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MRes. Veterinary Science

Disseminating evidence to equine practitioners

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Abstract

Abdominal pain is a significant welfare concern in equids and is frequently seen as an emergency in first opinion veterinary practice. Although there is a wealth of research into the condition at referral level, there is a paucity of studies with relevance to the primary assessment of the colic case. Furthermore, there is a wide variation on techniques used by veterinary practitioners, most based on anecdotal evidence or clinical experience. This has highlighted the requirement of development of evidence in this area to assist with the primary assessment of the colic case.

The aim of the project was to explore methods of disseminating evidence-based materials in equine veterinary practice. There were three phases: Phase 1 assessed methods of dissemination of evidence for practitioners, Phase 2 generated consensus statements on the primary assessment of colic and Phase 3 developed methods of dissemination, based on the outcomes of Phases 1 and 2.

The aim of the first phase was to identify barriers to knowledge transfer in equine practice. Semi-structured interviews were conducted with seven equine veterinary practitioners on how they accessed information, barriers they faced, and their preferred options for knowledge transfer (Appendix I). Interviews were recorded, transcribed, and analysed using thematic analysis. Based on these outcomes, an online questionnaire on knowledge transfer in equine practice was developed and distributed. Analysis of the interviews identified three main areas: practitioners' experience, time constraints and accessibility, with an overarching theme of practice culture. Preferred methods of knowledge transfer included apps and web-based resources, but several practitioners also relied on hard copy resources. The importance of concise, visual information was highlighted. There were 129 participants in the online survey. The main barriers identified were lack of time (76.4% participants) and difficulty accessing articles (65.2%). The resources accessed most frequently on a daily basis were apps (14.3%) and online papers (12.1%), and on a weekly basis were textbooks (29.7%) and online papers (23.1%). The preferred methods of knowledge transfer were websites and online publications (89.2% and 84.3% survey participants likely/very likely to use these). This study was the first step to understanding

how information is accessed in practice, and how resources can be developed to maximise uptake.

The aim of the second phase was to develop consensus statements on the primary assessment of horses with clinical signs of colic. Statements on the primary assessment of horses with colic, previously generated in multi-stakeholder workshops, were circulated to veterinary practitioners through an online consensus survey. Statements were accepted (>75% agreement) or rejected (<25% agreement). Statements which did not reach consensus (25-75% agreement) were reviewed, amended and redistributed up to three rounds. Two hundred and thirteen veterinary practitioners participated in the consensus survey. One hundred and forty statements met consensus, seven were rejected and 127 did not reach consensus. All (100%) participants agreed the minimum physical examination in every case should include: pain assessment, heart rate, capillary refill time, mucus membranes, gut sounds and rectal temperature. The areas with greatest consensus were regarding physical examination and abdominal ultrasound. Notably, statements on the common diagnostic test, rectal examination, had poor consensus. The number of statements did not reach consensus, highlighted a requirement for more evidence in these areas.

The aim of the third phase was to develop methods of disseminating information on the primary assessment of colic, based on outcomes of Phases 1 and 2. Veterinary websites and health campaigns identified in the survey in Phase 1 were reviewed and assessed, and using this and review of medical campaign websites, a new website and campaign logo and branding was developed. The 'VetReact' campaign and materials provided freely accessible online resources for veterinary practitioners on key components of primary assessment (clinical signs, history-taking, physical examination and diagnostic tests) and differentiation of critical cases, in addition to links to owner resources, other veterinary websites and primary evidence. This was built as a 'go-to' resource website, from which hard copy resources could be downloaded.

Recommendations were presented in an easy to read format, with a simple format to ensure ease of use and accessibility. The website was launched in

March 2017, through equine media and talks at veterinary schools. The website and materials are continuing to be developed and promoted.

This research represents a component of a larger scale project, the Nottingham Colic Project. It has specifically focused on developing and disseminating information to practitioners. The project materials are designed to assist with the primary assessment of colic cases and identification of critical cases at an early stage, with the overall goal of reducing the morbidity and mortality from colic and improving the welfare of the horse.

Chapter 1. Literature Review

1.1 Significance of colic

Colic is a major welfare concern within the equine population. It is a frequent cause of morbidity and mortality, and the most common out of hours emergency condition (Bowden, Unpublished).The definition of equine colic is abdominal pain; it is a clinical sign typically caused by pathological changes of the gastrointestinal tract (Southwood and Fehr, 2012). Different types of colic are associated with a wide range of conditions, with varying prognosis rates.

1.2 Importance and epidemiology

Colic is the most common emergency condition treated by veterinary practitioners in first opinion practice (Bowden, Unpublished). It has also been ranked by American veterinary practitioners as the most important equine medical condition (Traub-Dargatz et al., 1991).

The relatively high incidence and mortality associated with colic, has a significant impact on equine welfare and also has a significant economic and emotional impact on the owner. One study in the USA reported colic incidence to be 10.6 cases per 100 horse years (Tinker et al., 1997b). Furthermore, in this study, mortality from colic represented 28% of equine deaths. Another study within a geriatric population in the UK showed a lower mortality of 19.5% (Ireland et al., 2011). Despite variations in study design, both studies in the USA and UK have demonstrated that colic can have a substantial effect on mortality. There is a wide range of colic conditions and mortality rates show relative variations; some types have excellent prognosis and very low mortality, and others with a poor prognosis and high mortality. The mortality rate of all types of colic is high, up to 60.7% (Pascoe et al., 1983); it should be noted there have since been advances in the diagnosis and treatment in colic, so this figure may be out-dated. The time taken to diagnose whether the colic presentation is a critical case (i.e. requiring surgery or intensive medical management), and determining the correct diagnosis and appropriate treatment can all affect the disease process and hence mortality (Singer and Smith, 2002). Diagnosis is an essential aspects

of case assessment and triage that should be considered to reduce mortality and improve survival rates.

Depending on the complexity of the underlying disease, the costs of veterinary care can be high and can lead to further repercussions for the treatment and welfare of the animal. Early diagnosis and treatment are again important in helping to reduce the financial burden of the disease (Proudman et al., 2002, Egenvall et al., 2008)

Evidence clearly illustrates the importance of colic. Research has mainly been focussed on the disease at a referral or surgical level with the aim of improving survival rates (Donawick and International, 2004, Proudman et al., 2005). These only represent a small proportion of the overall cases, however, there have been very limited studies into colic on a first opinion level. This is important both because it represents the majority of cases, but also because of the influence the initial diagnosis may have on subsequent survival (Singer and Smith, 2002). Research into first opinion care has only been reported in three studies in the UK (Proudman, 1992, Hillyer et al., 2001, Curtis et al., 2015).

1.3 Types of colic

Abdominal pain can be grouped into a number of different types of disease, each attributed to a myriad of underlying causes. Clinical signs of abdominal pain are displayed as a consequence of: distended gastro-intestinal organs, tension of the mesenteric tissues, disruption of blood supply to intra-abdominal organs (ischaemia), inflammation or infection of the abdominal organs (Singer and Smith, 2002). The type of disease will give rise to one or more of the above causes of abdominal pain; this close-knit relationship of pain, type of disease and severity is fundamental in the diagnosis and treatment of colic and differentiating critical cases. For example, more severe types of colic may cause distension, tension and ischaemia of gastrointestinal organs, signs of greater pain and have a worse prognosis.

1.3.1 Comparison of incidence

Comparison of the different incidence rates has been reported in a prospective study into the primary assessment of 1016 colic cases (Curtis et al., 2015):

Mild idiopathic colic 57%

- Spasmodic (25%)
- Tympanic (7%)
- Unknown (25%)

SCOD (simple colonic obstruction or displacement) 15%

- Large colon impaction (11%)
- Large colon displacement (3%)

Surgical/strangulating lesion 18%

- SI lesion (7%)
- LI lesion (4%)
- Other location (>1%)
- No lesion site identified (7%)

Other (10%)

- Gastric disease/EGUS (Equine Gastric Ulcer Syndrome) (<1%)
- Simple SI obstruction (1%)
- Caecal disease (1%)
- Small colon obstruction (1%)
- Rectal impaction (1%)
- Grass sickness (1%)
- Neoplasia (<1%)
- Parasitic (1%)
- Peritonitis/PUO (Pyrexia of Unknown Origin) (1%)
- Enteritis, colitis or enterocolitis (1%)
- Sand colic (1%)
- Rupture of the gastro-intestinal tract (>1%)
- Non-GI casues (1%)

From these data it can be seen over half of colic presentations are mild or idiopathic. Additionally the disease may be attributed to a wide variety of causes and/or types. These equally have a variety of outcomes, and as such the veterinary practitioner must be equipped with the skills to differentiate these cases. This includes making decisions and acting appropriately according to the severity of the case, which requires skill and confidence.

The majority of cases resolve following single medical or no treatment (Tinker et al., 1997a); this may be following primary assessment by a veterinary practitioner or without reporting the case at all. A small proportion of cases will not respond to this first line of treatment and for survival, may require hospitalisation for intense medical management or surgery. Two to four per cent of cases are reported to require surgery; this is where the underlying cause would be fatal without this intervention. With surgery, the success rate is variable depending on the underlying cause. High mortality rates have been reported in small intestinal strangulation. For example, in one study small intestinal volvulus had a mortality rate of 41.7%, with 20.2% not surviving to be discharged post-surgery (Stephen et al., 2004). These high mortality rates have also been reported in other studies into small intestinal strangulations; 40.4% (Mezerova et al., 2008) and 24.8% (Mair and Smith, 2005). In the context of this study, the outcomes and prognosis of surgical colic were not explored, but are also important to consider in the decision-making process.

1.4 Primary case presentation

There are a range of clinical signs of colic, often dependent on the severity of pain and the underlying cause. Acute abdominal pain is not an uncommon presentation, and many cases respond positively to single medical treatment. (Proudman, 1992) reported 7% of cases to be surgical, compared to 72% spasmodic or undiagnosed. A recent prospective study in the UK found 76.4% of cases to be non-critical and 23.6% critical at the first evaluation of the case. It is essential that critical cases, i.e. Those that require intense medical management or surgery, are differentiated early (Curtis et al., 2015). Time is an important factor and influences the prognosis of many of the more serious disorders (Fischer, 1997, Beccati et al., 2011). With an increase in time to treatment, there may be further damage to the potential underlying lesion, systemic compromise due to the effects of dehydration and SIRS, and deterioration of the cardiovascular system; all of which influence general anaesthesia success and post-operative outcomes (Singer and Smith, 2002). Therefore the ability recognise the presenting signs and make a correct diagnosis at first examination are essential for improving the survival rate of cases.

