the event of a veterinary emergency, but to truly empathise with horse owners.

Before participating in semi-structured interviews, confirmed participants were provided with an information sheet which briefly outlined my employment history and equine experience. Additionally, during my introduction at the start of the interviews, I informed participants that, although I did not own a horse, I had made difficult decisions on behalf of an animal I owned and loved. Whilst this may have biased the answers they gave, I believe that this was minimised as much as was possible through the personalisation of interview schedules and maintaining focus on participants own experiences.

Appendix IV: Amendments following piloting of a survey exploring horse owner knowledge and approach to colic (Chapter Four)

Survey Section	Question	Correction performed after pilot
Previous study participation	**2) Have you previously completed a survey about equine colic by the Nottingham Equine Colic Project?**	Question re-phrased to: *'Have you previously completed a survey by the University of Nottingham's Equine Colic Project about owner knowledge of equine colic in the past 4 years?'*
Section 1: *Recognising the 'normal' horse'*	**6) Which of the following [various health parameters] do you feel you could confidently measure accurately?**	Question re-phrased to: *'Please indicate how confident you feel accurately measuring and understanding each of the following values [temperature, heart and respiratory rate] in your horse'.*

Section 2: *Equine Colic*	**9) Please list the top five signs that you would recognise as potential indicators of colic** *(1 = sign you would most associate with colic 5 = sign you would potentially associate with colic)***.**	Question re-phrased to: *'Please list (in no particular order) up to five signs that you would recognise as potential signs that your horse may have or be developing colic.'*
Section 2: *Equine Colic* *(Cont.)*	**10 – 14)** *Six colic scenarios depicting various severities and types of followed by the question:* **How likely do you think it is that this horse has colic?**	The number of scenarios were reduced. Two specific cases, representing a horse with impaction colic (scenario 1) and a strangulating lesion (scenario 2), were chosen for inclusion. Two new questions, with pre-defined answers, followed each scenario: 1. *'Which of the following best describes what you would initially do in this situation?'* 2. *'If you decided to call a vet out, which of the following best describes what you would do whilst waiting for the vet to arrive?'*
Section 3: *You and Your Horse*	**18) Approximately how long have you had horses for** *(included those you have owned, loaned or care for)***?**	Question re-phrased to: *'How long have you owned or been involved in the care of horses/ponies for?'*

Section 3: *You and Your Horse (Cont.)*	**21) Do you have any formal equine qualifications?**	Question re-phrased to: *'Do you have any formal equine qualifications? If you have more than one, please choose the highest level of qualification.'*
	Are you a member of the British Horse Society (BHS)?	New question added followed by pre-defined answers.
Section 4: *Campaign awareness*	**22) Are you aware of the 'REACT Now to Beat Colic' campaign?**	Images of the 'REACT' campaign logo and acronym added next to this question to maximise participant understanding.
	23) Where did you hear about the campaign?	Question re-phrased to: *'Where did you FIRST hear about the REACT campaign?'*
	25) Do you have a hard copy of the 'REACT to beat colic' owner information pack?	Question re-phrased to: *'If you have paper copies of the 'REACT Now to Beat Colic' fact sheets, where did you collect your copies?'*

Section 4: *Campaign awareness (Cont.)*	**Is there any aspect of colic NOT included within the campaign resources that you would like to know more about?**	New question added followed by a free-text box.
	27) Since having a copy of the 'REACT to beat colic' owner pack, have you referred to the information during a recent episode of colic? **28) Please tell us a little more about this recent episode of colic and which pieces of information within the pack you referred to.**	Questions removed and replaced with closed questions, with pre-defined answers, investigating the potential impact of campaign resources on participant knowledge in five topics areas explicitly covered by the 'REACT' campaign: • Monitoring normal health values on a regular basis • Colic recognition and seeking veterinary advice • Knowledge and understanding of a colic veterinary assessment • Referral • Emergency planning
	On the sliding scale below please indicate how you feel the 'REACT to beat colic' campaign has impacted upon your knowledge and approach to equine colic overall.	New question added followed by a sliding numerical scale.

Appendix V: Formation of new categories for statistical analysis (Chapter Four)

Categorical data	Original Survey Categories	Condensed/new categories used for statistical analysis
Age	1. 18-24 2. 25-29 3. 30-34 4. 35-39 5. 40-44 6. 45-49 7. 50-54 8. 55-59 9. 60-64 10. 65+ 11. Prefer not to say	1. 18-29 2. 30-39 3. 40-49 4. 50-59 5. 60+ *Prefer not to say excluded*
Years equine experience	1. less than 6 months 2. more than 6 months but less than a year 3. 1-2 years 4. 3-5 years 5. 6-10 years 6. 11-20 years 7. 21-30 years 8. 31-40 years 9. 40+ years	1. Less than 6 months – 10 years 2. 11-20 years 3. 21-30 years 4. 31-40 years 5. 40+ years
Qualification	1. No formal qualification 2. Pony club tests 3. College course (NVQ, National Diploma etc) 4. BHS stages 1 and 2 5. BHS stage 3 or AI 6. BHS qualifications from BHSAI to BHSII 7. BHS qualification greater than BHSII 8. Undergraduate degree 9. Postgraduate qualifications (Masters/PhD etc) 10. Veterinary nursing qualifications 11. Veterinary medicine qualifications 12. Other	1. No formal qualification (categories 1 & non-formal equine qualification listed in category 12 combined) 2. Formal qualification (categories 2 – 11 and formal equine qualification listed in category 12 combined)

Appendix VI: Supplementary results (Chapter Four)

Additional results can be viewed by clicking on the links shown below.

Table detailing the formal equestrian qualifications held by horse owners:

https://uniofnottm-my.sharepoint.com/:b:/g/personal/katie_lightfoot_nottingham_ac_uk/EZqyggkZMqhHiLuLk166O2MBq4Gu90d6U364QooZ96o96A?e=UgKPK6

Table detailing the anatomical regions participants suggested were affected by colic:

https://uniofnottm-my.sharepoint.com/:b:/g/personal/katie_lightfoot_nottingham_ac_uk/EQOo1rXUndRDirUmc54DluQB4HZj66GLAkXtl_dnEzOUbg?e=uGJJjg

Table detailing participant reported causes of colic:

https://uniofnottm-my.sharepoint.com/:b:/g/personal/katie_lightfoot_nottingham_ac_uk/ER8wDgPKMaJEswt68ZK2bt4ByuXBexnHCFs8KMKCQGOHlg?e=fI64s3

Table detailing participant reported signs of colic:

https://uniofnottm-my.sharepoint.com/:b:/g/personal/katie_lightfoot_nottingham_ac_uk/Ed75PbvJZFNKtBPCEDx2BZABo4j-LtnwbDQu5ve-BD7imA?e=jXhcci

Appendix VII: Amendments performed following piloting of a survey investigating horse owner intention to adopt emergency recommendations (Chapter Five)

Survey Section	Question	Correction performed after pilot
Introduction	**Study overview and survey introduction**	Estimated completion time added.
Section 1: *'Your Equestrian Involvement'*	**9) Which of the following statements BEST describes your current horse ownership and role in emergency decision making?**	Answer options altered to ensure those who did not own a horse but provided regular care as part of a business or loan/share agreement, were represented. Sub-question relating to equestrian activities removed.
	New Question: Is there anything else you would like us to know about your current horse ownership or role in emergency decision making?	Open answer with a free-text box added to allow participants to submit any other details they feel are relevant to their current horse ownership.
Section 2: *'Preparing for a colic emergency'*	**Introduction to Section 2**	The statement 'if you are completing this survey on a mobile device, please scroll across to the right of the screen to ensure you can see all available answer options'.
	Questions 14, 15 and 16	Likert scale reversed so that answer options now displayed, left to right, read 'strongly disagree' to 'strongly agree'.
Section 3: *'Your Experience of Colic'*	**New Question: Which of the following statements BEST describes where you currently keep the horse/s you own/care for?**	Added to establish the environment in which participants currently care for their horse/s.
	New Question: How interested are you in information about colic and the development of an emergency colic plan?	Added to establish participants' interest in emergency planning.

Section 3: *'Your Experience of Colic' (Cont.)*	**New Question: If your horse was to become critically ill with colic in the future, how important, on a scale of 0 (not important) to 10 (very important), would each of the following factors be on your decision to pursue referral treatment?**	Based on the scale used by (McGowan *et al*., 2012), this question was added to establish factors that could influence participants' decision to pursue referral treatment. A free-text box was added for participants to list factors not listed.
	**** Questions 28, 36 and 37 removed and replaced by the new question detailed above. ****	
Section 4: *'The 'REACT Now to Beat Colic' Campaign'*	**39) Would you find the information* detailed above useful in regard to planning for a potential colic emergency?**	Question removed and replaced with *'if you wanted to know more about colic, where would you mainly go to seek advice?'* Accompanied by pre-defined, multiple choice answers.
	40) Have you read any of the information / resources provided by the 'REACT' campaign? *	Question removed and replaced with *'have you actively used any of the resources, or implemented any of the 'REACT' recommendations, in regard to emergency planning in case your horse developed colic?'* Accompanied by pre-defined, single choice answers. Two sub-questions, with free-text boxes, linked to previous answer to establish reasons for not using resources and ways of active use.

Appendix VIII: Formation of new categories for statistical analysis (Chapter Five)

Section	Question	Categories	New Categories
Demographics	*Qualification*	1. I do not hold any formal UK equestrian qualifications 2. Association of British Riding Schools (ABRS) 3. British Horse Society (BHS) 4. British Riding Club (BRC) 5. College Course 6. Pony Club 7. Postgraduate Qualification 8. UK Coaching Certificate (UKCC) 9. Undergraduate Qualification 10. Veterinary Medicine Qualification 11. Veterinary Nursing Qualification	1 = No formal UK equestrian qualification 2 = Groups 2-11, formal UK equestrian qualification
	Equestrian membership	1. I am neither affiliated with nor a member of any equestrian associations 2. A Breed Society 3. A Riding Club 4. British Dressage 5. British Driving Society 6. British Eventing 7. British Grooms Association 8. British Horse Society 9. British Show Horse Association 10. British Show Jumping Association 11. Pony Club 12. Veteran Horse Society	1 = No UK equestrian membership 2 = Groups 2-12, UK equestrian membership

	Horse management	1. At home / on private land with no other owners' horses' 2. At a commercial yard / on private land with other owners' horses'	Same as original categories
Emergency Planning	*TTM Questions (12 – 14)*	1. I do not do this and have no plans to start doing so 2. I do not do this, but I am thinking of doing this in the near future 3. I do not do this, but I am preparing to do so in the next month 4. I started doing this within the last 6 months 5. I already do this and have done so for over 6 months	Preliminary data analysis: same as original categories Statistical data analysis: 1 = Groups 1-3, Not implementing 2 = Groups 4-5, Implementing
	TPB – Behavioural, Control, Normative	1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5. Strongly agree	Positive valance: same as original categories Negative valance: 1. Strongly Agree 2. Agree 3. Neither agree nor disagree 4. Disagree 5. Strongly disagree
Experience of Colic	*Colic experience*	1. I have no personal experience of equine colic, nor have I witnessed someone else manage a horse with this condition 2. I have no personal experience of equine colic, but I have witnessed someone else manage a horse with this condition 3. I have owned a horse which developed colic and have direct personal experience of emergency decision making during this event	1 = Groups 1-2, No direct experience 2 = Group 3, Direct experience

	Most recent colic episode witnessed or managed	1. Within the last month 2. Over one month ago but within the last 6 months 3. Over 6 months but less than one year ago 4. Over one year ago	1 = Groups 1-3, Within last 12 months 2 = Group 4, Over 12 months ago
	Nature of most recent episode witnessed or managed	1. The horse spontaneously recovered without the need for a vet 2. A vet was called and the horse was treated at the yard 3. The horse was referred for medical treatment and survived 4. The horse was referred for surgical treatment and survived 5. The horse was euthanased at the yard without further investigation or treatment 6. The horse was referred to a hospital for treatment but died 7. The horse was referred to a hospital but was euthanased	1 = Groups 1, 2 & 5, No referral 2 = Groups 3, 4, 6 & 7, Referral
Experience of Colic	*Interest in emergency planning information*	1. Extremely / very interested 2. Moderately / fairly interested 3. Somewhat / a little interested 4. Not at all interested	1 = Groups 1 – 3, Interested 2 = Group 4, Not interested
	Concern about future colic episodes	1. Extremely / very concerned 2. Moderately / fairly concerned 3. Somewhat / a little concerned 4. Not at all concerned	1 = Groups 1 – 3, Concerned 2 = Group 4, Not concerned

	Preparedness for future colic episodes	1. Extremely / very prepared 2. Moderately / fairly prepared 3. Somewhat / a little prepared 4. Not prepared at all	1 = Groups 1 – 3, Prepared 2 = Group 4, Not prepared
	REACT awareness	1. No, I have not heard of this campaign 2. Yes, I have heard of this campaign	Same as original categories

Appendix IX: Supplementary results (Chapter Five)

Additional results can be viewed by clicking on the links shown below.

Table detailing participant reported use of 'REACT' resources:

https://uniofnottm-my.sharepoint.com/:b:/g/personal/katie_lightfoot_nottingham_ac_uk/EWlj4m9FTMNKtQqL_glRtWgBQ-zFUamAANdIT18wMMJTOQ?e=e8mbtm

Table detailing reasons why participants had not read or used 'REACT' resources:

https://uniofnottm-my.sharepoint.com/:b:/g/personal/katie_lightfoot_nottingham_ac_uk/Eeuozx4kQQRGspS3o8Z_QZ4BFW4RAckFfUQTWecEvav-jg?e=Zm24Hu

Table detailing factors that would influence participants' decision to pursue referral treatment:

https://uniofnottm-my.sharepoint.com/:b:/g/personal/katie_lightfoot_nottingham_ac_uk/EfBsaA5mYxhLtYsp2372gKoBZlKwhM9C-F9j2EmLpwy_Cg?e=m5mrgk

Appendix X: Results of statistical analysis (Chapter Five)

Variable	TTM Group A (Prevention/Recognition)		TTM Group B (Involving Others)		TTM Group C (Personal Preparation)	
	P value	Include or Exclude (✓ / x)	P value	Include or Exclude (✓ / x)	P value	Include or Exclude (✓ / x)
Demographics						
Years Equine Involvement	0.705	✓	0.560	✓	0.002	✓
Equestrian Membership	0.978	x	0.423	x	<0.001	✓
Equestrian Qualification	0.009	✓	0.071	✓	0.025	✓
Concern about Colic	0.755	x	0.280	x	0.449	x
Prepared for Colic	0.999	x	0.361	x	0.080	✓
Interest in colic Information	0.998	x	0.068	✓	0.476	x

Experience of colic	0.222	✓	0.685	✓	<0.001	✓
Aware of REACT	<0.001	✓	0.560	**x**	0.467	**x**
Type of Colic Experience	0.234	✓	0.971	✓	0.341	✓
Theory of Planned Behaviour: Behavioural Beliefs						
TPB – Mean behavioural score	<0.001	✓	<0.001	✓	<0.001	✓
Theory of Planned Behaviour – Normative Beliefs						
TPB – '… opinion of other horse owners is important'	0.062	✓	0.369	**x**	0.558	**x**
TPB – '… opinion of friends/family is important'	0.422	**x**	0.079	✓	0.565	**x**

TPB – '… opinion of yard manager is important'	0.033	✓	0.054	✓	0.370	**x**
TPB – '… opinion of equestrian societies important'	0.406	**x**	0.877	**x**	0.718	**x**
TPB – 'the opinion of my vet is important'	0.373	**x**	0.243	✓	0.033	✓
TPB – ' I feel pressure from others'	0.046	✓	0.805	**x**	0.244	✓
Theory of Planned Behaviour – Control Beliefs						
TPB – '… inevitable my horse will develop colic,	0.170	✓	0.709	**x**	0.722	**x**
TPB – '… treatment options not within my control'	0.387	**x**	0.570	**x**	0.022	✓

TPB – '… I would know when to call the vet'	0.001	✓	0.009	✓	0.001	✓
TPB – '… I can recognise signs quickly'	0.019	✓	0.075	✓	<0.001	✓
TPB – '… easy for me to create a plan'	0.110	✓	0.091	✓	<0.001	✓
TPB – '… no point creating a plan for my horses'	<0.001	✓	<0.001	✓	<0.001	✓
TPB – '… having a plan would not change outcome'	0.167	✓	0.042	✓	0.004	✓
TPB – ' … easily find information'	0.052	✓	0.014	✓	0.001	✓

Appendix XI: Amendments performed following piloting of a survey investigating misconceptions about colic (Chapter Six)

Survey Section	Question	Correction performed after pilot
Introduction	**Study overview and survey introduction**	Estimated completion time added.
Section 1: *'About You'*	**Question 5, sub-question b:** *In order to identify where further support can be provided, please could you tell us a little more about how well you thought the topic of colic was covered during your equine course/s*	Sub-question re-worded to: 'P*lease could you tell us a little more about how well you thought the topic of colic was covered during your equine course/s'*
	New question: When and where was the last time you read anything related to colic in the horse?	New question added to ascertain which sources of information participants use in order to learn about colic and how often they do this.
Section 2: *'Your Horse'*	**Question 10: Is your horse currently insured?**	Three additional sub-question added for participants who insured their horse: *What is your horse currently insured for?* (closed with pre-defined, single choice answers) *Do you have any exclusions on your insurance policy?* (closed with pre-defined, single choice answers)

		Please could you tell us a little more about the exclusions on your insurance policy? (open with free-text box)
Section 3: *'What do you think?!'*	**Question 36: If your horse developed colic and was continuously rolling, would you walk them around to try and stop them?**	Additional sub-question added for participants who answered 'No': *Why would you NOT walk your horse around if it was trying to roll?*
	Question 41: How much do you think colic surgery costs on average?	Question re-worded to: How much do you think colic surgery costs on average (including VAT, livery and any treatment / care provided whilst the horse is hospitalised)?
Section 4: *'Did you know?'*	***All questions in this section***	Original sub-question removed, and two new sub-questions added to each question in this section: If previous answer 'No': *Why would your approach to colic not change after reading the information 26 / 35 above?* If previous answer 'I might / probably won't...': *Why would you be unsure about changing your approach to colic after reading the information above?* (both open with free-text box)

	New question: If you would like to provide us with additional information regarding any of your answers above, the information you have just read or your views on colic, please feel free to use the box below.	Optional free-text box added to the end of this section to allow participants to leave additional comments if they wished.

Appendix XII: Supplementary results (Chapter Six)

Univariable regression

Independent variable	Exp (B)	95% Confidence Interval (CI)		P value
		Upper	Lower	
Horse age	0.914	0.929	0.900	<0.001
Years equine involvement	0.982	0.989	0.975	<0.001
Length of current horse ownership	0.933	0.948	0.919	<0.001
Equestrian qualification	1.084	1.311	0.897	0.405
Is horse insured	0.329	0.401	0.271	<0.001
Is horse used for ridden work	0.373	0.483	0.288	<0.001
Does horse have on going health issues	1.444	1.756	1.187	<0.001
Does horse have a history of colic	1.120	1.389	0.903	0.304
Ongoing behavioural issues	1.059	1.635	0.685	0.797
Perceived pressure to refer	1.536	1.866	1.264	<0.001
Horse owned for leisure / hobby purposes	1.075	1.234	0.937	0.301
Horse owned for competitive sport	0.892	0.944	0.844	<0.001
Horse owned for fitness purposes	0.919	0.986	0.856	0.018
Horse owned for companionship	0.984	1.075	0.901	0.719
Horse owned for equestrian lifestyle	0.972	1.032	0.916	0.354
Horse is a family member	0.755	0.859	0.664	<0.001
Horse is a working animal	1.066	1.158	0.981	0.130
Horse is a pet	0.905	0.986	0.830	0.023
Strong personal connection	0.756	0.886	0.646	0.001
Biggest commitment	0.867	0.936	0.802	<0.001

Generalised Linear Model Analysis (Ordinal Regression) – model with 'best fit' highlighted in yellow

Model	Variables in model	Variable removed	Model Log Likelihood	Model -2 log likelihood (-2 x log likelihood)	AIC
A	Horse Age Years equine involvement Length of current ownership Is horse insured Is horse used for ridden work Does horse have on going health issues Is there perceived pressure to refer Is the horse considered owned for competitive sport Is the horse considered owned for fitness purposes Is the horse considered a family member Is the horse considered a working animal Is the horse considered a pet Does the owner have a strong personal connection to horse Does the owner consider horse their biggest commitment	N/A	-1411.815	2823.63	2857.63
B	As 'model A'	Is the horse considered a pet	-1411.823	2823.65	2855.65
C	As 'model A'	Is the horse considered a pet Is the horse considered owned for fitness purposes	-1412.044	2824.09	2854.09

D	As ‘model A’	Is the horse considered a pet Is the horse considered owned for fitness purposes Does horse have on going health issues	-1412.672	2825.34	2853.34
E	As ‘model A’	Is the horse considered a pet Is the horse considered owned for fitness purposes Does horse have on going health issues Is the horse considered a family member	-1413.630	2827.26	2853.26
F	As ‘model A’	Is the horse considered a pet Is the horse considered owned for fitness purposes Does horse have on going health issues Is the horse considered a family member Length of current ownership	-1415.518	2831.036	2855.04
G	As ‘model A’	Is the horse considered a pet Is the horse considered owned for fitness purposes Does horse have on going health issues Is the horse considered a family member Length of current ownership Is horse used for ridden work	-1418.083	2836.166	2858.17

H	As ‘model A’	Is the horse considered a pet Is the horse considered owned for fitness purposes Does horse have on going health issues Is the horse considered a family member Length of current ownership Is horse used for ridden work Does the owner have a strong personal connection to horse	-1420.755	2841.51	2861.679

Appendix XIII: UK equine veterinary practices invited to participate in a 12 month prospective study investigating critical decision-making in horses diagnosed with colic (Chapter Seven)

Practice	Location	Number of sites	Equine Veterinary surgeons	Certificate holders / Specialists / Advanced practitioners	Hospital Interns
A	East Midlands	One referral hospital with ambulatory services	14	4	2
B	South East	One referral hospital with ambulatory services	20	7	3
C	South West	Four first opinion practices One referral hospital with ambulatory services	22 14	4 8	4

Appendix XIV: Prospective data collection forms and resources (Chapter Seven)

Colic Primary Assessment Form

Partial Practice Postcode (i.e. DE1):		Attending Practitioner (initials only):	
Time initial call taken:	❑ AM ❑ PM	Visit Date:	
Time of vets examination on arrival:	❑ AM ❑ PM		

Section 1: Horse Details

Name of Horse:		Owner Surname or Initials:	
How old is your horse?	years	months	
What gender is your horse?	❑ Mare	❑ Filly	❑ Gelding ❑ Stallion
What breed is your horse?			
What activity / discipline do you mainly use your horse for?			

Is your horse currently insured?	❑ Yes (see below)	❑ No	❑ I'm not sure
How much is your horse insured for?	£	❑ I'm not sure	
What does your insurance policy cover?	❑ Mortality only	❑ Vets fees only	❑ Mortality and vets fees ❑ I'm not sure
Do you have any exclusions on your policy?	❑ Yes (see below)	❑ No	❑ I'm not sure
Please specify any policy exclusions:			

Does your horse have any ongoing medical conditions?	❑ Yes (see below)	❑ No	❑ I'm not sure
Please specify any current medical conditions:			
Does your horse display any stereotypical behaviours?	❑ Yes (see below)	❑ No	❑ I'm not sure
Please specify any stereotypic behaviour:	❑ None ❑ Windsucking	❑ Crib biting ❑ Weaving	❑ Box walking ❑ Other (please specify):
When was your horse last wormed?			❑ I'm not sure
When did your horse last have a dental examination?			❑ I'm not sure

Within the last 30 days:			
Have there been any recent changes to you horse's feeding regimen?	❑ Yes	❑ No	❑ I'm not sure
Have there been any recent changes to you horse's stabling/turnout?	❑ Yes	❑ No	❑ I'm not sure
Not including this current episode, has your horse been treated for colic?	❑ Yes	❑ No	❑ I'm not sure

Thinking about your horse's current episode of colic:				
When did you last see your horse behaving normally?		Date:	Time:	❑ I'm not sure
When did you first notice your horse showing colic signs?		Date:	Time:	❑ I'm not sure
Which signs of colic did your horse show? (please tick all that apply)	❑ Kicking abdomen ❑ Rolling ❑ Sweating ❑ Pawing the ground ❑ Flank watching	❑ Attempts to lie down ❑ Depressed/dull demeanour ❑ Restless/agitated ❑ Reduced appetite ❑ Reduced droppings	❑ Increased heart rate ❑ Increased respiratory rate ❑ Other (please specify):	

Section 5: Clinical Exam

Medication PRIOR to arrival	**Has medication been given:**	❑ Yes	❑ No	❑ Unknown		
	If 'Yes' - **Who gave medication:**	❑ Owner	❑ Other (please specify):			
	Name of drug:		**Quantity given:**			
Initial observations on arrival (see supplementary sheet for more information)	**Demeanour:**	❑ BAR	❑ QAR	❑ Depressed	❑ Mildly restless	❑ Moderately restless	❑ Severely restless
	Specific Behaviour and severity:			None/normal	Slight/occasional	Moderate/frequent	Severe/continuous
		Kicking at stomach	Severity score:	❑ 0	❑ 1	❑ 2	❑ 3
		Pawing	Severity score:	❑ 0	❑ 1	❑ 2	❑ 3
		Sweating	Severity score:	❑ 0	❑ 1	❑ 2	❑ 3
		Flank watching	Severity score:	❑ 0	❑ 1	❑ 2	❑ 3
		Attempting to lie down	Severity score:	❑ 0	❑ 1	❑ 2	❑ 3
		Rolling	Severity score:	❑ 0	❑ 1	❑ 2	❑ 3
General Condition	**Weight:**	kg ❑ Estimated ❑ Actual	**Body Condition Score:** (see supplementary sheet for more information)	❑ 0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5			
	Is horse clipped:	❑ Yes ❑ No	**Cleanliness of horse:**	❑ Clean	❑ Moderately clean	❑ Filthy	
Clinical parameters	**Heart Rate:**	bpm	**Pulse Character:**	❑ Weak	❑ Strong		
	Respiratory Rate:	bpm	**Rectal Temperature:**	°C			
	Oral MM Colour:	❑ Normal	❑ Pale	❑ Congested	❑ Cyanotic	❑ Toxic Rings	
	Oral MM feel when touched:	❑ Moist	❑ Dry	❑ Tacky			
	Capillary Refill Time:	❑ > 2.5 seconds	❑ < 2.5 seconds				
Abdominal observations	**Gut Sounds:**	**Upper LHS:**	❑ Absent ❑ Hypo ❑ Normal ❑ Hyper	**Upper RHS:**	❑ Absent ❑ Hypo ❑ Normal ❑ Hyper		
		Lower LHS:	❑ Absent ❑ Hypo ❑ Normal ❑ Hyper	**Lower RHS:**	❑ Absent ❑ Hypo ❑ Normal ❑ Hyper		
	Abdominal distension:	❑ None	❑ Slight	❑ Moderate	❑ Severe		
Extremities	**Temperature:**	❑ Normal	❑ Cool to the touch	❑ Warm to the touch			
	Quality of digital pulses:	❑ Absent	❑ Reduced / weak pulse	❑ Increased / strong pulse			
Injuries	**Abrasions caused by self trauma:**	❑ None	❑ Present over eyes / on head	❑ Present over pelvic region			
	Any other signs of injury:	❑ None					