1.4.1 History

A number of factors are important to identify with the history. These include the duration of signs (Singer and Smith, 2002, Fischer, 1997) and information relating to some of the risk factors described above (including current husbandry and management, recent anthelmintic treatment, previous episodes of disease, specific behaviour shown). There is limited evidence on the clinical history that is normally obtained from the owner. Most of the information available is based on a clinical experience or knowledge of the clinical signs, risk factors and the management of cases. Some research evidence is available; management history recorded in a prospective study of 1016 horses exploring primary evaluation of colic cases (Curtis et al., 2015) found that of the 74.7% of the cohort questioned, 47.0% had had a recent change in management. There are many possible risk factors, however, veterinary practitioners frequently do not ask questions relating to these. Therefore research to help identify the most important aspects of a clinical history would help assimilate key information within the constraints of an emergency situation.

1.4.2 Physical examination

The physical examination is an essential aspect of the primary case evaluation. These may be grouped (White et al., 1999):

- Manifestations of pain
    - Behavioural change
    - Heart rate
    - Respiratory rate
- Assessment of shock
    - Heart rate
    - Respiratory rate
    - Mucus membranes
        - Colour, moistness, capillary refill time
    - Temperature
- Assessment of intestinal movement
    - Auscultation of gasto-intestinal system

The aim of the physical examination is to determine the level of pain the horse is exhibiting, the organs that might be involved and the progression or stage of disease. Findings from the initial physical examination govern the subsequent steps in the diagnostic approach and treatment administered, and the urgency with which they need to be performed.

A prospective study (involving 1016 cases) found that veterinary practitioners' performed the following assessments on the primary assessment of horses with colic (Curtis et al., 2015):

- Pain and behaviour assessment 100%
- Heart rate 98.9%
- Gastrointestinal sounds 98.7%
- Respiratory rate 89.4%
- Rectal temperature 81.4%

The significance of these results is that although the majority of veterinary practitioners will include these steps in their physical examination, not all the assessments are undertaken by all practitioners in their diagnostic approach. This variation in clinical practice highlights the need for evidence or recommendations on which tests are most important.

A review by Ashley et al. (2005) described assessment of manifestations of pain in horses and donkeys, including pain scoring systems. This is useful to understand the different behaviours that might be expressed by an equid with abdominal pain and parameters that can also be monitored. These behaviours include: vocalisation (deep groaning), rolling, kicking at abdomen, flank watching, stretched and dullness and depression.

A recent study by Curtis et al. (2015), highlighted the importance of interpreting pain behaviours in horses with colic. Univariable and multivariable analysis were used to determine predictive variables for differentiating critical cases. Kicking, sweating, attempts to lie down, pawing, demeanour and flank watching were all significant in the univariable model at providing a prediction into critical nature of disease. The final multivariable model indicated the combination of all six of these behaviour scores to be the most useful predictor.

Pain assessment for colic cases has been the focus for some recent research. Scoring systems for both pain and behavioural changes have been developed and assessed for their practical use (McConachie et al., 2016, VanDierendonck and van Loon, 2016) These both represent the current gold standard of pain assessment in a hospital environment, but some of these assessments can be applicable to the primary assessment of cases.

Van Dierendonck and van Loon (2016) validated two scales for use in acute abdominal pain, Equine Utrecht University Scale for Composite Pain Assessment (EQUUS-COMPASS) and the Equine Utrecht University Scale for Facial Assessment of Pain (EQUUS-FAP). EQUUS-COMPASS assesses both physiological and behavioural manifestations of pain, including: heart rate, respiratory rate, rectal temperature, digestive sounds, posture, laying down/rolling, sweating, tail flicking, kicking at abdomen, pawing, head movements, pain sounds, overall appearance, reaction to palpation of flank. EQUUS-FAP assessed observations of the head, eyelids, focus, nostrils, corners mouth/lips, muscle tone head, flehmen and/or yawn, teeth grinding or moaning and ears. Each of these indications is divided into categories and given a score, increasing with severity, and each indication given an overall weighting. For example, heart rate: 24-44 beats/min (score 0), 45-52 beats/min (1), 53-60 beats/min (2) >60 beats/min (3), with the overall weighting factor for heart rate being 1. These scales were found to be significant for both assessing the differences of horses displaying abdominal pain and controls and the differentiation of critical cases versus those that were able to be managed using first-line care. Sensitivity and specificity for each model were: EQUUS-COMPASS (87% and 71%) and EQUUS FAP (77% and 100%).

The scoring system described by McConachie et al. (2016) describes a model for Multiple Organ Dysfunction (MODs) in acute surgical colic (MODS SGI). This prospective study assessed organ-specific data extrapolated from literature, data collection and clinical judgement. It was found that the MODS-SGI score was able to predict survival of cases with acute surgical colic, to six months. The MODS SGI included a measurement of different parameters: cardiovascular, renal, hepatic, respiratory, muscular skeletal, coagulation, gastrointestinal and attitude. This score system is clearly only applicable to surgical cases based in a hospital environment, but again it is useful to understand the gold standard of

assessment from which we can extrapolate some information for use in the primary assessment of cases and determining which cases might be displaying MODS/Systemic Inflammatory Response Syndrome in the field.

Assessment of cardiovascular parameters has been described for many years for evaluating the colic case. Certain types of colic, such as critical cases, will display cardiovascular comprise, shock and organ failure. Furr et al. (1995) used univariate analysis to identify which clinical features were significantly associated with severity of colic severity. The variables included heart rate, abnormal mucous membrane, peritoneal fluid concentration and blood lactate concentration. Heart rate has been identified as a prognostic marker for the outcome of cases, in a number of studies using logistic regression (Reeves et al., 1989, Thoefner et al., 2001, Curtis, 2016). Heart rate may also be associated with surgical outcomes and complications (French et al., 2002) but findings vary between studies (Proudman et al., 2002). The studies by Curtis (2016) and Bowden, (Unpublished) highlighted the value of cardiovascular parameters, including heart rate, pulse and mucus membranes in determining prognosis even at a primary practice level.

Gastrointestinal sounds are also a useful diagnostic aid. Auscultation of the gastrointestinal tract trans-abdominally, allows the assessment of borborygmi. Reduced sounds or complete absence has been reported as an indication for surgery (Parry et al., 1983), and the study by Curtis (2016) and Bowden (Unpublished) found that localised absence of gut sounds may be more predictive of severe gastro-intestinal disease that the sum of all quadrants.

When conducting the physical examination, it is the combination of different clinical findings that indicates the prognosis of the case, rather than the outcome of individual tests (Southwood and Fehr, 2012). The findings from the physical examination govern the proceeding steps in the diagnostic work up, treatment and also provides prognostic value. The complexity of decision making is discussed below.

1.4.3 Diagnostic Tests

A plethora of diagnostic tests has been described for evaluating horses with abdominal pain. Diagnostic tests can prove critical in the decision making process, both at first opinion and referral level. The decision to use diagnostic tests is usually based on findings at the initial physical examination, but will also be determined by outcomes of other diagnostic procedures.

There is currently limited evidence available behind the common methods used in the primary approach to colic cases, for example rectal examination or nasogastric intubation. Conversely, there are a large number of studies exploring laboratory based tests, or those mainly feasible in a hospital environment with specialist facilities. Information regarding other diagnostic tests is largely available in the format of reviews and textbooks, describing the procedure and interpretation of results (Southwood and Fehr, 2012)

To overcome the gap in evidence, one recent study surveyed the array of tests undertaken at a first opinion level (Curtis et al., 2015), including factors affecting decision making, and association between veterinary practitioners' background and the type of tests employed. Factors affecting decision making were individual preference of the practitioners (which may be linked to their experience, ability and confidence), the facilities available (which may be linked to the safety of the horse and personnel involved), and financial considerations.

Regarding selection of tests, it was found the most frequent diagnostic test was response to analgesia/treatment (mean ± SD 87.2±24.0 per cent), followed by rectal examination (75.9±21.2 per cent), nasogastric intubation (43.9±27.6 per cent), haematology and biochemistry (15.2±20.6 per cent), abdominal paracentesis (13.5±17.8 per cent) and ultrasound (8.0±18.1 per cent) sequentially. There was a wide range of variation in many of the results, which could be linked to a number of confounding factors. For example, safety concerns were raised over rectal examination, abdominocentesis and nasogastric intubation.

1.4.4 Differentiating critical cases

Some may argue the most important question that needs to be asked: 'Does this horse require surgical attention or not?' (Johnston, 1992). However, this question ignores the cases that require urgent attention or euthanasia, such as severe enterocolitis, grass sickness or gastro-intestinal rupture. In this thesis, a critical case is used as an umbrella term, and defined as where the case requires urgent and intensive medical management or surgery, or where the animal dies or is euthanised as a result of its condition (Curtis, 2016). Non-critical cases are defined as those which following primary assessment, resolve either following first line medical treatment from the veterinary practitioner or resolve spontaneously. This then redefines the most important question as: 'Is this a critical case?'

A number of studies have explored the use of different prognostic tools in the differentiation of critical cases. An example is using peritoneal lactate as a detection of intestinal strangulation and ischemia, where it was reported to be more accurate than blood lactate (Latson et al., 2005). Handheld, portable analysers are available for use by hospital and ambulatory practitioners alike, some of which have been investigated for use (Nieto et al., 2015). Another example is the use of acute phase proteins such as serum amyloid A as biomarkers for assisting with diagnosis (Pihl et al., 2013). For ambulatory veterinary practitioners, the requirement for a quick, reliable and easy to perform test is imperative to ensure usefulness and maximal uptake. This research presented has been performed on hospital populations, which is a limitation, in addition to some of the evidence being commercially endorsed, which may introduce bias.

1.4.5 Decision making

When making the decision to refer a case for hospitalisation, for intensive medical management or surgery, a number of considerations need to be taken into account. A triage-like system may be adopted, where treatment is prioritised following rapid primary assessment. Triage is frequently used in human medicine, governed by a pool of evidence and often formal recommendations, 'red flag' protocols (Guyatt et al., 2008, Downie et al., 2013). This technique is used less in veterinary medicine, due to sparsity of evidence.

With regards to colic specifically, the variety of underlying aetiologies can also hinder this approach. Further factors that influence decision making include owner factors (finances and opinion) and the experience and confidence of the veterinary practitioner (Everitt, 2011). Everitt outlined the key differences to human medicine being owner factors, finances involved (contrasting with the National Health Service for human medicine), and a treatment option of euthanasia. It must be noted, however, that this research was largely based on small animal practice, and there is currently a gap of knowledge in the decision making of equine practitioners. The study by Curtis et al. identified other factors such as facility and resource availability, financial factors and risks to the veterinary practitioner to be contributors in their decision-making at a primary level (Curtis, 2016). These are important factors that differ from other types of veterinary practice, and should be considered when understanding the decision making process and the barriers that may be influential in equine practice.