Section 6: Results Of Diagnostic Procedures

Rectal Palpation (please select main finding)	❑ Not performed	❑ Large colon impaction	❑ Small intestine impaction
	❑ Nothing abnormal detected	❑ Large colon gas distension	❑ Small intestine gas distension
	❑ Right dorsal displacement	❑ Small colon impaction	❑ Caecal impaction
	❑ Left dorsal displacement	❑ Small colon gas distension	❑ Other (please specify):

Nasogastric intubation	**Reason for performing:**	❑ Not performed	❑ Tube passed diagnostically	❑ Tube passed therapeutically	
	Fluid quantity:	litres	**Fluid colour:**		
	Was spontaneous reflux observed:	❑ Yes	❑ No		
Abdominal paracentesis	**Sample collection:**	❑ Not performed	❑ Simple sample collection	❑ Difficult sample collection	
	Fluid quantity:	litres	**Fluid colour:**		
	Cell count:	x10^9/litre	**TP:**	g/litre	**Lactate:** mmol/litre	**Other:**
Abdominal ultrasound (please select main finding)	❑ Not performed	❑ Colon gas distension	❑ Other (please specify):		
	❑ Reduced small intestine motility	❑ Increased peritoneal fluid			
	❑ Colon impaction	❑ Small intestine fluid distension			

Drugs administered for DIAGNOSTIC purposes only (see section 8 to record drugs given for treatment purposes)	**Name of drug:**		**Quantity given:**	mls
	Reason for administration:			
	Name of drug:		**Quantity given:**	mls
	Reason for administration:			
	Name of drug:		**Quantity given:**	mls
	Reason for administration:			
	Name of drug:		**Quantity given:**	mls
	Reason for administration:			

Response to analgesia	**Demeanour after administration:**	❑ BAR	❑ QAR	❑ Depressed	❑ Mildly restless	❑ Moderately restless	❑ Severely restless	
Haematology and Biochemistry	❑ Not performed	**PCV:**	%	**TP:**	g/litre	**Lactate:**	mmol/litre	
	Other (please specify):							

Section 7: Diagnosis

Diagnosis:	**No definitive diagnosis:**	❑ Unknown ❑ Gas ❑ Spasmodic
	Large Colon:	❑ Impaction ❑ RDD ❑ LDD ❑ Volvulus ❑ Caecal impaction
	Small Intestine:	❑ Strangulation ❑ Entrapment ❑ Volvulus ❑ Impaction
	Other:	❑ Grass sickness ❑ Enteritis/colitis/entercolitis ❑ Neoplasia ❑ Other:
	Is diagnosis:	❑ Definitive ❑ Presumptive

Section 8: Treatment & case outcome

Discussion of treatment plan	**Please list any factors relating to the circumstances of this horse / owner / individual case that were considered significant during the formulation of the treatment plan:**		
No Treatment Required	❑ Symptoms resolved without medical/surgical intervention	❑ Symptoms resolved after first administration of antispasmodic drugs and / or pain relief	
Medical treatment (Not including drugs administered for diagnostic purposes)	Please specify medical treatment (i.e. drugs, dosages, frequency of administration and duration of treatment):		
	Where was treatment provided:	❑ Owner premises	❑ At local veterinary practice (if facilities available)
	Was IV fluid therapy performed:	❑ Yes	❑ No
	Was enteral fluid therapy performed:	❑ Yes	❑ No
	Outcome:	❑ Resolved after initial visit / treatment ❑ Resolved after secondary visit / treatment ❑ Referred (see 'referral') ❑ Euthanased / died (see 'euthanasia or sudden death')	
Referral	**Reason for referral:**	❑ Severity of clinical signs ❑ Severity of behavioural signs ❑ Further diagnostic investigation required ❑ Intensive medical treatment requiring hospitalisation ❑ Surgical investigation and / or treatment required ❑ Other (please specify):	
Euthanasia or sudden death	**Date of death:**		
	Cause of death:	❑ Euthanasia ❑ Sudden death	
	Time of death:	❑ After the initial assessment (no further treatment or investigation) ❑ Within the first 24 hours of medical treatment ❑ After the first 24 hours of medical treatment ❑ Other (please specify):	
	Please list any factors relating to the circumstances of this horse / owner / individual case that were considered significant during the decision for euthanasia:		

Colic Referral Hospital Assessment Form

Partial Practice Postcode (i.e. DE1):		**Referral Practitioner** (initials only):	
Admission Time:	❑ AM ❑ PM	**Admission Date:**	
Time FIRST examined by vet (i.e. ambulatory call):	Date:	Time:	❑ This is the first examination

Section 1: Horse Details

Horse Name:		**Owner Surname:**	
Age:	**Gender:** ❑ Mare ❑ Gelding ❑ Stallion		

Breed Category (see supplementary sheet for more information on breed categories)	❑ Donkey/Mule ❑ Small/miniature pony (i.e. Shetland, Falabella) ❑ Pony (i.e. Fell, Connemara) ❑ Arab/Arab type	❑ Cob ❑ Thoroughbred/Thoroughbred type ❑ Sports Horse (i.e. Irish Sports Horse, Warmblood) ❑ Draught/heavy horse
	Specific breed if known:	

Insurance status	**Insured:**	❑ Yes ❑ No ❑ Unknown	**Amount if insured:**	£ ❑ Unknown
	Policy type:	❑ Mortality only ❑ Vets fees only ❑ Mortality and vets fees ❑ Unknown		
	Exclusions:	❑ Unknown		

Current ownership	**Time in owner's possession:**	years months
	Who is daily care provided by:	❑ Owner ❑ Owner's friend ❑ Livery yard groom ❑ Owner's family ❑ Contracted loaner ❑ Private groom

Main use and/or discipline	❑ General/leisure riding ❑ Showing ❑ Riding school	❑ Eventing ❑ Show jumping ❑ Dressage	❑ Hunting ❑ Endurance ❑ Racing	❑ Retired and/or companion ❑ Breeding ❑ Other (please specify):
	Work quantity: hours/per week	**Work intensity:**	❑ None ❑ Light ❑ Medium ❑ Intense	
	Competition level:	❑ None/not applicable ❑ Local shows only ❑ Unaffiliated shows nationally	❑ Affiliated shows nationally ❑ Affiliated shows internationally ❑ Other (please specify):	

Ongoing medical conditions	❑ None ❑ Laminitis ❑ Respiratory disease (i.e. RAO) ❑ PPID ❑ Equine Metabolic Syndrome ❑ Lameness issues (please specify): ❑ Other (please specify):

Stereotypic behaviour	❑ None ❑ Windsucking	❑ Crib biting ❑ Weaving	❑ Box walking ❑ Other (please specify):

Preventative care	**Last wormed:**	Date: ❑ Unknown	**Worming product:**	
	Last dental:	Date: ❑ Unknown	**Dental disease/issues:**	❑ Yes ❑ No ❑ Unknown
	If 'Yes' - **please provide details of dental issues:**			

Section 2: Recent Management Changes (in the last 30 days)

Change in feeding regimen:	❑ Yes ❑ No	If 'Yes' - **days since change:**	
If 'Yes' - **reason for change**	❑ Introduction of hard feed ❑ Change in type of hard feed	❑ Change in forage type ❑ Change in forage supplier	❑ Other (please specify):
Change in stabling/turnout:	❑ Yes ❑ No	If 'Yes' - **days since change:**	
If 'Yes' - **type of change**	❑ Decrease in turnout time ❑ Increase in turnout time	❑ Pasture change ❑ Box rest	❑ Bedding type (please specify): ❑ Other (please specify):

Section 3: Colic History

Colic episode within the last 30 days (excluding current episode):	❑ Yes ❑ No	If 'Yes' - **date of last episode:**	
If 'Yes' - **Did a vet attend/examine the horse:**	❑ Yes ❑ No	If 'Yes' - **how many vets visits:**	

Section 4: Current Colic Episode

When was the horse last seen to be 'normal':	Date:	Time:	❑ Unknown
When were colic signs first noticed:	Date:	Time:	❑ Unknown

Sign FIRST noticed by owner (please select one)	❑ Kicking abdomen ❑ Rolling ❑ Sweating ❑ Pawing the ground ❑ Flank watching	❑ Attempts to lie down ❑ Depressed/dull demeanour ❑ Restless/agitated ❑ Reduced appetite ❑ Reduced droppings	❑ Increased heart rate ❑ Increased respiratory rate ❑ Other (please specify):

Section 5: Clinical Exam

Medication PRIOR to arrival	**Has medication been given:**	❑ Yes	❑ No	❑ Unknown		
	If 'Yes' - **Who gave medication:**	❑ Owner	❑ Other (please specify):			
	Name of drug:		**Quantity given:**			
Initial observations on arrival (see supplementary sheet for more information)	**Demeanour:**	❑ BAR	❑ QAR	❑ Depressed	❑ Mildly restless	❑ Moderately restless	❑ Severely restless
	Specific Behaviour and severity:			None/normal	Slight/occasional	Moderate/frequent	Severe/continuous
		Kicking at stomach	Severity score:	❑ 0	❑ 1	❑ 2	❑ 3
		Pawing	Severity score:	❑ 0	❑ 1	❑ 2	❑ 3
		Sweating	Severity score:	❑ 0	❑ 1	❑ 2	❑ 3
		Flank watching	Severity score:	❑ 0	❑ 1	❑ 2	❑ 3
		Attempting to lie down	Severity score:	❑ 0	❑ 1	❑ 2	❑ 3
		Rolling	Severity score:	❑ 0	❑ 1	❑ 2	❑ 3
General Condition	**Weight:**	kg ❑ Estimated ❑ Actual	**Body Condition Score:** (see supplementary sheet for more information)	❑ 0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5			
	Is horse clipped:	❑ Yes ❑ No	**Cleanliness of horse:**	❑ Clean	❑ Moderately clean	❑ Filthy	
Clinical parameters	**Heart Rate:**	bpm	**Pulse Character:**	❑ Weak	❑ Strong		
	Respiratory Rate:	bpm	**Rectal Temperature:**	°C			
	Oral MM Colour:	❑ Normal	❑ Pale	❑ Congested	❑ Cyanotic	❑ Toxic Rings	
	Oral MM feel when touched:	❑ Moist	❑ Dry	❑ Tacky			
	Capillary Refill Time:	❑ > 2.5 seconds	❑ < 2.5 seconds				
Abdominal observations	**Gut Sounds:**	**Upper LHS:**	❑ Absent ❑ Hypo ❑ Normal ❑ Hyper	**Upper RHS:**	❑ Absent ❑ Hypo ❑ Normal ❑ Hyper		
		Lower LHS:	❑ Absent ❑ Hypo ❑ Normal ❑ Hyper	**Lower RHS:**	❑ Absent ❑ Hypo ❑ Normal ❑ Hyper		
	Abdominal distension:	❑ None	❑ Slight	❑ Moderate	❑ Severe		
Extremities	**Temperature:**	❑ Normal	❑ Cool to the touch	❑ Warm to the touch			
	Quality of digital pulses:	❑ Absent	❑ Reduced / weak pulse	❑ Increased / strong pulse			
Injuries	**Abrasions caused by self trauma:**	❑ None	❑ Present over eyes / on head	❑ Present over pelvic region			
	Any other signs of injury:	❑ None					

Section 6: Results Of Diagnostic Procedures

Rectal Palpation (please select main finding)	❑ Not performed	❑ Large colon impaction	❑ Small intestine impaction	
	❑ Nothing abnormal detected	❑ Large colon gas distension	❑ Small intestine gas distension	
	❑ Right dorsal displacement	❑ Small colon impaction	❑ Caecal impaction	
	❑ Left dorsal displacement	❑ Small colon gas distension	❑ Other (please specify):	
Nasogastric intubation	**Reason for performing:**	❑ Not performed	❑ Tube passed diagnostically	❑ Tube passed therapeutically
	Fluid quantity:	litres	**Fluid colour:**	
	Was spontaneous reflux observed:	❑ Yes	❑ No	
Abdominal paracentesis	**Sample collection:**	❑ Not performed	❑ Simple sample collection	❑ Difficult sample collection
	Fluid quantity:	litres	**Fluid colour:**	
	Cell count:	x10⁹/litre	**TP:** g/litre	**Lactate:** mmol/litre	**Other:**
Abdominal ultrasound (please select main finding)	❑ Not performed	❑ Colon gas distension	❑ Other (please specify):	
	❑ Reduced small intestine motility	❑ Increased peritoneal fluid		
	❑ Colon impaction	❑ Small intestine fluid distension		
Drugs administered for DIAGNOSTIC purposes only (see section 8 to record drugs given for treatment purposes)	**Name of drug:**	**Quantity given:**	mls	
	Reason for administration:			
	Name of drug:	**Quantity given:**	mls	
	Reason for administration:			
	Name of drug:	**Quantity given:**	mls	
	Reason for administration:			
	Name of drug:	**Quantity given:**	mls	
	Reason for administration:			
Response to analgesia	**Demeanour after administration:**	❑ BAR	❑ QAR	❑ Depressed	❑ Mildly restless	❑ Moderately restless	❑ Severely restless
Haematology and Biochemistry	❑ Not performed	**PCV:** %	**TP:** g/litre	**Lactate:** mmol/litre			
	Other (please specify):						

Section 7: Diagnosis

Diagnosis:	**No definitive diagnosis:**	❑ Unknown ❑ Gas ❑ Spasmodic
	Large Colon:	❑ Impaction ❑ RDD ❑ LDD ❑ Volvulus ❑ Caecal impaction
	Small Intestine:	❑ Strangulation ❑ Entrapment ❑ Volvulus ❑ Impaction
	Other:	❑ Grass sickness ❑ Enteritis/colitis/entercolitis ❑ Neoplasia ❑ Other:
	Is diagnosis:	❑ Definitive ❑ Presumptive

Section 8: Treatment & case outcome

Discussion of treatment plan	**Please list any factors relating to the circumstances of this horse / owner / individual case that were considered significant during the formulation of the treatment plan:**

No Treatment Required	❑ Symptoms resolved without medical/surgical intervention ❑ Symptoms resolved after first administration of antispasmodic drugs and / or pain relief

Medical treatment (Not including drugs administered for diagnostic purposes)	Please specify medical treatment (i.e. drugs, dosages, frequency of administration and duration of treatment):		
	Was IV fluid therapy performed:	❑ Yes	❑ No
	Was enteral fluid therapy performed:	❑ Yes	❑ No
	Survived until discharge:	❑ Yes	❑ No (see euthanasia / sudden death)

Surgical treatment	Please specify surgical treatment (i.e. procedure undertaken, drugs, dosages, frequency of administration and duration of treatment):		
	Was IV fluid therapy performed:	❑ Yes	❑ No
	Was enteral fluid therapy performed:	❑ Yes	❑ No
	Survived until discharge:	❑ Yes	❑ No (see euthanasia / sudden death)

Euthanasia or sudden death	**Date of death:**	
	Cause of death:	❑ Euthanasia ❑ Sudden death
	Time of death:	❑ On arrival at the referral hospital (before initial assessment) ❑ After the initial assessment (no further treatment or investigation) ❑ Within the first 24 hours of medical treatment ❑ After the first 24 hours of medical treatment (but before hospital discharge) ❑ During first surgical treatment ❑ During anaesthetic recovery ❑ Within the first 24 hours of post operative recovery ❑ After the first 24 hours of post operative recovery (but before hospital discharge) ❑ Other (please specify):
	Please list any factors relating to the circumstances of this horse / owner / individual case that were considered significant during the decision for euthanasia:	

University of Nottingham
UK | CHINA | MALAYSIA

WorldHorseWelfare

Information for participating veterinary practices

Please find below information on the purpose of this study and how we would like you to participate. If you would like any further information, or have any additional questions, please feel free to contact the principle researcher (details at the end of this information sheet) who will be happy to help.

What is the purpose of the study?

Abdominal pain is a leading cause of morbidity and mortality in the domesticated horse. Despite rapid decision making, both on the part of the horse owner and attending veterinary practitioner, being key to maximising chances of recovery, the complex and highly distressing nature of this condition can often create barriers to treatment and survival.

Existing evidence has provided practitioners with potential clinical indicators that could assist them in identifying cases which require urgent medical or surgical intervention. However, little is known about the impact of non-clinical factors, such as owner finance, on treatment availability and case outcome. Therefore, this study aims to investigate both clinical and non-clinical factors that could affect a horse's treatment and survival during an episode of colic.

Who is participating?

[Practice Name] is one of a number of UK equine veterinary practices participating in this research between September 2018 and September 2019. We would like participating practices to invite every owner of a horse undergoing colic assessment and/or treatment to be part of this study during this time. This research has been kindly sponsored by the University of Nottingham's School of Veterinary Medicine and Science and World Horse Welfare.

What am I required to do?

This research is prospective in nature and requires the collection and analysis of information that would be routinely asked for by members of your veterinary team during a colic assessment and/or treatment. This data would form part of that horse's hospital records and is directly associated with the diagnosis, treatment and outcome of that colic episode.

In order to carry out our research, we would be very grateful if you could complete a bespoke colic assessment form, either during a primary (ambulatory) or referral assessment, for each colic case you attend between September 2018 and September 2019. We would like to collect information on **ALL** colic cases, regardless of the outcome or if they were referred for further treatment or not. We would also like to follow case progression, from primary (ambulatory assessment) through to referral treatment (if required), therefore, both a primary and referral form should be completed for these horses.

Short term survival (i.e. up until hospital discharge or conclusion of primary assessment and/or treatment) of horses diagnosed with gastrointestinal colic is the focus of this study. We therefore do NOT require you to complete additional tasks or chase owners for follow up information after their horse's assessment and/or treatment.

Further information about this form can be found overleaf and on the 'completion and submission' guide included within your practice research pack.

What is included within the colic assessment form?

The bespoke colic assessment form has been designed by researchers at the University of Nottingham's School of Veterinary Medicine and Science alongside members of your veterinary practice team. It has been piloted in all participating practices and approved by the School of Veterinary Medicine and Science Ethics Committee.

Each section within the form is based upon results of existing scientific literature, which links this information to either the development of colic or case outcome. The final page contains a novel approach to recording factors, which were considered during the formulation of a treatment plan between vets and horse owners. For this section, please enter any information you think significantly contributed to the treatment decision or outcome in that case, i.e. owner finances, horse age, temperament or presenting clinical condition etc. The more information you can provide us with the better.

In addition to collecting research data, we hope this form will assist veterinary practices in recording a comprehensive account of colic cases which can enhance the hospital records of their patients.

Do I have to use a paper-based form?

No. We have created both a paper-based and online version of the colic assessment form so that you can use whichever method is most convenient for yourself. **The online form will be available to use by the end of September 2018, therefore, please use the paper-based version until you are notified that the online form has gone 'live'.** For further information on how to complete and submit both types of form, please see the 'completion and submission' information included within your practice research pack. Data submitted online will be automatically submitted to the project researchers, whereas paper-based forms will need to be returned via post to the University of Nottingham (pre-paid envelopes will be provided).

Why do we require owner consent to record information?

As this is a prospective research study, and with recent changes to data protection laws, we are required to ask each horse owner to provide written consent before their horse's data can be used. An information sheet, which provides a comprehensive study overview, has been provided within your practice research pack and each owner should be given a copy to keep. Additionally, owner consent forms, which have been approved by the School of Veterinary Medicine and Science Ethics Committee, have been provided for owners to complete and return during their horse's assessment and/or treatment.

Who do we contact for additional resources?

We understand how busy working within equine practice can be, therefore additional forms will be sent to practices on a bi-monthly basis on behalf of the study researchers to ensure you don't run out. However, if you do run out of forms, please see the 'completion and submission' information sheet for instruction on how to generate more. For more pre-paid envelopes, please contact the principle researcher.

Further information and contact details:

Principle Researcher: Katie Lightfoot (PhD student): katie.lightfoot@nottingham.ac.uk
Lead Supervisor: Professor Sarah Freeman: sarah.freeman@nottingham.ac.uk
Additional Supervisors: Dr John Burford, Professor Gary England and Professor Mark Bowen

University of Nottingham
UK | CHINA | MALAYSIA

WorldHorseWelfare

Completion and submission of research forms

1. Owner consent forms

To comply with current data protection regulations, we must ensure written consent is obtained from each horse owner prior to data collection. Potential participants should be given a paper copy of the 'Research Participant Information' sheet to read before completing the 'Research Participant Consent' form, both of which have been provided within your practice research pack.

Horse owners should keep the information sheet for their own records. Signed consent forms **MUST** be returned to researchers at the University of Nottingham either via post with completed paper assessment forms (see below), or via email: katie.lightfoot@nottingham.ac.uk (subject heading – 'colic research consent').

2. Primary or Referral colic assessment form?

We would like to gather information on **ALL** colic cases that have required a veterinary assessment, regardless of treatment or outcome. Therefore, we would like you to complete a colic assessment form on both **PRIMARY** (ambulatory) and **REFERRAL** colic assessments where possible. We are also keen to follow horses which have been primarily assessed on an ambulatory basis and subsequently referred for further investigation and / or treatment.

Primary colic assessments

Primary cases are those in which the current colic episode is being assessed by a veterinary practitioner for the first time, which will most often be at the owner's premises during an ambulatory visit. For these cases, please complete a **PRIMARY** colic assessment form up until the conclusion of primary treatment / resolution of symptoms **OR** the referral/euthanasia of the horse. If the horse is referred to a referral hospital that is also participating in this study, please ensure a REFERRAL assessment form is also completed for this case (see below).

Referral colic assessments

Referral cases are those in which the horse has been primarily assessed by an ambulatory practitioner and subsequently referred for further investigation and / or treatment at an equine hospital. For these cases, please complete a **REFERRAL** colic assessment form up until the conclusion of referral treatment / hospital discharge **OR** the euthanasia / death of the horse. In the event an owner has been advised to bring their horse directly to the hospital without primary assessment, for example, due to the severity of signs, please class these cases as referral assessments.

3. Submission of completed colic assessment forms

We have created both paper-based and online versions of the bespoke colic assessment form, so that you may use whichever method is most convenient for yourself. To ensure the success of this research project, we would be incredibly grateful if you could provide us with as much information as possible when completing these forms.

Please ensure you put your practices partial postcode, the horse's name and owner's surname on EVERY form you complete. This will ensure we can identify participating practices and follow horses which have undergone both a primary and referral assessment.

Paper-based colic assessment forms

Twenty pre-printed copies of both the primary and referral assessment forms have been provided within your practice research pack. We will endeavour to supply you with additional forms on a bi-monthly basis. However, further copies can be generated by photocopying the corresponding master copy (also included within your research pack), or by downloading form templates via the Vet React website (www.react.vet).

The paper-based form (which is slightly different for primary and referral cases) consists of the following three pages:

(1) Horse details / history

(2) Clinical and diagnostic assessment

(3) Diagnosis and case outcome

Please complete **ALL** sections relevant to your case, in as much detail as possible, up until the conclusion of that horse's assessment and / or treatment.

Once completed, please return paper-based forms directly to the University of Nottingham's School of Veterinary Medicine and Science using the pre-paid envelopes included within your research pack. Alternatively, scanned forms can be emailed to katie.lightfoot@nottingham.ac.uk (subject heading – 'completed colic form'). Prior to submission, forms can be scanned onto the horse's clinical file as a record of their treatment.

Online colic assessment forms

Online forms can be accessed via the Vet React website (www.react.vet) **from the end of September 2018**. These forms, which are again slightly different for primary and referral cases, are split into the following two sections:

(1) Horse details and diagnostic assessment – to be completed at or just after initial assessment.

(2) Diagnosis and case outcome – to be completed on conclusion of assessment and/or treatment.

Each section of the online form will be automatically submitted once 'SUBMIT' has been clicked. Therefore, please ensure you record, or have access to, as much information as possible when completing each section of the online form, as you will not be able to return to, or amend, information once it has been submitted.

An electronic copy of these forms will be automatically emailed to your nominated practice email address upon submission, to enable you to update the relevant clinical records. .