1.5 The Nottingham Colic Project

The Nottingham Colic Project aimed to generate evidence on colic at a first opinion level. It identified that colic is the most common emergency condition in first opinion practice (Bowden, Unpublished), and that there are significant variations in practitioners approach to horses with colic case (Curtis, 2016). These findings highlight the requirement for further research in this area, to enable first opinion veterinary practitioners to make evidence-based decisions.

1.5.1 Significant findings

The work undertaken so far has included a systematic review of the current available evidence on colic, has generated evidence from primary practitioners and has gauged opinion from primary stakeholders: both horse owners, carers and veterinary practitioners. The study has led to the development of multi-disciplinary statements on the recognition and diagnosis of equine colic. These were generated through two multi-disciplinary workshops, to develop consensus statements. A key component of this process was the involvement of primary stakeholders: horse owners and first opinion vets. The workshops focused on early recognition of horses with colic at an early stage and the differing

approaches according to the variation in case presentation. An intrinsic element to this project will be developing recommendations or guidelines based on the statements generated and reviewed via a consensus process.

1.6 Evidence based medicine

Using evidence in medical practice dates back to the 19th-century (Sackett, 1997). Evidence-based medicine (EBM) is defined as using the best available evidence when making medical decisions, in order to optimise outcomes. To practice EBM also involves the combination of the practitioners' own clinical experience alongside evidence. Evidence should be assimilated using systematic approaches, critically appraised and be contemporaneous (Rosenberg and Donald, 1995).

Sackett explains the five fundamental reasons for evidence-based medicine:

- New evidence is constantly being developed which may influence patient management and treatment
- There are barriers to accessing evidence easily and frequently including a lack of time, out-dated textbooks and disorganised journal format
- This leads to clinical performance and contemporary knowledge to deteriorate with time
- The effects of traditional continued education on clinical performance
- An alternative approach, EBM has been demonstrated to assist with keeping practices current

1.6.1 Veterinary medicine

Comparatively, evidence based veterinary medicine (EBVM or EVM) lacks the development of EBM. This is due to barriers that have hindered development of an accessible pool of evidence. These include the following adapted statements from RCVS Knowledge (2018):

- Information being located in a wide variety of locations
- Many of the locations that the research is published requires a subscription charge, or affiliation to a University
- A lack of time to apply EVM at the point of care

- Lack of time to critically appraise available evidence
- Evaluating validity of evidence is a challenge, especially those financed commercially
- Gaps in available EVM resources in some areas, in terms of quality; especially research applicable to first opinion veterinary practice
- Available research may not be easily transferrable to clinical practice
- Deficiency in methodical, rigorous, large scale studies in Veterinary Medicine (Dean, 2013)
- Lack of funding towards clinical research

Despite this, the Royal College of Veterinary Surgeons (RCVS) encourages the use of evidence in practice: 'in order to be fit-to-practice, veterinary practitioners hold the responsibility to ground their decisions on sound, objective, up-to-date evidence, when available' (RCVS, 2017a). To address some of the aforementioned issues surrounding EVM, a charity group was formed in association with the RCVS, namely RCVS Knowledge, with the aim of providing evidence-based resources and information for the veterinary profession. A toolkit has been made available to answer questions veterinary practitioners might have on this topic (RCVS, 2017b). Other groups include the Centre for Evidence-based Veterinary Medicine and the Evidence-based Veterinary Medicine Association: they have similar aims for developing and promoting more accessible research for veterinary practitioners.

A review by McKenzie (2014a) into EBVM describes some of its benefits. These benefits include: mitigating the limitations of individual judgement and decision making, assists in developing diagnostic and treatment plans, reduces errors and unnecessary variation, reduces stress of the practitioner and contributes towards ethical obligations: understanding the evidence to communicate limitations and benefits to the client.

Mair (2001) reviewed the applicability of EBVM to equine veterinary practice. The key issue described by the author is the lack of quality patient-centred research available for critical appraisal (Keene, 2000). Inadequate funding for this type of veterinary research, small numbers of trained clinical researchers and penalties from universities for conducting time consuming studies were described as

barriers for the development of this research, reflecting some of the barriers stated from RCVS Knowledge above. Conversely, (Mair, 2001) explains clinically useful equine research can be conducted with comparatively smaller budgets. As such, veterinary practitioners should endeavour to contribute to this pool of quality evidence, to allow for the development of EBVM in equine practice.

1.6.2 Knowledge transfer

There are many ways of transferring evidence to practitioners; an essential step in clinical research development, to enable it to influence clinical practice. These methods aim to address the barriers to accessing evidence in practice. Examples include clinical audits, protocols, best practice guidelines, critically appraised topics (CATs) and BestBETS. These have been developed for use commonly in other healthcare professions, and although the veterinary profession lags behind in some ways, there are examples of where these have been a success. Clinical audits critique existing practice, before an intervention takes place. The process continues in a cycle, evaluating the interventions and allows continual improvements. These have been reviewed by Waine and Brennan (2015) and specifically with regards to equine practice and colic surgery (Mair and White, 2008). Waine highlights the disparities in clinical audit methods but concludes that audits have their benefits in veterinary practice. The development of international clinical audit focussing on equine colic surgery was discussed by Mair. Benefits included the ability to create a database documenting the success rates of surgery, trends and the development of individual practice audits. However, the attitudes from surgeons highlighted the need for data collection to be straightforward and quick for compliance; this might be a reason that the audit is still in development 10 years since these publications.

An example of how CATs are used in veterinary practice are the 'knowledge summaries' from the RCVS (Knowledge, 2018) these are page summaries of given topics using critically appraised evidence with a clinical bottom line for a structured question. Equine Veterinary Education (EVE) has published a collection of EBVM in the form of CATs named Clinical Evidence in Equine Practice (EVE). Best BETs critically appraise best available evidence on a structured question, and provide a clinical bottom line, these are shorter than

CATs. These are used in both medicine and veterinary medicine (CEVM, 2017), however there is yet to be any published evidence on the equine species. Best practice guidelines 'provide appropriate care based on scientific evidence and broad consensus, leaving room for justifiable variations in practice' (Thomson et al., 1995). Evidence is critically appraised and relevant stakeholders are involved in the development of statements. Where there is a lack of evidence, a consensus process is undertaken using a panel of experts.

Practice generated evidence data is a recent initiative in veterinary practice (Kerbyson, 2015). Here, electronic datasets have been described as being used to analyse outcomes of procedures undertaken in individual practices. This could allow for clinical questions to be developed and asked using their individual practice population and is another interesting development within EBVM.

Within clinical veterinary practice, in addition to the research methods detailed above there are further modalities for transferring and accessing information and evidence in practice. For example using published papers online or in hard-copy journals, mail-outs in the post and on email, bulletins, Continued Professional Development, symposiums, congresses and apps. Different practitioners have their own methods of accessing evidence and information. There has not been much research into which modalities veterinary practitioners chose to use and why. Huntley et al. (2016) and Nielsen et al. (2015) surveyed the different sources of information accessed in the veterinary professional both in the UK and internationally but did not obtain the opinions of the cohort as to why they chose to use the sources and any barriers that they face, the outcomes from these surveys are discussed in more detail in Chapter 2.

With the development of new technologies, there are more and more opportunities for veterinary practitioners to access information 'on-the-go'. It would be interesting to see which are favoured by equine practitioners and the barriers that they face to assist with the dissemination of information into practice today and in the future.

1.6.3 Evidence-based guidelines in human medicine

In human medicine, evidence-based guidelines have been recognised to reduce inappropriate variations in practice and identify key features ("red flags") of cases which need alternative or more urgent care (Wilne et al., 2007). Evidence-based guidelines are used extensively in the medical profession supported by both the World Health Organisation (WHO) and The National Institute for Health and Care excellence (NICE). 'Best Practice Guidelines' and 'Evidence-Based Clinical Protocols' have similar definitions and application in the medical field. Both are an assimilation of the best available evidence; guidelines tend to refer to a topic as a whole and protocols a stepwise method for procedure or work-up of a condition.

Guidelines have been praised and critiqued in their application and there is significant literature in human medicine which discusses this topic. A table (Appdendix IV) summarises the benefits and limitations of medical guidelines, adapted from (Woolf et al., 1999). These should be considered when developing and implementing guidelines. Evidence-based guidelines can be useful for practitioners wishing to practice EBM. Many practitioners may lack the skills or time to assimilate and critically appraise evidence for their use in practice. Therefore having concise, synthesised information in the form of guidelines can prove beneficial (McKenzie, 2014b). However, some may argue that guidelines encourage a 'cook book' approach, and encourage practitioners to rely on them without clinical judgement. Being aware of the benefits and the limitations of guidelines is important, and each of these factors should be carefully considered when generating and using guidelines.

1.6.4 Evidence-based guidelines and protocols in veterinary medicine

Certain parallels may be drawn between healthcare and veterinary professions regarding the benefits and limitations of guidelines. Additional considerations should be taken into account however, such as the differing stakeholders and the addition of the animal-owner dynamic.

Veterinary practitioners do not act under one governmental body, where guidelines can be funded and disseminated nationally. There is also no clear path to how these recommendations are best delivered amongst the veterinary

profession. Best practice guidelines relate to specific areas within medicine; veterinary medicine is a diverse, smaller profession with many different species being treated under one umbrella. It could be hypothesised that creating and implementing guidelines for veterinary medicine therefore has additional challenges.

Ensuring guidelines are robust with an evidence base is essential, but is an additional hurdle. Guideline development requires sufficient evidence to start with, critical appraisal skills and time. High-quality veterinary studies are less available than in the medical field (Vandeweerd et al., 2012, Keene, 2000). These studies are vital for guideline development, without these resources, consensus processes e.g. Delphi workshops may be used to generate statements and broaden knowledge with only small evidence pools available (Hasson et al., 2000, Jones and Hunter, 1995). This adds further time and cost to the process, and is another barrier to the development of guidelines within the veterinary profession.

Although there are not many examples of guidelines in veterinary medicine, likely to be attributed to some of the barriers discussed above, the guidelines which are available have had positive outcomes and response. 'RECOVER' guidelines have been produced for small animal emergency resuscitation (Fletcher et al., 2012). These guidelines have been successfully developed and implemented and are based on the best available evidence. The author notes there are still evidence gaps in this area that need addressing, which is a recurring issue in veterinary research. In farm animal veterinary practice, the Sustainable Control of Parasites in Sheep (SCOPS) guidelines were developed in 2003 following a workshop involving sheep industry representatives. These have been updated three times, most recently in 2012 to review new research and anthelmintics and illustrates the importance of the continual audit of guidelines once developed. These guidelines have been evaluated (Learmount et al., 2015) and it was found that in farms where SCOPS methods were used, there was a reduction in anthelmintic drug use, whilst having no effect on worm burden or production in lambs. These examples illustrate how guidelines have been employed successfully in the veterinary sector, however at the point of writing

there are limited guidelines for use in equine practice based on high quality evidence.

Protocols are used for specific conditions within veterinary practice. They are provide a logical stepwise plan for approach to conditions, and within the medical and veterinary field are not usually stringent rules, allowing for the application of clinical judgement (Bowden, Unpublished). These can be used in general practice for the treatment of common conditions, which may have been developed locally or by the operating organisation. Protocols may or may not have an evidence base, depending on the nature of the practice, drugs available and finances involved (Boysen et al. 2004). Wide-scale protocols are available in equine practice, with some resources published on the British Equine Veterinary Association (BEVA) website (BEVA, 2018a). One resource advocated by BEVA is the Horse Racing Betting Levy Board (HBLB) 'Codes of Practice' (HBLB, 2018). These have been developed for use by racehorse vets and breeders, covering a number of conditions. e.g. information on *Streptococcus equi equi* (Strangles). Included is a numbered stepwise approach to suspect cases and outbreaks, with further guidance and information on the condition. The HBLB Codes of Practice are reviewed annually, but their evidence base is not published for assessment of quality or rigour which makes this resource difficult to review from an evidence-based perspective. BEVA has recently developed PROTECT ME, an antimicrobial stewardship toolkit (BEVA, 2017). This is not a strict protocol and provides an adjustable evidence-based framework which can be tailored by clinicians and practices. This has influenced a reduced use of third and further generation cephalosporins by 30% since 2012, and by 90-95% in one clinical practice that has audited the use of such medicines (Bowen, 2016). This has been a key development in equine practice, and reflects the impact that a protocol with a large-scale campaign may in the veterinary profession.

1.7 Campaigns within the veterinary and healthcare professions

In the UK and internationally, there are multiple research groups constantly producing novel evidence for use in medical and veterinary practice. Guideline and protocol development frequently involves a campaign to publicise the work and have a wider impact. Campaigns that have been used by organisations to

platform these studies have been varied and some have published success. Studies include the Headsmart campaign (Wilne et al., 2007) and BEVA Protect ME (BEVA, 2017) which are discussed in greater detail later.

1.8 Different methods of disseminating research

With ever evolving technologies, there is an array of different information resources available for veterinary practitioners. Traditionally, hard-copy resources have been a key resource and include textbooks and journals. These sources of information are usually in depth, but may be dated and less useful for access in ambulatory practice.

With the more recent development of the web-based technologies, much information is now available in online or electronic format. Research papers are available online and can be searched using databases for example PubMed or CAB abstracts (Cockcroft and Holmes, 2004). Grindlay et al. (2012) explored the best bibliographic databases, with CAB Abstracts having the best coverage out of the nine databases reviewed, with over 30% higher coverage than the next best database. Information may be quickly accessed with the click of a keyboard but accessibility is hindered by subscription costs, filtering the large amounts of information to determine relevance and also the availability of internet 'on the road'.

One area of technological growth, which is rapidly expanding is the development of mobile phone and tablet apps. Apps have been developed for use in the veterinary field including information resources from BEVA (BEVA, 2018b), HBLB (HBLB, 2016) and drug dosage calculators for example. Apps overcome some of the limitations of accessibility since they are available on portable devices with some available for offline use. However access may be limited by the availability/compatibility of devices able to run Apps, storage limitations and some requiring subscription costs.

There has not been published research into the methods of information resources that equine practitioners use. Understanding which methods are most useful for accessing information in practice would be a valuable insight.

1.9 Impetus for this study

The title of this project is 'Disseminating Evidence to Equine Practitioners'. The evidence that will be used will be that generated from the Nottingham Colic Project. This project will be specifically looking at how this evidence can be transferred to veterinary practitioners involved in the primary assessment of the colic case, largely those working in equine ambulatory practice. There is a paucity of studies on how best to transfer knowledge, using veterinary studies as a whole, and especially in equine practice; this project would be a timely assessment of the different options. It is clear from the literature that there are methods that are successful for disseminating research into medical practice, and also barriers and limitations. It is hoped by understanding how practitioners access evidence in practice and the specific barriers faced will enable optimum uptake of this research. In doing so, it should facilitate the development of a useful toolkit to help with the primary assessment and diagnosis of colic. This research should also be useful to inform future studies on the best methods of dissemination of evidence in this area.

As a summary of the above literature review, colic is an important welfare concern in the horse, and reacting effectively and efficiently is essential to promote best chances of survival. Recent research indicates the requirement to address the gaps in evidence in at a primary assessment level. This could be a valuable aspect of improving the outcome of colic cases. With the base of evidence now growing, it is essential that this research can be transferred effectively into practice.

Discussed in the above literature review are examples of how evidence has been disseminated in medical and veterinary practice, and the different methodologies for knowledge transfer. Approaches to knowledge transfer will be based on the current literature and also novel research that will be generated as part of this project. Another researcher has undertaken the first steps into developing guidelines on the primary assessment of colic cases, and this project will build upon of the aims and suggestions from the outcomes (Curtis, 2016).

1.9.1 An overview of the research undertaken as part of the Nottingham Colic Project so far

To understand the basis of this project, below is an overview of the Nottingham Colic Project so far. It was found that there was a limited body of evidence applicable for the primary evaluation of equine colic. To address this, the project has several phases:

1. Identifying gaps in evidence
2. Generating new evidence
3. Converting the evidence into practical recommendations
4. Enabling accessibility of research for veterinary practitioners and horse owners
5. Monitoring impact of the Colic Project

1. Identifying gaps in evidence

A systematic review was conducted (Curtis, 2016), of the current available evidence on risk factors and diagnostic tests. Further to the systematic reviews, horse owners/carers were surveyed to investigate their current understanding and concerns of colic and how they would recognise and react to a horse displaying colic symptoms (Bowden, Unpublished).

2. Generating new evidence

It was found that much of the available evidence was developed using referral populations. Four studies were undertaken to generate new evidence in primary / ambulatory practice, these were:

1. Prospective study into horses presenting with colic (Curtis, 2016)
2. Questionnaire on the use of diagnostic tests by veterinary practitioners (Curtis, 2016)
3. Retrospective study on the primary presentation and outcomes of horses seen out of hours with colic (Bowden, Unpublished)
4. Two multidisciplinary workshops to generate evidence on the primary assessment of colic cases and developing consensus statements (in progress)

3. Converting evidence into practical recommendations

Due to the lack of available evidence, expert opinion was used to determine how the outcomes from the studies could be applied into practice. Multidisciplinary workshops were held at the University of Nottingham involving primary stakeholders: horse owners/carers with experience of colic, veterinary practitioners of varying backgrounds and equine welfare organisations. The workshops were used to review the existing evidence and generate novel evidence on colic. From this, a consensus process has been undertaken to generate recommendations, specifically for horse owners.

4. Enabling accessibility of research for veterinary practitioners and horse owners

Owner-specific research has been marketed and distributed with the help of the BHS, namely REACT campaign. This includes hard copy leaflets and online videos to raise awareness and educate owners on the recognition of colic.

1.9.2 Planned continuation of the Nottingham Colic Project

1. Identifying gaps in Evidence

No further work will be completed as part of this project.

2. Generating new evidence

Statements from the multidisciplinary workshop will be subject to a consensus process which will finalise the evidence generated.

3. Converting evidence into practical recommendations

Evidence has already been converted into practical recommendations for owners and the same needs to be done for veterinary practitioners. This next stage will consolidate the evidence and will be reviewed using surveys involving a larger group of equine veterinary practitioners involved in the primary assessment of colic cases through an iterative consensus process. This process will be used to translate the outcomes into evidence-based recommendations.

4. Enabling accessibility of research for veterinary practitioners and horse owners

Research will be undertaken into how veterinary practitioners use EBVM in practice, their preferred methods of knowledge of transfer, and understanding the barriers faced in practice. Following this, information resources will be developed for use by veterinary professionals, addressing the current paucity of available evidence in this area.

1.10 Aims and Objectives

There were three phases of this project: Phase 1 assessed methods of dissemination of evidence for practitioners, Phase 2 generated consensus statements on the primary assessment of colic, and Phase 3 developed methods of dissemination, based on the outcomes of Phases 1 and 2.

The aim of the first phase of the project was to determine the most appropriate strategies for dissemination of evidence to the equine veterinary profession.
The objectives for the first phase were:

- To conduct interviews with selected equine practitioners to explore their experiences and opinions on the use of evidence-based medicine in equine practice.
- To use findings from the interviews, and evidence from literature and current campaigns to develop and conduct an online survey of equine practitioners on the barriers to using evidence-based medicine in equine practice

The aim of the second phase of the study was to develop consensus statements on the primary evaluation of the colic case.
The objective was to:

- Create an online surveys for veterinary practitioners, to rank agreement on statements on the recognition and diagnosis of colic, generated in multidisciplinary workshops (Freeman and Curtis, 2015)

The aim of the third phase was to develop methods of disseminating information on the primary assessment of colic, based on outcomes of Phases 1 and 2.
The objectives were:

- To develop a website which presented current information in an accessible format

- To develop a plan to conduct a campaign to transfer knowledge into practice, considering current barriers to using evidence-based medicine in equine practice

Chapter 2. Interviews with veterinary practitioners on disseminating information into practice

2.1 Introduction

There are two phases to this section of work which comprises interviews and an online questionnaire. The first phase of the work was to conduct interviews with six veterinary practitioners to assess how information is accessed and used in veterinary practice, and gather opinions on different options for disseminating evidence. Findings from the interviews were then be used to develop an online survey to explore these areas with a wider population of the veterinary profession.

2.1.1 Aims and objectives

The aim of this phase of the project was to determine the most appropriate strategies for dissemination of evidence to the equine veterinary profession. The objectives were:

- To conduct interviews with selected equine practitioners to explore their experiences and opinions on the use of evidence-based medicine in equine practice.
- To use findings from the interviews, and evidence from literature and current campaigns to develop and conduct an online survey of equine practitioners on the barriers to using evidence-based medicine in equine practice

2.2 Methods

2.2.1 Interviews

The interview schedules were constructed as open questions with a structured format using predefined prompts and further questions to encourage interviewees to expand on any answers where necessary (Appendix I). The proposed interview schedule was reviewed and assessed by five equine veterinary surgeons/researchers from the Centre for Evidence-based Veterinary

Medicine. The interview was then piloted and received feedback from three veterinary surgeons.