University of Nottingham
UK | CHINA | MALAYSIA

WorldHorseWelfare

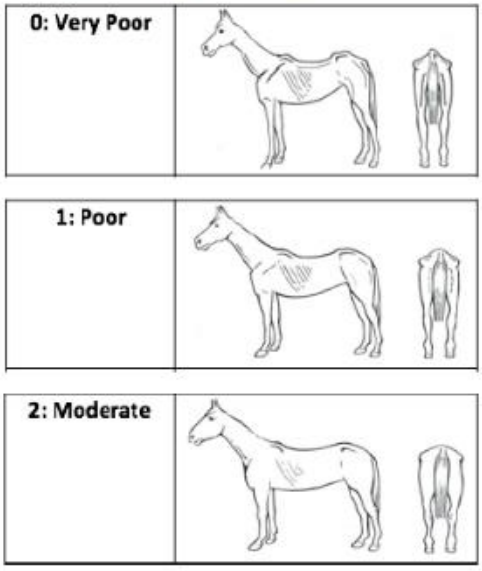
Colic Assessment Form – Supplementary Information

1. Breed Categories

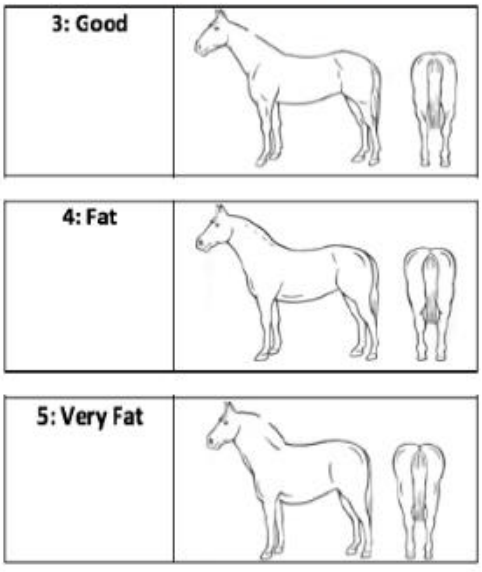
Category	Breed or Type included within category
Donkey / Mule	N/A
Small / Miniature Pony	Includes breeds and types such as: • Shetland • Miniature horse • Miniature Shetland • Shetland cross • Falabella
Pony	Includes breeds and types such as: • Welsh Section A, B and C • Welsh pony and Welsh cross breeds • Fjord • Fell • Connemara and Connemara cross breeds • Exmoor and Exmoor cross breeds • Riding pony • Highland and Highland cross breeds • New Forest and New Forest cross breeds • Dartmoor and Dartmoor cross breeds • Dales and Dales cross breeds • Haflinger
Arab / Arab type	Includes breeds and types such as: • Arab • Arab cross breed • Anglo Arab
Cob	Includes breeds and types such as: • Cob • Cob cross • Welsh Section D • Welsh Cob
Thoroughbred / Thoroughbred type	Includes breeds and types such as: • Thoroughbred • Thoroughbred cross (except ID x TB) • Morgan • Appaloosa • Hackney and Hackney cross breeds • Trotter and Trotter cross breeds • Standardbred • Quarter Horse • Riding Hack
Sports Horse / Sports horse type	Includes breeds and types such as: • Warmblood and warmblood cross breeds • Irish Draught • Irish Sports Horse (i.e. ID x TB) • Hunter • Andalusian • Lipizzaner • Fresian and Fresian cross breeds • Selle Française • Hannoverian and Hannoverian cross breeds • Cleveland Bay and Cleveland Bay cross breeds • Trakehner and Trakehner cross breeds • KWPN
Draught / Heavy horse	Includes breeds and types such as: • Shire and Shire cross breeds • Clydesdale and Clydesdale cross breeds • Percheron and Percheron cross breeds • Suffolk Punch

2. Body Condition Score (BCS)

Visual Aid for BCS 0 - 2



Visual Aid for BCS 3 - 5



BCS Description

Score	Description		
0	**Neck:** • Marked 'ewe' neck • Narrow and slack at base	**Back and Ribs:** • Skin tight over ribs • Spinous processes easily seen	**Pelvis:** • Angular with tight skin • Deep cavity under tail and either side of croup
1	**Neck:** • 'Ewe' neck • Narrow and slack at base	**Back and Ribs:** • Ribs easily visible • Skin sunken either side of backbone • Spinous processes well defined	**Pelvis:** • Sunken rump but supple skin • Well defined croup and pelvis • Deep depression under tail
2	**Neck:** • Narrow but firm	**Back and Ribs:** • Ribs just visible • Backbone well covered • Spinous processes felt	**Pelvis:** • Rump flat either side of backbone • Croup well defined • Slight cavity under tail
3	**Neck:** • No crest (except stallions) • Firm neck	**Back and Ribs:** • Ribs just covered and easily felt • No 'gutter' along back • Spinous processes covered, but can be felt	**Pelvis:** • Covered by fat and rounded. • No 'gutter' • Pelvis easily felt
4	**Neck:** • Slight crest	**Back and Ribs:** • Ribs well covered • Need firm pressure to feel structures • Gutter along backbone	**Pelvis:** • 'Gutter' to root of tail • Pelvis covered by fat • Need firm pressure to feel pelvic structures
5	**Neck:** • Marked crest • Wide and firm • Fold of fat	**Back and Ribs:** • Ribs covered and cannot be felt • Deep 'gutter' along back • Back broad and flat	**Pelvis:** • Deep 'gutter' to root of tail • Skin distended • Pelvis covered and cannot be felt

Based on the Body Condition Scoring system developed by Carroll and Huntingdon (1988)

3. Demeanour Definitions

Demeanour	Definition
Bright, alert and responsive (BAR)	A horse that is standing normally, responsive to auditory stimuli and interested in its environment. No obvious signs of discomfort or distress and displaying normal behaviour for that individual.
Quiet, alert and responsive (QAR)	A horse that is standing normally but less responsive to auditory and environmental stimuli. No obvious signs of discomfort or distress but quieter than normal for that individual.
Depressed	A horse that is dull, non-responsive to auditory stimuli and disinterested in its environment. It may have ears pulled back or down, but ears are not pricked forward or moving in response to noise. It may have a lowered head carriage level with or just below the withers.
Restless	A horse that does not stand quietly instead moving with varying degrees of agitation: **MILD**: Intermittent movement including pawing and flank-watching. Horse is still responsive to auditory stimuli. **MODERATE**: Frequent movements such as those listed for 'MILD' but horse can also be seen to be sweating (slight to moderate), attempting to lie down, kicking at abdomen and rolling. Horse is still responsive to auditory stimuli and can be distracted from carrying out displayed movements. **SEVERE**: Continuous, violent movements, such as rolling, and severe sweating. Horse does not respond to auditory stimuli or attempts to distract it.

Based on the definitions used by Curtis *et al.*, (2015), Sutton *et al.*, (2013), Southwood and Fehr (2013) and Mair and Smith (2005)

4. Behavioural Definitions and Severity Score

Behaviour	Definition
Kicking at abdomen	A horse that kicks in the direction of its abdomen
Pawing	A horse that scrapes the ground with a forelimb
Flank-watching	A horse that glances at its side or flank
Sweating	A horse which has visible quantities (slight, moderate or severe) of perspiration on its head or body
Attempts to lie down	A horse that buckles the legs ('crouches') as if to lie down but does not, or lies down but gets up immediately
Rolling	A horse that lies down on its side and moves by rocking onto its back, sometimes landing on its opposite side

Numerical Score	Verbal Score	Severity Description
0	None/normal	The horse is not showing this behaviour or the behaviour is deemed normal for that individual
1	Slight/occasional	The horse is seen to be performing this behaviour but the occurrence of the action is infrequent
2	Moderate/frequent	The horse is seen to be performing this behaviour repeatedly but stops for short periods of time before resuming the behaviour
3	Severe/continuous	The horse is performing this behaviour continuously with no breaks in repetition. The behaviour can also be described as 'violent'

Based on the severity scoring system used by Curtis *et al.*, (2015), Sutton *et al.*, (2013) and Mair and Smith (2005)

University of Nottingham
UK | CHINA | MALAYSIA

WorldHorseWelfare

Investigating factors associated with the treatment and survival of horses diagnosed with colic (abdominal pain)

The University of Nottingham's School of Veterinary Medicine and Science and *[name of practice]* would like to invite you to take part in our current research project investigating equine colic, which has been kindly supported by World Horse Welfare.

What is the purpose of the study and why have I been invited?

This study aims to investigate factors that could affect a horse's treatment and survival during an episode of colic. *[name of veterinary practice]* is one of a number of UK equine veterinary practices participating in this research between August 2018 and August 2019. We are inviting every owner of a horse undergoing colic assessment and/or treatment at these participating practices during this time to be part of this study.

What will happen if I take part?

This study requires the collection and analysis of information routinely asked for and collected by veterinary surgeons during a colic assessment and/or treatment. This data forms part of your horse's hospital records and is directly associated with the diagnosis, treatment and outcome of their colic episode. Our research does NOT require you to complete tasks or provide additional personal information during or after your horse's assessment and/or treatment, and it does not affect how your horse is treated. In order to carry out our research, all you are required to do is complete the attached consent form allowing us to collect and analyse the information your veterinary surgeon will record during the duration of your horse's colic assessment and/or treatment.

What are the possible benefits of taking part?

The experiences of you and your horse can help to save future equine lives. We hope that the information generated from this study will help us to improve the way colic is assessed and managed through the development of educational resources to help support vets and horse owners during a colic episode.

What are the possible disadvantages and risks of taking part?

This research poses no direct health risks to participants or their horse and will NOT affect the assessment and/or treatment of horses with colic.

Do I have to take part?

Participation within this study is completely voluntary. If you decide to take part you will be given this information sheet to keep and asked to sign the attached consent form, however, you can still withdraw at any time. Please feel free to ask a member of the veterinary team attending to you and your horse for further information.

Will my taking part in the study be kept confidential?

All information about you and your horse will be handled in confidence. As this information forms part of your horses routine hospital records, your veterinary practice will keep a copy of all data recorded during your horse's colic assessment and/or treatment on their password protected database in association with your horses personal record file. Only data essential to this study will be accessed by the University of Nottingham researchers listed at the end of this form. As previously mentioned, we do not require any additional personal information, such as addresses or telephone numbers, from horse owners participating within this study. However, we will keep all information collected during the course of this research **strictly confidential**, stored in a secure office, and on a password protected database. Additionally, we will anonymise all collected information using a unique code so that you and your horse cannot be identified. Researchers will keep anonymised data securely for 7 years, after which time this data will be disposed of securely.

What will happen to the results of the research study?

The results of this study will be used as part of the principle researchers PhD thesis on decision making in cases of equine colic. Evidence generated during this study may also be published in scientific publications, presented at relevant veterinary conferences and used to develop educational resources for vets and horse owners. In all cases, information associated with you and your horse will remain anonymous at all times.

Who has reviewed the study?

This study and documents relevant to data collection were reviewed and approved by the University of Nottingham's School of Veterinary Medicine and Science Ethics Committee. Additionally, veterinary surgeons from all participating practices, and the University of Nottingham, assisted in the development of this study.

What if there is a problem?

If you have a concern about any aspect of this study, you should contact the principle researcher who will do their best to answer your questions. If you remain unhappy and wish to complain formally, you can do this by contacting the School Research Ethics Officer. All contact details are given at the end of this information sheet.

Further information and contact details

Principle Researcher: Katie Lightfoot (PhD student): katie.lightfoot@nottingham.ac.uk

Lead Supervisor: Professor Sarah Freeman: sarah.freeman@nottingham.ac.uk

Additional Supervisors: Dr John Burford, Professor Gary England and Professor Mark Bowen

Research Ethics Officer: Richard Lea: Richard.lea@nottingham.ac.uk

University of Nottingham
UK | CHINA | MALAYSIA

WorldHorseWelfare

Research Participation Consent Form

Study Title: Investigating factors associated with the treatment and survival of horses diagnosed with colic (abdominal pain)

Principle Researcher: Katie Lightfoot

Research Supervisors: Professor Sarah Freeman, Dr John Burford, Professor Gary England, Professor Mark Bowen

After considering the study information provided, please read each of the following statements and initial the corresponding boxes if you agree.

	Initial
I am over the age of 18 years old	
I have read or had the provided information read to me describing the above study	
I have had the opportunity to consider this information and ask any questions I may have had about this study and my involvement	
I understand that I can refuse to take part if I wish, without providing a reason, and this refusal will not affect my ability to take part in future studies	
I understand that even if I have consented to participate, I can withdraw from this study at any time without providing a reason	
I know that I can contact the researchers involved in this study for further information	
I understand that all information collected will be kept strictly confidential and anonymised so that it will not be possible to identify any participants of this study	
I understand that anonymised data collected during this study will be used as part of a PhD qualification, published within future scientific publications and used to develop educational resources	
I agree to take part in the above study and provide my consent for researchers to access, record and analyse hospital data associated with the duration of my horses colic assessment and treatment	

If you would like to take part in this study, please provide the following information:

Date:.....

Name of horse owner:.....

Signature of horse owner:.....