Sampling of participants was opportunistic. Veterinary practices were selected and asked to participate based on their previous involvement in the Nottingham colic project (prospective case study or workshops) and if they had agreed for further contact and involvement. They were selected to represent a range of different types of practice, but all had first opinion components. Interviews were conducted face-to-face (6) and via telephone (1). All interview participants were required to give informed consent. The interviews were recorded and then transcribed, notes or responses to key areas were also handwritten at the time of the interviews. Responses were categorised according to main themes.

A total of thirteen veterinary surgeons from eight different veterinary practices were contacted. Seven vets replied and were available for interview within the study time frame, and they were based within four different practices. The interview duration was approximately 20 minutes. All four practices operated first opinion veterinary work with some practitioners also undertaking work within the hospital, in addition to ambulatory services.

2.2.1.1 Profiles

To anonymise results, the practices have been named 1, 2, 3, 4 and vets A and B from each practice.

Practice	Type	Size	Expertise	Vet	Experience
1	Mixed	Medium – operating facilities for surgeries inc. colic. Six vets, 3 nurses.	New graduates and long standing experienced equine vets	1A	• 2.5 years graduated • 80% equine
				1B	• 3 years • Mixed/equine first opinion
2	Mixed. Equine work ambulatory and hospital-based which also receives referrals.	Large, 12 vets and 20 supporting staff. Colic surgeries are undertaken.	One diplomat and four post-graduate certificate holders.	2A	• 27 years graduated • 100% equine • Practice partner
				2B	• 5 years graduated • 100% equine • Undertaking certificate
3	Mixed. Small and equine. Equine – is both	Medium sized. Equine team of three senior	Experienced partners and	3A	• Four years graduated • Stud work and ambulatory equine

	ambulatory and hospital based. First-opinion and referral.	partners, four assistants, two interns and seven nurses.	newly qualified interns.	3B	• 12 years graduated • 100% equine • Practice partner
4	Mixed. Ambulatory and some surgery facilities.	Small. Five large animal vets involved in equine work.	One equine post-graduate certificate holder.	4A	• 8 years graduated • 40% equine, 80% farm • Certificate holder in farm practice

Table 1. Vet profiles of the veterinary practitioners who participated in the interview questionnaire

2.2.1 Thematic analysis

The transcripts from the interviews were evaluated using thematic analysis (Braun and Clarke, 2006). The first step was for the primary researcher to fully familiarise themselves with the interview transcribes. Following this, subthemes could be identified throughout the dataset. Subthemes were defined as repeated patterns and important topics. These were consolidated, according to frequency and importance, in consultation with another researcher and reference to relevant literature, and then refined into themes and sub-themes. A web showing the connections between themes and sub-themes was also drawn. The flowchart below shows the main theme and sub-themes (Figure 1).

2.2.2 Development of survey

The survey was based on the findings from the interviews. The survey was conducted using an online questionnaire format, designed on SurveyMonkey (2017). It was divided into the following sections:

1. Demographics of participants
2. How participants access information
3. How participants use EBVM in practice
4. Awareness of the BEVA Protect ME scheme
5. Participants opinions of different options for disseminating evidence from the Nottingham Colic Project (including opinion of web-based information, hard copy information: papers, magazines leaflets, mobile phone/tablet apps)
6. Their opinion of what information should be targeted for veterinary education and owner education.

Questions were structured and closed, but with an open text box for free text comments after every section. A range of question types were used for the different sections, including 'frequency'/'importance' matrix drop downs, 5-point Likert Scale (See Chapter 3), multiple choice, checkbox lists, simple yes/no and comment boxes.

The survey was reviewed by five veterinary practitioners and researchers at the University of Nottingham, including a review from the British Equine Veterinary Association (BEVA) perspective. It was piloted by one veterinary practitioner, and participants from the interview round were invited to review the questionnaire and provide feedback.

2.2.3 Distribution of survey

The survey was distributed to veterinary practices in the UK that were involved in equine veterinary work. These were identified through the 'Find a Vet' function on the Royal College of Veterinary Surgeons (RCVS) website, with a filter applied to identify practices registered as involved in equine work. This search provided practices and email contact details. Each contact was emailed on two separate

occasions, firstly to provide details of the survey and request participation, and secondly to remind practices to participate. The survey was also advertised using social media (e.g. Nottingham colic project Facebook and twitter pages). International participation was sought using a contact who distributed the link via the American Association of Equine Practitioners (AAEP) in October 2016. The survey was left open for four months.

2.2.4 Survey analysis

Numerical survey data were downloaded from SurveyMonkey and descriptive analysis was performed in Microsoft Excel. Free text responses were coded according to type and number.

2.2.5 Triangulation of data

Triangulation of data was undertaken using multiple methods. This included:

- Comparing responses between different interview participants.
    - Between those that worked in the same practice.
    - Between those that worked in different practices.
- Comparing responses between interviews and the online survey.
- Discussing results and outcomes with supervisors.
- Asking a number of different questions that may have similar connotations in both the interviews and online survey, to ensure any answers and opinions were not missed.

2.3 Results

2.3.1 Thematic analysis

Thematic analysis of the interview transcripts identified a number of recurring subthemes, across the seven interviews. These related to the barriers of the use of EBVM in practice and problems in approach to first opinion colic cases. These subthemes are not rigid and many have overlapping aspects, a flowchart has been used to illustrate the specific aspects to each theme and how they are linked (Figure 1). The three main areas were: experience of veterinary practitioner, lack of time/time pressures and accessibility of resources. Additionally, there appeared to be an overriding theme of 'practice culture' throughout the interviews, these are all described in detail below.

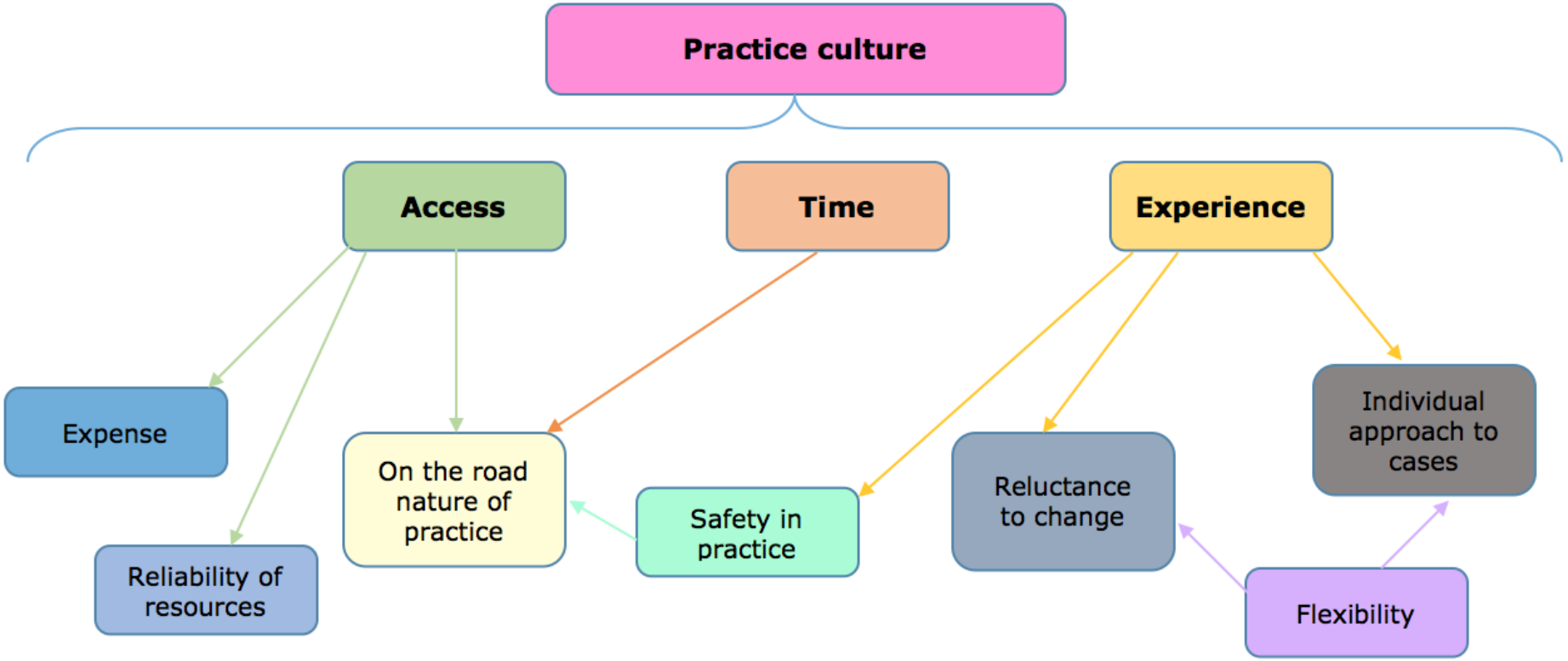


Figure 1. Flowchart showing the summary of the thematic analysis. It was found that there were three main areas:'Access', 'Time' and 'Experience'. Futher subthemes are linked to each of these. Practice culture was the overarching theme observed in between the four different practices.

2.3.1.1 Theme definitions

Included below are definitions and examples of each of the subthemes, data grouping and main theme (Figure 1). The interview involved both asking their views on knowledge transfer and their views on primary practice colic decision-making.

Theme	Grouping	Definition	Words/phrases related to theme	Subtheme	Definition	Words/phrases related to subtheme
Practice culture		Similar thoughts and actions seen in practitioners working within the same practice				
	Access	This refers to the access an accessibility of resources in practice	• University library • Mobile data usage • Ease of downloading podcasts • Online • Online journals • Hard copy versus online	**Expense**	The costs involved when accessing resources and the communication of expenses	• Pay to access websites • Paid apps • Communicating costs to clients
				On the road nature of practice	Equine ambulatory practice has unique barriers versus other veterinary and medical practice	• Podcasts • Apps • Facilities
				Reliability of resources	How trustworthy the candidate viewed the resource	• Commercial endorsement • Filtering reliable websites • Peer reviewed resources • Resources for owners • The BHS REACT campaign

	Time	The time pressure of practice – both during cases and lack of free time to study and access evidence	• Busy • Using personal time to research • During cases • Short, summarised information	**On the road nature of practice**	See before – this also contributes to time pressures e.g. Not stopping for lunch or stopping to read during the day	
	Experience	The clinical experience of the vet	• Senior partners • New graduates • Understanding and use of EBVM	**Reluctance to change**	There was some resistance to new ideas from some interviewees	• Clinical experience versus evidence
				Flexibility	Flexibility of resources – allowing vets to include their own clinical expertise alongside any protocols developed	• Template information versus rigid protocols • BEVA Protect ME template • Adjustable • Presentation of research • Also related to 'reluctance to change' and 'individual approach to cases'
				Individual approach to cases	No case or practitioner is the same	• Different vets • Different practices • Disparities within practice • First opinion versus hospital based

				Safety	This is related to the colic case and safety of vets in practice, it is less related to the knowledge transfer process	• Practical skills • Nasogastric intubation • Rectal examination • Also related to 'on the road nature of practice'

Table 2. Theme definitions from the interview scripts

2.3.1.2 Experience

Experience was mentioned commonly across the interviews and was communicated in a number of ways. Conducting interviews with senior partners versus more recently graduated veterinary practitioners displayed a difference in responses and approach to cases. Older, more experienced vets showed a reluctance to change their practices. In response to accessing information on colic, one veterinary practitioner with twenty seven years of experience responded 'I have a plan and approach in my head which been there for a long time. I don't need to remind myself of that really'. However these more experienced vets were able to appreciate the need for younger or less experienced vets to access this information, especially in purely first opinion or mixed practice. The differences in experience shows clear benefits of being located in a larger hospital; in response to 'What are the ways you access information for assessing and managing cases in practice?' one vet responded; 'Talk to colleagues, senior colleagues, would probably be the first port of call, mainly because it is there straightaway and in a bigger practice, there is good support here'. It was noted that without this support network, practicing as a newly graduated vet on the road is a challenge; 'your one-man-bands or mixed practitioners or people like that, they will often toil along'.

An individuality in approach to cases, was sometimes linked to experience, but also personal preference. An example of how this was highlighted was when the veterinary practitioners were questioned with 'Please may you describe your understanding of evidence-based veterinary medicine.' This generated a wide range of responses, not necessarily linked to age or experience, but there were common responses within the different practices.

The specific responses from each vet to this question illustrate this, and are described below:

1A) 'Where you have enough numbers of something that is giving clear evidence into something working or not working or trends and things like that'
1B) 'Not very good to be honest'

2A) ‘EBVM is a medicine that is conducted based on various degrees of evidence and there’s various criteria for that level of evidence and ideally you should be basing your decision-making on that evidence from research’
2B) ‘So doing procedures etc. because there is a decent amount of evidence behind it basically’

Furthermore, two veterinary practitioners, currently involved in studying for a Certificate articulated their value of EBVM at a higher level, and appeared more open to changing their current practices. For example, vet 2B) ‘…when I was at university, I qualified five years ago, but even then, EBVM was just like a slight idea on the radar... the most fundamental part of our job, is to be able to do EBVM and I think a lot of the reason potentially vets either my age or older, it’s just it’s a bit scary’

2.3.1.2.1 Experience. Subtheme: Disparities within practice

With regards to approach to cases, some of the interviewees alluded to disparities within practice around confidence and decision-making, this was frequently linked to the experience of vets. For example participants described that use of guidance or templates would vary according to the practitioner’s experience:

‘I think new grads would definitely. I think the more that you’ve seen, you’re probably less likely because you are happier with your own judgement.’

‘Well the new grads, I think it would be very useful to have a sort of guideline because as a referral practice, we have a lot of variable colic work.’

‘If they were reasonable guidelines, it probably would be useful, particularly if colleagues who maybe don’t have the same degree of experience.’

Accessing information was also highly variable between practitioners, dependent on experience. One vet compared the experienced colleagues with the less experienced with regards to how they might use templates or other information:

‘I think our senior partners would look at it and do probably what they’ve always done. New grads, definitely, because they always come; we have a lot of new grads at the moment and for every colic they come to me and go, “What do I do?”

As aforementioned, there is a clear reluctance for senior partners to change their practices with their approach to the colic case, which is also shown above. Additionally another partner commented: ‘I suppose having been in practice ten years, I’ve looked at quite a lot of colics and kind of have my own guidelines and templates.’

The veterinary practitioners with mid-range experience were more open to using template information in their approach to cases:

‘A template would be great and I think it would be great as well for – I mean we have quite a high turnover of vets. We do often have new vets and I think having a template where you’ve got this, then this, then this – it’s how I’ve learnt to do vettings.’

2.3.1.2.2 Experience. Subtheme: Skills and safety

Rectal examination skills were an area that came up repeatedly during the interviews as a key skill that is often not carried out to an adequate standard at first opinion level. One referral veterinary practitioner commented:

‘We often see people with people who send us colic is their rectalling skills aren’t very good. They’ll either say, ‘Oh I didn’t want to rectal it,’ because they’re too nervous to do it, or they do it and they don’t know what they are feeling.’

Furthermore to concerns over the diagnostic value of the rectal examination, one vet emphasised the importance of safety during the physical examination in their response.

2.3.1.2.3 Experience. Subtheme: Flexibility of resources

There were a number of comments around differences in experience of vets, disparities in practice and reluctance of some vets to apply EBVM and/or change their procedures and these were all grouped under a subtheme of flexibility of resources in terms of presentation of the colic research.

During the interview, the veterinary practitioners were questioned whether they used a currently available template for the use of antibiotics in the horse produced by the British Equine Veterinary Association (the BEVA Protect ME template). This once again received a varied response and illustrated the differences between practices.

There were a number of comments on the BEVA Protect ME template in terms of its helpfulness, format and whether it changed their procedures. These demonstrated differences in opinions and approaches and therefore the need for flexibility in any resources to accommodate this.

Practice 1: were unaware of the template so were unable to comment on its features.

Practice 2: 'We have the template up on our wall but as a guide and we have our own in house guide as well.' 'Just having it there makes you look at it. We've got it printed out downstairs.'

Practice 3: 'I think we were probably fairly good at it anyway. So maybe it didn't change it, I don't have a copy of it but I've read it enough times that I do think about it when I am prescribing' 'I definitely printed it and asked for it to be put up'

Practice 4: 'We've got a copy up in practice so that we have a copy of it for everyone to use'

2.3.1.3 Time

In response to the question 'What do you think are the main barriers for vets accessing information?' the most frequently occurring response was time: it was mentioned in six out of the eight interviews in response to this question.

However, time issues also appeared frequently, indirectly in responses to other questions. These included questions around frequency of access, and type of resource:

I: How frequently would you say you access papers or articles?
'At a push, once a week. No more than that. Actually sometimes it would be on a weekend. If we've got a quiet Saturday or Sunday afternoon, I will be sat up here on my own, and I'll certainly do online webinars like CPD online. I find those really good actually because you can clock an hour of CPD really easily just sitting at your desk waiting for the phone to ring.'

'I think when you are busy, you tend to rush around and not see what's been put in your drawer as much I think.'

'I quite like online CPD because I can just stick it on while I am doing stuff and then I just watch CPD while I'm making my dinner and doing stuff.'

I: What is the best way of disseminating information to veterinary practitioners?

'In a short way, if that makes sense. Kind of summarised so that you don't have to read too much. But also with the key points highlighted, so short communication or kind of short papers that are useful and easily accessible.'

I: What are the advantages and disadvantages of websites?

'You can access them whenever you want. You don't have to be tied down to a certain time, particularly with these webinars and things you can break into smaller chunks that you can view, rather than having to leave the practice for the day and get relevant information that way.'

I: What kind of things do you read?

‘I’m not very good at reading EVJ or EVE, because I just don’t really have time to sit down and look at it.’

2.3.1.4 Access

Time restrictions and accessibility of information often linked, but the ability to access information was frequently mentioned across the interviews.

I: So what do you think the main barriers are for vets accessing information?

‘…The other difficulty we have with accessing some information is that the information is out there but it’s in a journal or a library which we don’t have access to without spending a considerable amount of money to be able to access it.’

‘Access to the papers and the information. A lot of the information is drugs company based unless you are undertaking a research project, access to some of the papers is limited. And time I think sometimes as well, the time to actually access the stuff which is there.’

The vets interviewed all described barriers of accessing journals and articles. In terms of evidence published online – some of the vets described the limited access they have to some journals and articles without paying a subscription fee. One of the practitioners undertaking a certificate said one of the benefits of such qualification was the use of a university online library. Interviewees also commented on issues around the different types of material they accessed.

‘I think there is a borderline between scientific and clinical… too theoretical as opposed to practical… I know numbers are important but not just stating facts and figures because I think dedication into reading those just goes really under five minutes, whereas if it’s more clinical based, I can read a whole thing.’

There was variation between how practitioners filter and access papers and information themselves.

‘I would do a PubMed search sometimes. I will consult diploma holders who often have that at their fingertips. I might do a search on the EVJ website or Vet Surgery website as well.’

‘I’m terrible. I Google stuff. I don’t always know where the source is coming from. I’ve looked at it as a medical paper but I don’t actually know.’

‘Almost always I would look up the paper and I would use the BEVA website, but occasionally I’ll look into textbooks. Especially if it’s to do a procedure I would look in a textbook, but usually I find them out of date.’

These different responses highlighted a need to improve accessibility of research, some means of filtering different types and levels of evidence, and helping vets apply EBVM, all within the time demands of equine practice.

An additional factor that was highlighted was the ‘on the road’ or ambulatory nature of first opinion equine practice.

‘So like if you’re doing a peritoneal tap on the road and you weren’t sure, to have a video easily accessible, that would be really good.’

‘If you are on the road, to be able to pass [evidence] onto the owner, because we obviously see quite a few referral colics and a lot of them arrive with an owner who has no idea what’s going on.’

‘[Podcasts] would be a fantastic way of getting evidence or CPD in the car.’

‘Podcasts, because most of this is going to useful for people on the road driving around.’

All these different factors contributed to the data grouping of accessibility that was raised frequently as an important barrier to how vets currently use resources.