Appendix XV: Supplementary results (Chapter Seven)

Horse Information	Number of cases	Response		
		Signalment		
Age	59 / 60	Average 12.2 years Range 1 – 26 years Modal age 11 years		
Gender	60 / 60	Filly – 1.7% (1 / 60) Gelding – 58.3% (35 / 60)	Mare – 36.7% (22 / 60) Stallion – 3.3% (2 / 60)	
Breed	60 / 60	Andalusian – 3.3% (2 / 60) Appaloosa – 1.7% (1 / 60) Cob – 11.7% (7 / 60) Draught / heavy horse – 3.3% (2 / 60) Irish draught – 1.7% (1 / 60) Irish Sports Horse – 1.7% (1 / 60) Knapstrupper – 1.7% (1 / 60)	Miniature / small pony – 3.3% (2 / 60) New forest – 1.7% (1 / 60) Pony – 10.0% (6 / 60) Selle Francis – 1.7% (1 / 60) Shetland - 1.7% (1 / 60) Sports horse – 15.0% (9 / 60) Thoroughbred – 26.7% (16 / 60)	Thoroughbred cross - 1.7% (1 / 60) Trakener - 1.7% (1 / 60) Warmblood – 5.0% (3 / 60) Warmblood cross - 1.7% (1 / 60) Welsh Section A - 1.7% (1 / 60) Welsh Section B - 1.7% (1 / 60) Welsh Section D - 1.7% (1 / 60)
Insurance status	56 / 60	Insured – 30.3% (17 / 56) Not insured – 70.0% (39 / 56)		
Insurance amount	17 / 17	£3000 – 5.9% (1 / 17) £5000 – 58.8% (10 / 17) Unknown – 35.3% (6 / 17)		
Policy type	17 / 17	Mortality and veterinary fees – 41.2% (7 / 17) Veterinary fess only - 17.6% (3 / 17) Unknown – 41.2% (7 / 17)		

Policy exclusions	15 / 17	Colic – 6.7% (1 / 15) Lameness - 6.7% (1 / 15) None - 6.7% (1 / 15) Unknown – 44.5% (11 / 15)		
Time in owner's possession	30 / 30	1 year or less – 16.7% (5 / 30) 2 to 5 years – 36.7% (11 / 30)	6 to 10 years – 30.0% (9 / 30) 11 to 15 years – 10.0% (3 / 30)	16 to 20 years – 6.7% (2 / 30)
Provision of daily care	60 / 60	Contracted loaner – 1.7% (1 / 60) Livery yard groom – 13.3% (8 / 60) Owner – 68.3% (41 / 60)	Owner's friend – 3.3% (2 / 60) Private groom – 10.0% (6 / 30) Unknown / not stated – 3.3% (2 / 60)	
Discipline	60 / 60	Breeding – 6.7% (4 / 60) Carriage driving – 1.7% (1 / 60) Cavalry – 3.3% (2 / 60) Companion – 3.3% (2 / 60) Dressage – 3.3% (2 / 60) Eventing – 8.3% (5 / 60)	General / Leisure – 40.0% (24 / 60) Hunting – 6.7% (4 / 60) None – 3.3% (2 / 60) Polo – 1.7% (1 / 60) Racing – 5.0% (3 / 60) Retired and/or companion – 3.3% (2 / 60)	Riding School – 5.0% (3 / 60) Showing – 1.7% (1 / 60) Show jumping – 5.0% (3 / 60) Youngster – 1.7% (1 / 60)
Work quantity	21 / 60	2 hours per week - 9.8% (4 / 21) 5 hours per week - 9.8% (4 / 21) 7 hours per week – 2.4% (1 / 21) 8 hours per week – 4.9% (2 / 21) 14 hours per week – 2.4% (1 / 21)	15 hours per week - 2.4% (1 / 21) 20 hours per week – 7.3% (3 / 21) 'Less than 5 hours per week' - 7.3% (3 / 21) 'Between 5 and 10 hours per week' - 2.4% (1 / 21) 'Over 10 hours per week' - 2.4% (1 / 21)	
Work intensity	33 / 60	Intense - 21.2% (7 / 33) Light - 42.4% (14 / 33)	Light/Medium – 3.0% (1 / 33) Medium - 33.3% (11 / 33)	

Competition level	39 / 60	Affiliated shows nationally/internationally - 5.1% (2 / 39) Flat racing - 2.6% (1 / 39) Local shows only - 20.5% (8 / 39) National hunt racing - 2.6% (1 / 39) None - 64.1% (25 / 39) Twice weekly hunting - 2.6% (1 / 39) Unaffiliated shows nationally - 2.6% (1 / 39)	
Medical history			
Ongoing / previous health issues	22 / 59	Bilateral coffin joint pathology – 4.5% (1 / 22) Coffin joint arthroscopy – 4.5% (1 / 22) Equine Metabolic Syndrome – 9.1% (2 / 22) Forelimb osteoarthritis in coffin joints - 9.1% (2 / 22) Gastric Ulcers – 13.6% (3 / 22) GI issues (constipation / sensitivity) – 4.5% (1 / 22) Hind limb lameness – 4.5% (1 / 22) Hindlimb proximal suspensory injury – 4.5% (1 / 22) DDFT Injury – 4.5% (1 / 22) Laminitis - 13.6% (3 / 22)	Liver disease – 4.5% (1 / 22) Neurological C6-C7 APJ – 4.5% (1 / 22) Orthopaedic (unspecified) - 13.6% (3 / 22) Pelvic stress fracture – 4.5% (1 / 22) PPID - 9.1% (2 / 22) Previous lameness - 9.1% (2 / 22) Respiratory disease - 13.6% (3 / 22) Shivers – 4.5% (1 / 22) TMT lameness – 4.5% (1 / 22) Vac reaction – 4.5% (1 / 22)
Stereotypic behaviour	60 / 60	Crib biting – 6.7% (4 / 60) None – 83.3% (50 / 60)	Weaving – 6.7% (1 / 60) Windsucking – 8.3% (5 / 60)
Date last wormed	58 / 60	Did not know / couldn't remember – 72.4% (42 / 58)	Within last 12 months – 24.1% (14 / 58) Over 12 months age – 3.4% (2 / 58)
Worming product last used	42 / 60	Unknown – 68.4% (39 / 42)	Equest – 5.2% (3 / 42)

Date dental exam last performed	57 / 60	Did not know / couldn't remember - 68.4% (39/57)	Within the past 12 months - 31.6% (18 / 57)
Changes in management			
Stabling and / or pasture changes	60 / 60	76.7% (46 / 60) of horses had no changes in stabling / pasture in the weeks prior to colic episode	23.3% (14 / 60) of horses had changes to stabling / pasture in the weeks prior to colic episode: – Changes had occurred within 1 day of colic episode for 1 horse – Changes had occurred within 2 days of colic episode for 4 horses – Changes had occurred within 4 weeks of colic episode for 1 horse – Days since change was unknown for 6 horses
Changes to feeding regimen	56 / 60	93.3% (56 / 60) of horses had no changes to feed in the weeks prior to colic episode	6.7% (4 / 60) of horses had changes to feed in the weeks prior to colic episode: – Changes had occurred within 2 days of colic episode for 2 horses – Changes had occurred within 4 weeks of colic episode for 1 horse – Days since change was unknown for 1 horse

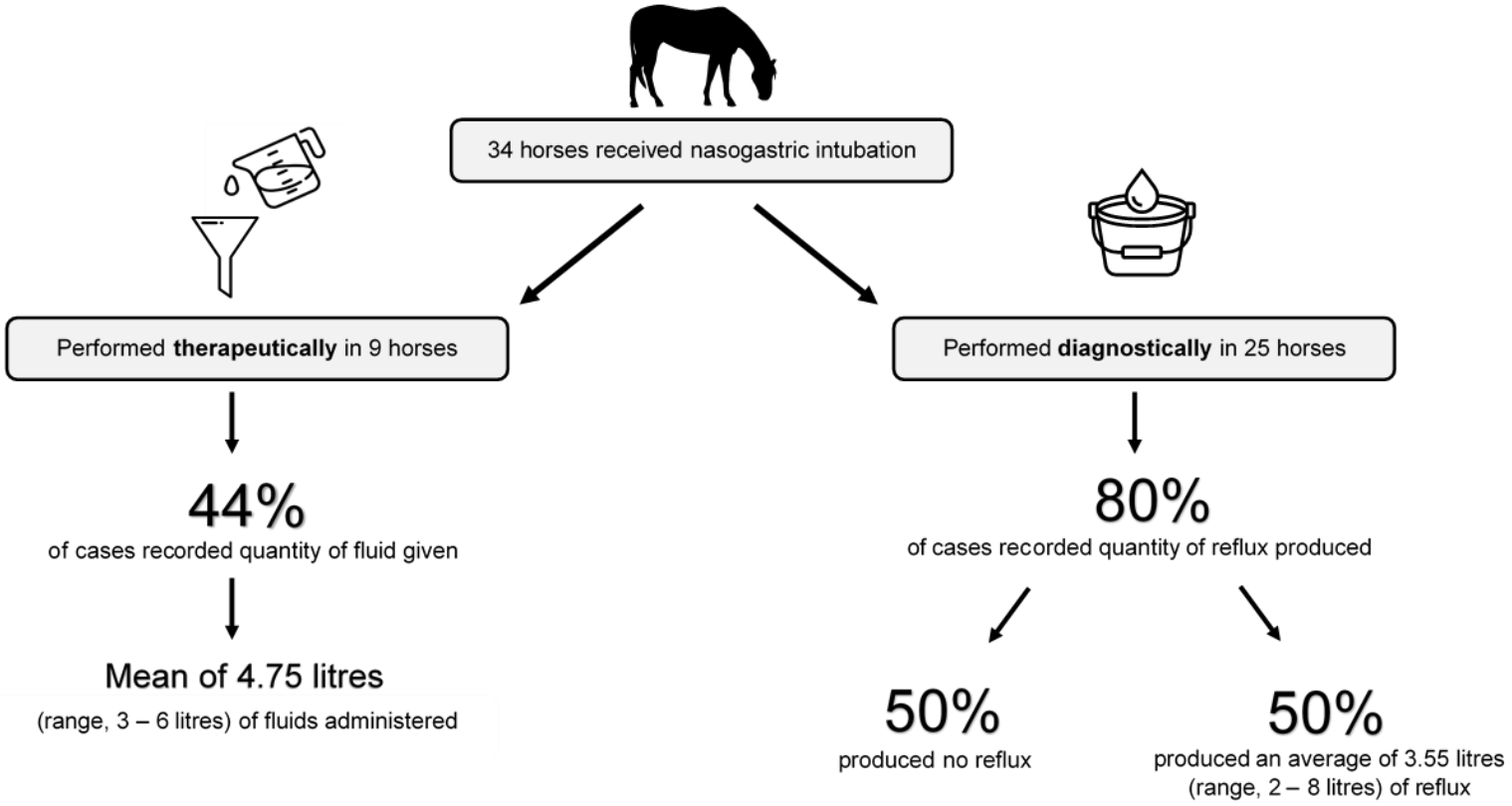


Diagram illustrating the number of horses receiving nasogastric intubation and the diagnostic outcome (Chapter Seven)

Factor considered in treatment formulation	Number of cases
Age of horse	5.1% (3 / 59)
Severity of clinical findings	79.7% (47 / 59)
Limitations of physical examination	1.7% (1 / 59)
Financial constraints	10.2% (6 / 59)
Concerns regarding horse welfare	3.4% (2 / 59)
No response to analgesia	3.4% (2 / 59)
Ongoing health issues	5.1% (3 / 59)
Owner concerned about horse tolerating box rest	1.7% (1 / 59)
Owner declined surgical treatment	1.7% (1 / 59)
Owner inexperienced	1.7% (1 / 59)
Owner unable to manage horse at home	1.7% (1 / 59)
Owner wanted to do everything possible	1.7% (1 / 59)
Previous history of colic	5.1% (3 / 59)

Details of medication administered during medical treatment

Drug name	Use	Number of horses receiving drug
Chloramphenicol	Antimicrobial against *L. intracellularis*	1 / 33
Doxycycline	Antimicrobial	2 / 33
DTO smectite	Endotoxin absorption from intestinal lumen; antidiarrheal	3 / 33
Epsom salts and magnesium sulphate	Osmotic laxative	1 / 33
Flunixin meglumine	Nonsteroidal anti-inflammatory; analgesic	17 / 33
Omeprazole	Proton pump inhibitor; treatment for gastric ulcers	1 / 33
Gentamicin	Antimicrobial	5 / 33
Metronidazole	Antimicrobial	3 / 33
Misoprostol	Synthetic prostaglandin	1 / 33
Omeprazole	Proton pump inhibitor	1 / 33
Oxytetracyline	Antimicrobial	2 / 33
Pain relief (unspecified)	N/A	3 / 33
Paracetamol	Analgesic	1 / 33
Pentoxyphylline	Treatment of endotoxemia	1 / 33
Phenylbutazone	Non-steroidal anti-inflammatory; analgesic	1 / 33
Polymixin B	Antiendotoxin	1 / 33
Procaine penicillin	Antimicrobial	6 / 33
Ranitidine	H2 receptor antagonist; gastric ulcer treatment	1 / 33
Did not specify treatment	N/A	2 / 33
Vitamin E supplement	Antioxidant	1 / 33

Horse demographics – survived vs euthanased

Horse details	Survived to discharge (n = 37)	Euthanased (n = 18)
Age	Average: 11.3 years Range: 1 – 26 years	Average: 13.6 years Range: 6 – 21 years
Gender	Female: 16 (1 filly, 15 mares) Male: 21 (1 stallion, 10 geldings)	Female: 5 mares Male: 13 (1 stallion, 12 geldings)
Breed	Most frequent: Thoroughbred (11 / 37) Sports horse (7 / 37) Cob (6 / 36)	Most frequent: Thoroughbred (3 / 18) Pony (3 / 18) Sports horse (2 / 18)
Insurance status	Not insured – 23 Insured – 11 Unknown - 3	Not insured – 12 Insured - 6
Main discipline / use	Most frequent: General / leisure (16 / 37)	Most frequent: General / leisure (6 / 18)
Ongoing health issues	No ongoing health issues - 23 At least 1 ongoing health issue – 13 Unknown - 1	No ongoing health issues – 11 At least 1 ongoing health issue - 7
Stereotypic behaviour	Crib biting – 3 Weaving - 1 Windsucking - 3 None - 30	None – 15 Crib biting – 1 Windsucking - 2

Recent changes in management	No – 36 Yes – 1	No – 16 Yes - 2
Recent changes in feeding regimen	No – 29 Yes - 8	No – 13 Yes - 5
Colic episode within the last 30 days	No – 34 Yes – 2 Unknown - 1	No – 16 Yes - 2
Demeanour on hospital admission	Bright and responsive (BAR) - 8 Depressed - 4 Mildly restless - 2 Moderately restless - 2 Quiet and responsive (QAR) - 18 Severely restless - 3	Depressed - 2 Mildly restless - 1 Moderately restless - 3 Quiet and responsive - 8 Severely restless - 4
Behaviour severity score	Most frequent score: Kicking – 0 (27 / 37) Pawing – 0 (25 / 37) Sweating – 0 (20 / 37) Flank watching – 0 (26 / 37) Attempts to lie down – 0 (23 / 37) Rolling – 0 (33 / 37)	Most frequent score: Kicking – 0 (13 / 18) Pawing – 0 (11 / 18) Sweating – 2 (7 / 18) Flank watching – 0 (8 / 18) 1 (8 / 18) Attempts to lie down – 0 (10 / 18) Rolling – 0 (13 / 18)

Appendix XVI: Interview information and consent surveys (Chapter Eight)

Horse Owner

University of Nottingham
UK | CHINA | MALAYSIA

WorldHorseWelfare

Decision making during critical cases of equine colic (abdominal pain)

The University of Nottingham's School of Veterinary Medicine and Science would like to invite you to take part in our current research project investigating equine colic, which has been kindly supported by World Horse Welfare.