2.3.2 Ideas for disseminating evidence

The veterinary practitioners were asked for their suggestions with, 'What do you think are the best ways of disseminating evidence to veterinary practitioners?' This open question was used first to generate their ideas, before more specific questions were asked about different resources. Responses from this first open question included a range of different resources: journals, papers, staff meetings, clinical clubs, talks, external CPD activities, books, certificate, library access and BEVA resources. When mentioning journals and papers, participants gave a number of specific examples, including how they were accessed (online), specific journals (Veterinary Journal and Veterinary Record) and the types of publications (short communications and short papers). Externally delivered CPD was also described in a number of different format, including online CPD, CPD days and BEVA Congress. In the more specific questions, interviewees were asked, 'What are the main ways you access information for assessing and managing cases in practice?' Responses included: journals, expert opinion, websites and apps. A further question was asked specifically in relation to the Colic Project, 'What format do you think would be the most useful and accessible presentation of this research to vets?' The most popular answer was an app, but a slideshow, flow diagrams, 'something easy to look at', similar to BEVA Protect ME, podcasts, online, flyers, and decision making trees were also suggested.

2.3.2.1 Ideas for resources from interview answers

Further questions regarding resources were more specific and were divided into sections around use of web-based information, hard copy information and mobile phone/tablet app. It was found once again that there was variation over what resources practitioners favour.

2.3.2.1.1 Web-based resources

Web-based resources were accessed frequently by the interviewees, including online journals and papers, online CPD organisational websites, webinars and

YouTube. These were talked about as being more accessible than traditional hard copy resources, but disadvantages of these resources was also highlighted.

'I wonder who might be able to get hold of that information. As well, I think it also needs to be only available to professionals really. I think YouTube can cause problems with people who aren't professionals and who are trained.'

'The major advantage is that you get a lot of information really quickly, but you have to sift through what would be useful and what isn't because you can end up on Horse and Hound website with people from a livery yard commenting on what they think.'

'Disadvantage is there's loads of them [websites], so almost too much in terms of resources. The benefit is you can get to the information quite quickly if you know how to sort of navigate through them'

2.3.2.1.2 Hard copy information

Hard copy resources were accessed less frequently by the younger vets, but were described as being useful for presenting short and summarised information in a visual manner e.g. posters, flow diagrams, flyers and decision making trees. There were conflicting opinions on the use of hard copy journals, and one vet commented on the first impressions in whether they would use these resources:

'I do find it easier to read a journal than to read a paper on a screen. That's just me personally. Whether it is just because of my age, though having said that, I do have a Kindle. So I read books on a Kindle, but I would tend, if I had a choice, I would be reading a journal as a hard-copy.'

'I think it does work for a lot of my colleagues, but personally it just clutters up my inbox and I don't tend to – I probably think because the internet is so available and I find that much more useful.'

'If I'm handed something, I'll know in the first couple of seconds whether I'm going to read it or not. So I know this sounds stupid but it would be kind of a

photo or like a picture on it or a headline or bullet points, things like that. If it's a lot of writing, to be honest I would be unlikely to read it…'
The final two comments also relate to time and accessibility as described earlier, and highlight the importance of resources which are easily accessible and engage the practitioner.

2.3.2.1.3 Apps

One of the most popular responses that generated a higher level of interest was regarding development of an app. In summary, the ideas presented in the answers to the question, regarding Apps were:

- Check-list
- Videos (mixed response)
    - Peritoneal tap
- Data collection
- Easy to access data
    - Parameters
    - Reference values
    - Differentials
    - Recommended doses
- Prognosis
    - Links to papers
    - Information for clients
- Rectal findings
- Costs
    - For less experienced ambulatory vets
    - For clients
- How to perform procedures

Essentially, an app quick and easy to use as a quick reference whilst on the road was the key feedback on how it should be formatted. Participants gave a variety of feedback on how an app could be developed. Examples of some of the comments are below:

‘Just a check-list where you can enter. I wouldn’t want to be doing loads on an app whilst I’m there. I think videos and things like that are great, but I think that I would be more interested in being on a website after I’ve been at my colic or when I’ve got a quiet moment at the weekend.’

‘The only other thing I’d say with the app, is there’s a danger of people saying, ‘Oh well, the app says it should be fine.’

‘Data sheet collection would be quite useful particularly when you are passing cases over in the evening to the vet on call so that we’ve got a standardised method of case management handover. And yeah some stuff on the procedures, how to perform procedures would be quite useful when you’re quite tired and your brain isn’t quite working, it is quite nice to refresh yourself...’

2.3.2.2 Client involvement

Practices described an array of methods they use to involve the client in cases; these included client evenings, hard copy resources, practice website and practice newsletter. Information published was mainly based on clinical experience versus EBVM, but this varied. Some of the vets seemed quite out of touch with the owner education programme, with responses including ‘I think we do that…’, ‘I’m not sure…’ and similar phrases.

The use of hard copy resources e.g. leaflets or fact sheets was mentioned frequently:

- ‘They can be quite effective actually, it is quite a good way to get them talking.’
- ‘[Regarding laminitis] I do a weight-loss plan written down and I’m finding that I’m getting dramatically better results. The owner has got something to read because what they take in, sort of twenty per cent. …I think if it’s written down, it really, really consolidates and they’ve got something to go back to and go,’ I can’t remember exactly what she said. I think as well, they can access the internet and read anything, websites are so unpredictable, unreliable..’

- ‘We sometimes give them information. We’ve got some fact sheets we give them and on the website, but actually how useful that is, I don’t know because they will have looked on all sorts of other places and got all sorts of opinions whether it be good or bad. So whether ours trumps the other things – I honestly don’t know…’
- ‘My impression is they probably prefer to look on these equine fora and listen to any Tom, Dick and Harry spouting off on any subject with very little evidence.’

2.3.2.3 Veterinary education

Across the interviews, it was found that practitioners held the opinion that veterinary education is very variable, dependent on where one studies and also on the motivation of the individual student. There was varied opinion on the topic of education including further education as displayed below.

I: Do you think the education for undergraduate vet students is adequate for colic specifically?
The answers were mainly grouped into: seeing different types of cases, diagnostic skills including rectal examination and using EBVM. Examples of answers are:

‘Probably not, it’s probably emphasised the same amount as every condition gets the same amount. Whereas in practice, wounds and colic. That’s what we see ninety per cent of the time.’

‘Unless your university is associated with a first opinion practice, you’re not seeing the first opinion colics. You’re seeing a very, very small proportion of surgical colics.’

‘So I’d seen quite a few and I felt really prepared for going in and seeing an ambulatory colic, but then sometimes you’ll get phone calls from a new grad that obviously feels out of their depth going to see and colic and I know some of my friends that haven’t, that do mixed practice, and wouldn’t have seen many at all, really panic when then go out to them.’

I: Do you think there is enough further education on colic available?

'Probably not again. I mean for the amount of colic you see, there's not as many CPDs.'

'I think there's lots of really fantastic CPDs and say the certificate and obviously if you want to go down the route of a residency and all that kind of thing, it's available.'

'Yes, but maybe not that easily accessible and probably not published that much because everyone, once you've seen some colics, you know a colic's a colic and you either treat it and it gets better or you refer it and it goes away.'

2.3.3 Development of survey

As outlined previously, the online survey was based on the interview questionnaire and the outcomes from the interviews. The table below maps the different themes and how they influenced the online survey questions.

Section of survey	**Theme (subtheme) from interviews**	**Specific questions in survey**
Demographics of participants	Practice culture Experience (reluctance to change, flexibility, individual approach to cases) Access (on the road nature of practice)	Age and year of graduation of participant Type of veterinary practice
How participants access information	Practice culture Access (expense, on the road nature of practice, reliability of resources) Time (on the road nature of practice)	Types of resources used, how often used and how important they are Barriers to EBVM

How participants use EBVM in practice	Practice culture Access (expense, on the road nature of practice, reliability of resources) Time (on the road nature of practice) Experience (reluctance to change, flexibility, individual approach to cases)	Opinions of importance of EBVM, and which hard copy and online sources of information used Problems accessing different resources
Awareness of the BEVA Protect ME scheme	Practice culture Experience (reluctance to change, flexibility)	Whether aware of it, impact on clinical practice
Participants opinions of options for disseminating evidence from the Nottingham Colic Project	Practice culture Access (expense, on the road nature of practice, reliability of resources) Time (on the road nature of practice)	How likely to use different colic resources
Participants' opinions of what information should be targeted for veterinary education and owner education	Practice culture Experience (reluctance to change, flexibility, individual approach to cases)	Preparedness of new graduates, training for graduates, resources for owners

Table 3. Mapping of the interview outcomes in the online survey development

Different needs according to experience was commonly mentioned within in the interview, with more experienced practitioners stating that they would not use some resources, but thought they would be helpful for new graduates. This informed the questions around preparedness of new graduates to determine whether there gaps where perceived to be. Accessibility to resources on the road was also a key feature, and therefore the questions on resources asked about the type of apps used, how frequently they were used, and also how important they were perceived to be to capture both the frequency and significance of their role in EBVM in ambulatory practice. These are two examples where the mixed methodology approach influenced the survey design.

Following feedback and piloting, some questions were reworded based on this, further international resources added and a picture of the BEVA Protect ME template.

2.3.4 Demographics

Using the RCVS 'Find a Vet' 1076 UK practices produced 787 non-duplicate email addresses in August 2016. The survey had a response of 129 veterinary practitioners, with 61.7% female and 38.3% male participation. The modal age bracket was 21-40 with 38.0% of responses. The majority of responses were from first opinion ambulatory veterinary practitioners with 54.6% of responses. Hospital or clinical based practice, referral hospital and mixed practice (equine AND farm/small/both) had 11-14% response in each category. The modal country of origin was the UK with 62.3% of veterinary practitioners based here, 32.1% in the USA, 1.9% in Europe and 3.8% 'Other'.