What is the purpose of the study and why have I been invited?

Managing a horse during an episode of colic can be a difficult and emotional time for an owner. Due to the distressing nature of this condition, many owners may find it challenging to decide which treatment option is best for their horse, especially when a critical illness is suspected and urgent referral to a specialist equine hospital is required.

The following research study aims to investigate horse owners' experience of decision making during critical cases of equine colic. It is hoped that the evidence generated can be used to develop resources to support both owners and veterinary professionals during these difficult situations.

A total of twelve horse owners from across the United Kingdom (UK) will be invited to participate in this project between January and March 2019. You have been invited to take part as you have direct personal experience of managing a horse with colic and expressed an interest in participating when you completed our online survey entitled *'Colic: Horse owner preparation and experience'*.

What will happen if I take part?

Participation in this study would involve a single confidential interview, which will be conducted via the telephone by the principle researcher (Katie Lightfoot). The interview will be performed at a time most convenient for yourself (between January and March 2019) and should last around one hour (60 minutes). A range of topics relating to colic will be covered, including your personal experiences and views on resources designed to support horse owners during these situations. The interview would, with your consent, be audio tape-recorded, and will be transcribed by Katie Lightfoot in order for data analysis to be conducted.

What are the possible benefits of taking part?

The experiences of you and your horse can help to save future equine lives. We hope that the information generated from this study will help us to improve the way colic is assessed and managed through the development of educational resources to help support vets and horse owners during a colic episode.

What are the possible disadvantages and risks of taking part?

The interview will be an in-depth discussion about your personal experience of equine colic, which may have been a particularly distressing time for you. Therefore, you may find the interview upsetting in some way.

Do I have to take part?

Participation within this study is completely voluntary. If you decide to take part, you will be asked to complete a short online survey to confirm your participation (the link to this will be in your email invitation), however, you can still withdraw at any time.

Will my taking part in the study be kept confidential?

Any information you disclose about you and your horse will be handled in confidence. All information collected during the course of this research will remain **strictly confidential**, stored in a secure office, and on a password protected database. Additionally, we will anonymise all collected information using a unique code so that you and your horse cannot be identified. The raw audio-recording of your interview will remain anonymous at all times and transcribed by the principle researcher only. Written, anonymised transcripts of your interview will only be accessed by the University of Nottingham researchers listed at the end of this form in order to perform data analysis. Anonymised data will be kept securely by researchers for 7 years, after which time this data will be disposed of securely.

What will happen to the results of the research study?

The results of this study will be used as part of the principle researchers PhD thesis on decision making in cases of equine colic. Evidence generated during this study may also be published in scientific publications, presented at relevant veterinary conferences and used to develop educational resources for vets and horse owners. In all cases, information associated with you and your horse will remain anonymous at all times.

Who has reviewed the study?

This study and documents relevant to data collection were reviewed and approved by the University of Nottingham's School of Veterinary Medicine and Science Ethics Committee.

What if there is a problem?

If you have a concern about any aspect of this study, you should contact the principle researcher who will do their best to answer your questions. If you remain unhappy and wish to complain formally, you can do this by contacting the School Research Ethics Officer. All contact details are given at the end of this information sheet.

Further information and contact details

Principle Researcher: Katie Lightfoot (PhD student): katie.lightfoot@nottingham.ac.uk

Lead Supervisor: Professor Sarah Freeman: sarah.freeman@nottingham.ac.uk

Additional Supervisors: Dr John Burford, Professor Gary England and Professor Mark Bowen

Research Ethics Officer: Richard Lea: Richard.lea@nottingham.ac.uk

Owner consent survey

Page 1: Welcome

Decision making during critical cases of equine colic (abdominal pain)

In order to take part in this research study, we require you to provide formal consent to participate. If you have read the study information document attached to your invitation email and would still like to participate, please complete the following survey.

1. **Please enter your Unique Identification Number (UIN), which can be found in the email inviting you to participate, in the box below.**

Page 2: Participant Consent

This consent form is a formal way of indicating that you agree to participate in this study and that you understand the following:

- **Participation within this study is completely voluntary.**
- **Participants must be 18 years of age or over in order to take part.**
- **Interviews will be audio-recorded.**
- **The original audio-recording of your interview will be accessed and transcribed by the principle researcher only.**
- **All information collected during this study will be anonymised, kept strictly confidential and stored on a password protected database.**
- **Only authorised researchers working at the University of Nottingham's School of Veterinary Medicine and Science will have access to anonymised, written interview transcripts during the analysis stage of this research study.**
- **Anonymised information will be used as part of a PhD qualification.**
- **Anonymised information may be published in future scientific papers or presented at relevant scientific conferences.**
- **Researchers will keep anonymised data securely for 7 years, after which time this data will be disposed of securely.**

As a participant in this survey, you may:

- **withdraw from this study at any time without providing a reason.**
- **contact the researchers involved in this study for further information.**

2. **If you agree to participate within this research study, please complete the following consent questions.**

- ☐ I confirm that I am over 18 years of age.
- ☐ I have read the participant information provided and understand the purpose of both this research study and my involvement.
- ☐ I give consent for my interview to be audio recorded and transcribed for research purposes.
- ☐ I have read and understand the above information regarding consent, and agree to the terms laid out for my participation in this study.

3. **To confirm your consent to participate, please enter your email address below. This should be the same address as the one we emailed your study invitation to.**

Page 3: You and Your Colic Experience

About You

To ensure your interview is arranged for a day and time most convenient for yourself, please indicate your preferences below. Interviews will be conducted between January and March 2019.

Although the interview itself will take around 1 hour (60 minutes) to complete, I would recommend allowing up to 2 hours to ensure any questions you may have can be answered.

4. **Please select your preferred day/s for an interview to take place.**

Please don't select more than 1 answer(s) per row.

Please select at least 1 answer(s).

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Preferred day/s	☐	☐	☐	☐	☐	☐	☐

5. **Please select your preferred time/s for an interview to take place.**

Please don't select more than 1 answer(s) per row.

Please select at least 1 answer(s).

	Early morning - between 7am and 10am	Late morning - between 10am and 12pm	Early afternoon - between 12pm and 4pm	Late afternoon - between 4pm and 6pm	Evening - between 6pm and 9pm
Preferred time/s	☐	☐	☐	☐	☐

6. **Please enter the telephone number you would like to be contacted on in the box below. To minimise any potential connection or audio issues during your interview, it would be preferable if you could use a landline, rather than a mobile, telephone.**

6.a. **To ensure I have your correct contact details, please re enter your telephone number in the box below.**

7. **Please use the box below to record any further information you would like me to know about your preferred interview day or time.**

Your Recent Colic Experience

To ensure we can explore as many topics as possible during your interview, please could you provide the following information about your most recent colic experience.

8. **Please enter the name of the horse involved in your most recent colic experience.**

9. **As a result of this most recent episode of colic, was your horse euthansed / did your horse pass away?**

- ○ Yes
- ○ No

10. **How old was your horse at the time of this most recent colic episode?**

11. **What breed was / is your horse?**

12. **What did / do you use your horse for? (e.g. discipline / activity).**

Page 4: Final page

Thank you for agreeing to participate and providing this information. I will be in contact with you shortly to arrange your interview. In the meantime, please do not hesitate to contact me if you have any questions or concerns.

If you would like a PDF copy of the information you have just submitted, please let me know.

Thank you again for your support in this research and I look forward to speaking with you.

Principle Researcher:

Katie Lightfoot – PhD Student (katie.lightfoot@nottingham.ac.uk)

Veterinary Surgeon

University of Nottingham
UK | CHINA | MALAYSIA

WorldHorseWelfare

Decision making during critical cases of equine colic (abdominal pain)

The University of Nottingham's School of Veterinary Medicine and Science would like to invite you to take part in our current research project investigating equine colic, which has been kindly supported by World Horse Welfare.

What is the purpose of the study and why have I been invited?

Due to the distressing nature of colic, some owners may find it challenging to decide which treatment option is best, especially when their horse requires emergency referral.

The following research study aims to investigate what challenges critical cases of colic can present, and factors that could potentially influence an owner's decision to pursue further veterinary treatment. It is hoped that the evidence generated can be used to develop resources to support both owners and veterinary professionals during these situations to ensure equine welfare is not compromised.

A total of twelve equine veterinary surgeons from across the United Kingdom (UK) will be invited to participate in this study between February and March 2019. You have been invited to take part as you have direct personal experience of attending / examining colic cases of a critical nature and expressed an interest in participating by completing our online recruitment survey.

What will happen if I take part?

Participation in this study would involve a single confidential interview, which will be conducted via the telephone by the principle researcher (Katie Lightfoot). The interview will be performed at a time most convenient for yourself (between February and March 2019) and should last a maximum of one hour (30-60 minutes). A range of topics relating to colic will be covered, including your personal experience of colic assessments and views on resources designed to support horse owners during these situations. The interview would, with your consent, be audio tape-recorded, and will be transcribed by Katie Lightfoot in order for data analysis to be conducted.

What are the possible benefits of taking part?

Equine colic can be a distressing time for all involved. Your professional experience can help us to identify potential barriers faced by veterinary surgeons attending emergency calls of this nature. We hope that the information generated from this study will help us improve the way colic is assessed and managed through the development of educational resources to help support vets and horse owners during a colic episode.

What are the possible disadvantages and risks of taking part?

The interview will be an in-depth discussion about your personal experience of equine colic, which may have been a difficult or distressing time for you. Therefore, you may find some aspects of the interview upsetting.

Do I have to take part?

Participation within this study is completely voluntary. If you decide to take part, you will be asked to complete a short online survey to confirm your participation (the link to this will be in your email invitation), however, you can still withdraw at any time. Additionally, you can ask to stop, or delay, the interview at any time.

Will my taking part in the study be kept confidential?

Any information you disclose about yourself and your experiences will be handled in confidence. All information collected during the course of this research will remain **strictly confidential**, stored in a secure office, and on a password protected database. Additionally, we will anonymise all collected information using a unique code so that you cannot be identified. The raw audio-recording of your interview will remain anonymous at all times and transcribed by the principle researcher only. Written, anonymised transcripts of your interview will only be accessed by the University of Nottingham researchers listed at the end of this form in order to perform data analysis. Anonymised data will be kept securely by researchers for 7 years, after which time this data will be disposed of securely.

What will happen to the results of the research study?

The results of this study will be used as part of the principle researchers PhD thesis on decision making in cases of equine colic. Evidence generated during this study may also be published in scientific publications, presented at relevant veterinary conferences and used to develop educational resources for vets and horse owners. In all cases, information associated with you will remain anonymous at all times.

Who has reviewed the study?

This study and documents relevant to data collection were reviewed and approved by the University of Nottingham's School of Veterinary Medicine and Science Ethics Committee.

What if there is a problem?

If you have a concern about any aspect of this study, you should contact the principle researcher or supervisors who will do their best to answer your questions. If you remain unhappy and wish to complain formally, you can do this by contacting the School Research Ethics Officer. All contact details are given at the end of this information sheet.

Further information and contact details

Principle Researcher: Katie Lightfoot (PhD student): katie.lightfoot@nottingham.ac.uk

Lead Supervisor: Professor Sarah Freeman: sarah.freeman@nottingham.ac.uk

Additional Supervisors: Dr John Burford, Professor Gary England and Professor Mark Bowen

Research Ethics Officer: Richard Lea: Richard.lea@nottingham.ac.uk

Vet Consent Survey

Page 1: Welcome

Decision making during critical cases of equine colic (abdominal pain)

In order to take part in this research study, we require you to provide formal consent to participate. If you have read the study information document attached to your invitation email and would still like to participate, please complete the following survey.

1. **Please enter your Unique Identification Number (UIN), which can be found in the email inviting you to participate, in the box below.**

Page 2: Participant Consent

This consent form is a formal way of indicating that you agree to participate in this study and that you understand the following:

- **Participation within this study is completely voluntary.**
- **Participants must be 18 years of age or over in order to take part.**
- **Interviews will be audio-recorded.**
- **The original audio-recording of your interview will be accessed and transcribed by the principle researcher only.**
- **All information collected during this study will be anonymised, kept strictly confidential and stored on a password protected database.**
- **Only authorised researchers working at the University of Nottingham's School of Veterinary Medicine and Science will have access to anonymised, written interview transcripts during the analysis stage of this research study.**
- **Anonymised information will be used as part of a PhD qualification.**
- **Anonymised information may be published in future scientific papers or presented at relevant scientific conferences.**
- **Researchers will keep anonymised data securely for 7 years, after which time this data will be disposed of securely.**

As a participant in this survey, you may:

- **withdraw from this study at any time without providing a reason.**
- **contact the researchers involved in this study for further information.**

2. **If you agree to participate within this research study, please complete the following consent questions.**

- ☐ I confirm that I am over 18 years of age.
- ☐ I have read the participant information provided and understand the purpose of both this research study and my involvement.
- ☐ I give consent for my interview to be audio recorded and transcribed for research purposes.
- ☐ I have read and understand the above information regarding consent, and agree to the terms laid out for my participation in this study.

3. **To confirm your consent to participate, please enter your email address below. This should be the same address as the one I emailed your study invitation to.**

Page 3: About You

To ensure your interview is arranged for a day and time most convenient for yourself, please indicate your preferences below. Interviews will be conducted between January and March 2019.

The interview will take around 1 hour (60 minutes) to complete.

4. **Please select your preferred day/s for an interview to take place.**

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Preferred day/s	☐	☐	☐	☐	☐	☐	☐

5. **Please select your preferred time/s for an interview to take place.**

	Early morning - between 7am and 10am	Late morning - between 10am and 12pm	Early afternoon - between 12pm and 4pm	Late afternoon - between 4pm and 6pm	Evening - between 6pm and 9pm
Preferred time/s	☐	☐	☐	☐	☐

6. **Please enter the telephone number you would like to be contacted on in the box below. To minimise any potential connection or audio issues during your interview, it would be preferable if you could use a landline, rather than a mobile telephone.**

6.a. **To ensure I have your correct contact details, please re enter your telephone number in the box below.**

7. **Please use the box below to record any further information you would like me to know about your preferred interview day or time.**

Page 4: Thank You

Thank you for agreeing to participate and providing this information. I will be in contact with you shortly to arrange your interview. In the meantime, please do not hesitate to contact me if you have any questions or concerns.

If you would like a PDF copy of the information you have just submitted, please let me know.

Thank you again for your support in this research and I look forward to speaking with you.

Principle Researcher:

Katie Lightfoot – PhD Student (katie.lightfoot@nottingham.ac.uk)

Appendix XVII: Veterinary surgeon recruitment survey (Chapter Eight)





Vet Interview Recruitment

Page 1: Welcome

Hello,

My name is Katie Lightfoot and I'm a PhD student currently studying at the University of Nottingham's School of Veterinary Medicine and Science.

Colic is the most common type of emergency seen by first opinion equine practitioners. Although the majority of cases will resolve following a single medical treatment, up to 1 in 5 may be critical in nature, requiring referral for further investigation, aggressive medical treatment or surgical intervention. Unfortunately, euthanasia can often be the only treatment option available in order to relieve suffering.

Due to the distressing nature of colic, some owners may find it challenging to decide which treatment option is best for their horse. This may lead to potential delays, which may not only compromise the horse's welfare, but its chances of survival. However, little is known about the challenges critical cases of colic can present, or what factors could potentially influence an owner's decision to pursue further veterinary treatment. Therefore, the following research study aims to generate new evidence in this area, which could be used to support both owners and veterinary professionals during decision making to ensure equine welfare is not compromised.

I am currently recruiting equine veterinary surgeons from across the United Kingdom (UK) who would be willing to participate in a telephone interview, around 60 minutes in duration, between January and March 2019. The interview will cover a range of topics relating to colic, including your personal experience of colic assessments and views on resources designed to prepare horse owners for a colic emergency. This research has been kindly co-funded by the University of Nottingham and World Horse Welfare.

If you would like to take part in these interviews, which will be arranged at a time most convenient for yourself, please indicate your interest by completing the following short recruitment survey. If selected, I will email you further study information and instructions on how to submit your preferred interview date and time. This study has been reviewed and approved by the School of Veterinary Medicine and Science's Ethics Committee.

Your experience and views are essential to my research and I greatly appreciate you taking the time to help me generate new evidence. If you have any questions, or would like further information, please do not hesitate to contact me using the details provided below.

Thank you again for your help.

Principle Researcher:

Katie Lightfoot – PhD Student (katie.lightfoot@nottingham.ac.uk)

Lead Supervisor:

Professor Sarah Freeman (sarah.freeman@nottingham.ac.uk)

Additional Supervisors:

Dr John Burford, Professor Gary England and Professor Mark Bowen

Page 2: Participant Consent

This consent form is a formal way of indicating that you agree to participate in this study and that you understand the following:

- **Participation within this study is completely voluntary.**
- **Your email address will be used to send you further information about the interview process ONLY.**
- **Participants must be 18 years of age or over in order to take part.**
- **All information collected during this study will be anonymised, kept strictly confidential and stored on a password protected database.**
- **Only authorised researchers working at the University of Nottingham's School of Veterinary Medicine and Science will have access to data collected through this survey.**
- **Anonymised information will be used as part of a PhD qualification.**
- **Anonymised information may be published in future scientific papers or presented at relevant scientific conferences.**
- **Researchers will keep anonymised data securely for 7 years, after which time this data will be disposed of securely.**

As a participant in this survey, you may:

- **withdraw from this study at any time without providing a reason.**
- **contact the researchers involved in this study for further information.**

1. **If you agree to participate within this research study, please complete the following consent questions.**

- ☐ I would like to participate in a telephone interview investigating decision making during critical cases of equine colic.
- ☐ I confirm that I am over 18 years of age.
- ☐ I have read and understand the above information regarding consent, and agree to the terms laid out for my participation in this study.

Page 3: Your Details

2. **Please enter your preferred email address in the box below. Your email address will be used to send you further information about this study ONLY.**

2.a. **To ensure I have your contact details correct, please re enter your preferred email address in the box below.**

3. **In what year did you graduate as a veterinary surgeon?**

4. **Do you currently work within a UK veterinary practice which treats equids on a regular basis?**

- Yes
- No

5. **Which of the following BEST describes the type of veterinary practice you are currently employed in?**

- Equine first opinion (ambulatory only)
- Equine first opinion (ambulatory and hospital facilities)
- Equine referral hospital only
- Equine referral hospital (with ambulatory and first opinion services)
- Mixed veterinary practice (companion and large animal)

5.a. **What percentage of equine work do you currently undertake on a regular basis?**

- 0 - 25%
- 26 - 50%
- 51 - 75%
- 76 - 100%

6. **Please provide the first part of your practice's residential postcode (e.g. LE12) in the box below. This will enable me to accurately locate which UK region your practice is located in, for demographic purposes.**

7. **On average, how many cases of colic would you estimate you personally attend per month?**

8. **Have you attended a colic call in which the horse you examined required referral (for further investigation and / or urgent medical / surgical intervention) or euthanasia?**

- Yes
- No

8.a. **How long ago was the most recent case of critical colic (a case which required referral / euthanasia) you attended?**

- Within the last month
- Over one month ago but within the last 6 months
- Over 6 months but less than one year ago
- Over one year ago

9. **Are you aware of the 'REACT Now to Beat Colic' educational owner campaign?**

- Yes
- No

Page 4: Thank You

Thank you for registering your interest to take part. I will be in contact in due course if you have been selected to participate. This email will contain further study information and instructions on how to submit your preferred date / time to be intereviewed. In the meantime, if you have any questions please do not hesitate to contact me using the contact details below.

Thank you again for your help and I look forward to speaking to you.

Principle Researcher:

Katie Lightfoot – PhD Student (katie.lightfoot@nottingham.ac.uk)

Lead Supervisor:

Professor Sarah Freeman (sarah.freeman@nottingham.ac.uk)

Additional Supervisors:

Dr John Burford, Professor Gary England and Professor Mark Bowen

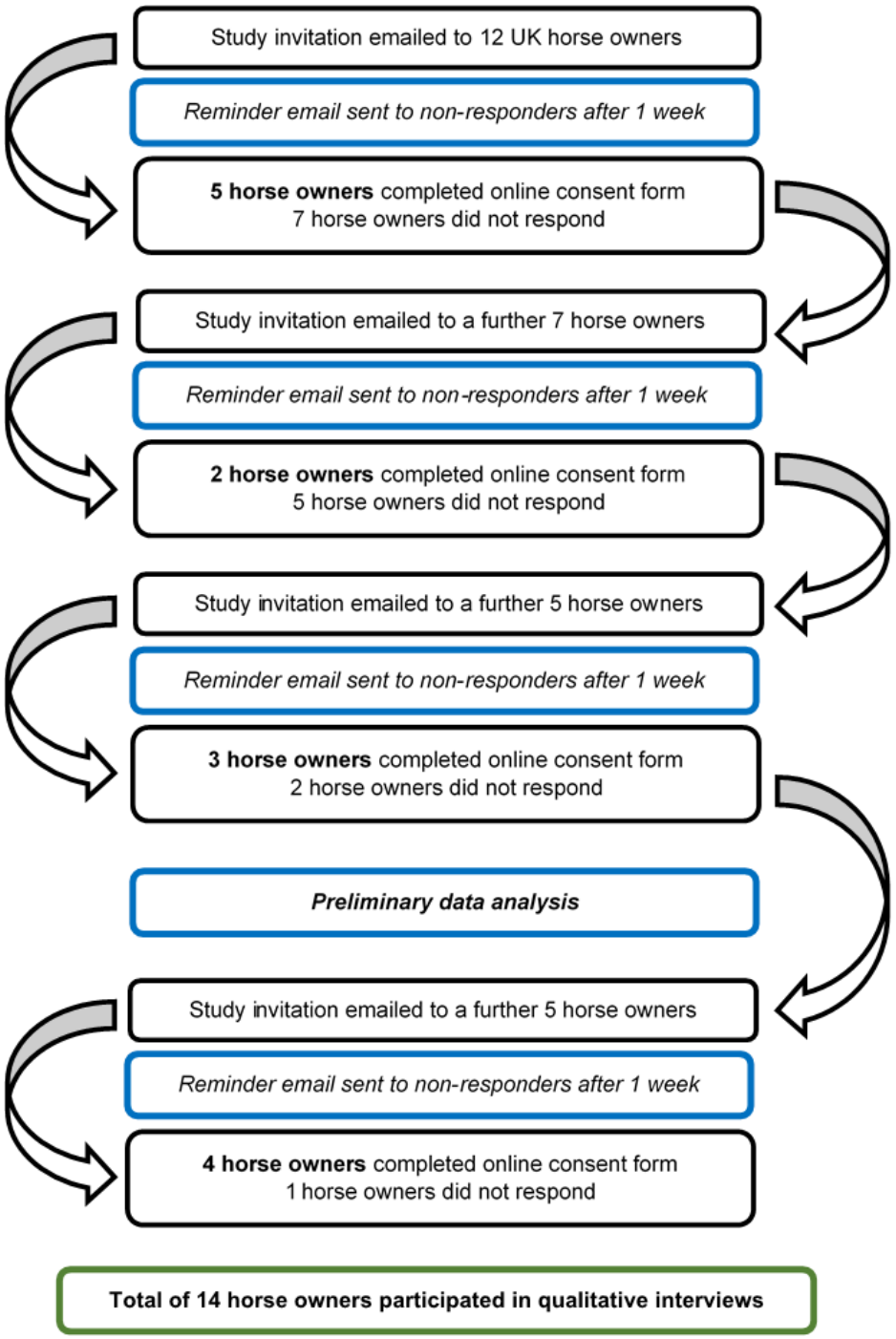
---

Appendix XVIII: Corrections performed on interview schedules (Chapter Eight)

Owner or Vet interview schedule?	Original interview question	Correction performed after pilot
Owner	1) To start with, I'd like to know more about what it's like to be a horse owner. Can you tell me a little bit about how you came to be involved with horses?	Wording altered to ensure participant provides their own experiences of being a horse owner: 'To start with, I'd like to know more about your experience as a horse owner. Can you tell me a little bit about how you came to be involved with horses?'
Vet	1) To start with, I'd like to know more about what happens during a colic assessment. Can you tell me a little more about how you would approach a typical colic case?	Wording altered to ensure participant does not primarily refer to clinical aspects of the colic assessment: 'To start with, I'd like to know more about your experience of assessing horses with colic.'
Vet	Prompts for question 1: A) Where does the assessment usually take place? B) What challenges / issues have you faced?	Prompt B became a new main question, with prompt A added as a new prompt for this question and re-worded to 'what kind of environment do these assessments usually occur in?'
Vet	Prompts for question 2: Do you find cases such as this one more challenging? Why / in what way?	Both of these prompts were reworded to: 'Do you find cases such as these more challenging? Why / In what way / Which aspects?'
Owner	N/A	An additional question exploring the discussion of treatment options was added.

Appendix XIX: Interview recruitment flowcharts (Chapter Eight)

Horse Owner



Veterinary surgeon