2.3.5 Accessing information resources (91/129 respondents)

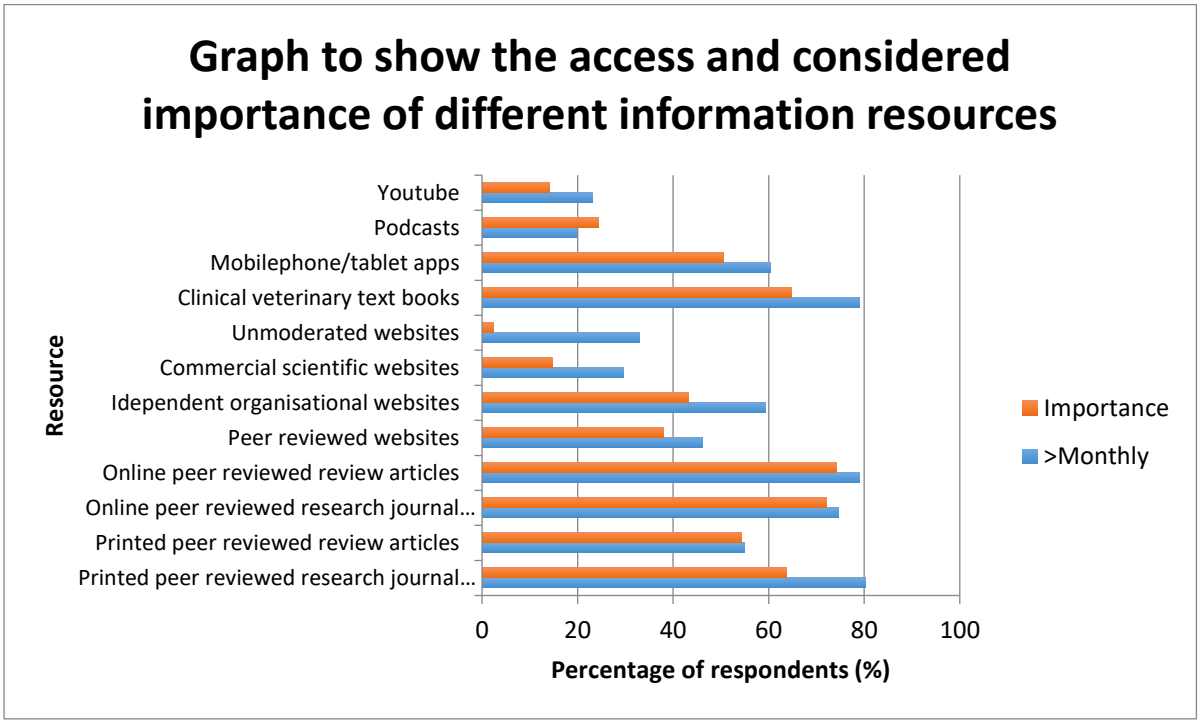


Figure 2. Graph showing the percentage of respondents who accessed each resource greater than monthly, versus the percentage of respondents who answered important or very important for each listed resource.

Veterinary practitioners were questioned on how frequently they used different resources (daily, weekly, fortnightly, monthly, six monthly, >6 monthly, never) and how important they considered each resource (very important, important, quite important, not very important, not important. When asked which resources they used on a daily basis, participants stated that they used mobile phone/tablet apps most frequently (14.3% or 13/91 participants), followed by online peer reviewed research journal articles (12.1%, 11/91) and clinical veterinary text books (9.9%, 9/91). Figure 2 shows the resources accessed greater than monthly. However, some veterinary practitioners also indicated that they never accessed some of resources including: Podcasts (56.0%, 51/91), YouTube (49.5%, 45/91) and unmoderated websites (36.3%, 33/91). The only resource accessed by 100% of veterinary practitioners was clinical veterinary textbooks.

Participants were asked how important they considered different resources to be. Online peer reviewed research journal articles were rated as the most important, with 51.1% of veterinary practitioners deeming this resource to be very important (Figure 2).

In the free text 'comments' for this section on information resources, five practitioners commented on the importance with communicating with peers including referral vets, consultation with senior staff members, peers in both the same and other practices. Other comments included using google and symposium proceedings.

2.3.6 Barriers to finding information (81/129)

The third section of the questionnaire consisted of closed questions about the main barriers to finding information: lack of time – 76.4% (68/89) of participants either agreed or strongly agreed this was an important factor, followed by difficulty accessing articles (65.2%, 58/89), expense of subscriptions (59.6%, 53/89), can be difficult to determine reliability of information (38.2%, 34/89), too much information is available (18.0%, 16/89) and current knowledge of area is sufficient (14.6%, 13/89).

There were a number of comments in this section related to some of the challenges in accessing information, including cost, accessibility and the volume and quality of evidence.

'New information is quite often lost in the generalised information… which isn't great if you are skim reading etc. to work out what you want to read.'
'Much of the information is not applicable to first opinion practice, and the results of many studies have a poor conclusion/insignificant finding.'
'Some things just aren't in the peer reviewed literature yet…'
'Expense is a big issue and accessing peer reviewed articles.'

2.3.7 Using Evidence-based Veterinary Medicine in practice (87/129)



Figure 3. Importance of research evidence as part of clinical approach.

Participants were asked to rate how important evidence was in their approach to cases: 83.9% of participants considered this to be either very important or important.

Sixty-three veterinary practitioners provided free text comments on how they use evidence in practice. These were categorised into overall codes and how frequently they occurred in this section is detailed in this bar chart using the most commonly occurring ideas (Figure 4).

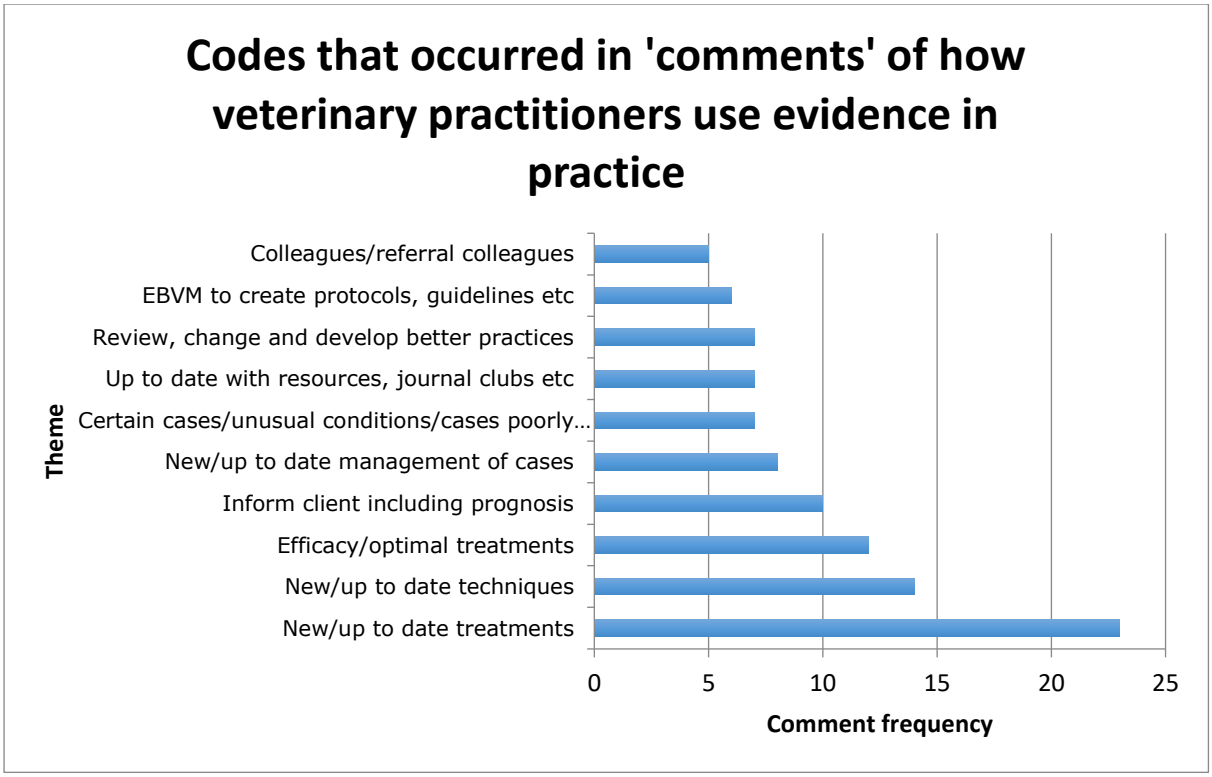


Figure 4. Bar chart showing the most common codes from 63 comments on the use of EBVM in practice. The 'comment frequency' is the number of times each of these codes appeared in the comments.

The question was: 'What do you read for information on equine conditions?' This was a frequency rating question and a list of common resources was listed. Few participants (5) accessed any of the literature on a weekly basis described. These are the ranked resources accessed more frequently than a monthly basis:

- Equine Veterinary Education (EVE) (88.4%, 76/86)
- Equine Veterinary Journal (EVJ) (75.6%, 65/86)
- Veterinary Record (45.9%, 39/85)
- In Practice (45.2%, 38/84)
- Veterinary Times (40.5%, 34/84)

- Journal of American Veterinary Medical Association (JAVMA) (33.3%, 29/87)

In the comments, an additional 23 resources were added to the original list, mainly comprising of international publications.

2.3.8 BEVA Protect ME

When asked about the BEVA Protect ME template for use on antimicrobials, 52.9% of respondents said they were aware of it, when this was filtered to those based in the UK only, this increased to 82.4%. Of these respondents who were aware of this initiative, 93.6% deemed the template to be helpful, with 46.8% changing their procedures. There were 16 comments on this section. Four respondents said they already used a similar protocol, others had positive comments or used it in certain circumstances, one respondent commented on lack of practice compliance despite own endeavours, and one participant indicated they had not 'got round to applying it'. 63.0% of respondents said they tailored the template to their own practice protocols. There were a number of further comments on the template, which included five comments about accessibility, both positives and negative and two about the need for wider dissemination.

2.3.9 Disseminating evidence from the Nottingham Colic Project into practice (83/129)

The section on disseminating evidence asked participants to rate how they considered staff (themselves, junior assistants and senior partners) within the practice would use different resources. 'This is a list of resources that may be developed from our colic research – please indicate the likelihood of use by both yourselves and colleagues (e.g. new graduates, senior partners).' The options were: very likely, likely, unlikely, very unlikely, not at all (Table 4)

	Yourself	Senior Partners	Junior assistants
Case recording form	65.1%	30.9%	81.8%

Decision making chart for differentiating critical cases	54.2%	28.6%	77.6%
Decision making chart for choosing diagnostic tests	55.4%	32.9%	74.6%
Information sheets on when and how to use diagnostic tests	66.3%	37.1%	82.1%
Client resources: owner fact sheets	81.9%*	58.6%*	85.1%*
Client resources: consent form templates	65.9%	47.8%	69.2%

Table 4. Veterinary practitioners rating of how likely they considered different members of their practice were to use different resources on equine colic, from an online survey of 129 practitioners. The data shows the percentage of vets who selected 'Very likely' or 'Likely' as options for usage of each resource. * - the mode choices per practice member.

The comments highlighted several practices having existing systems, and some around the practicalities e.g. 'Utility would depend on the quality and how it would be relevant to our practice', 'Don't think clients would have confidence in someone using a chart.'

The next question in this section asked participants what format they would consider to be most useful and accessible to present colic research. They were asked how likely you are to use each format (very likely, likely, unlikely, very unlikely, not at all). Each percentage below is the sum of the percentage who chose 'Very likely' or 'Likely' responses, displayed in the bar chart below (Figure 7). When asked if they would like an adjustable template similar to the BEVA Protect ME scheme, 61.9% or participants gave a 'Yes' response.

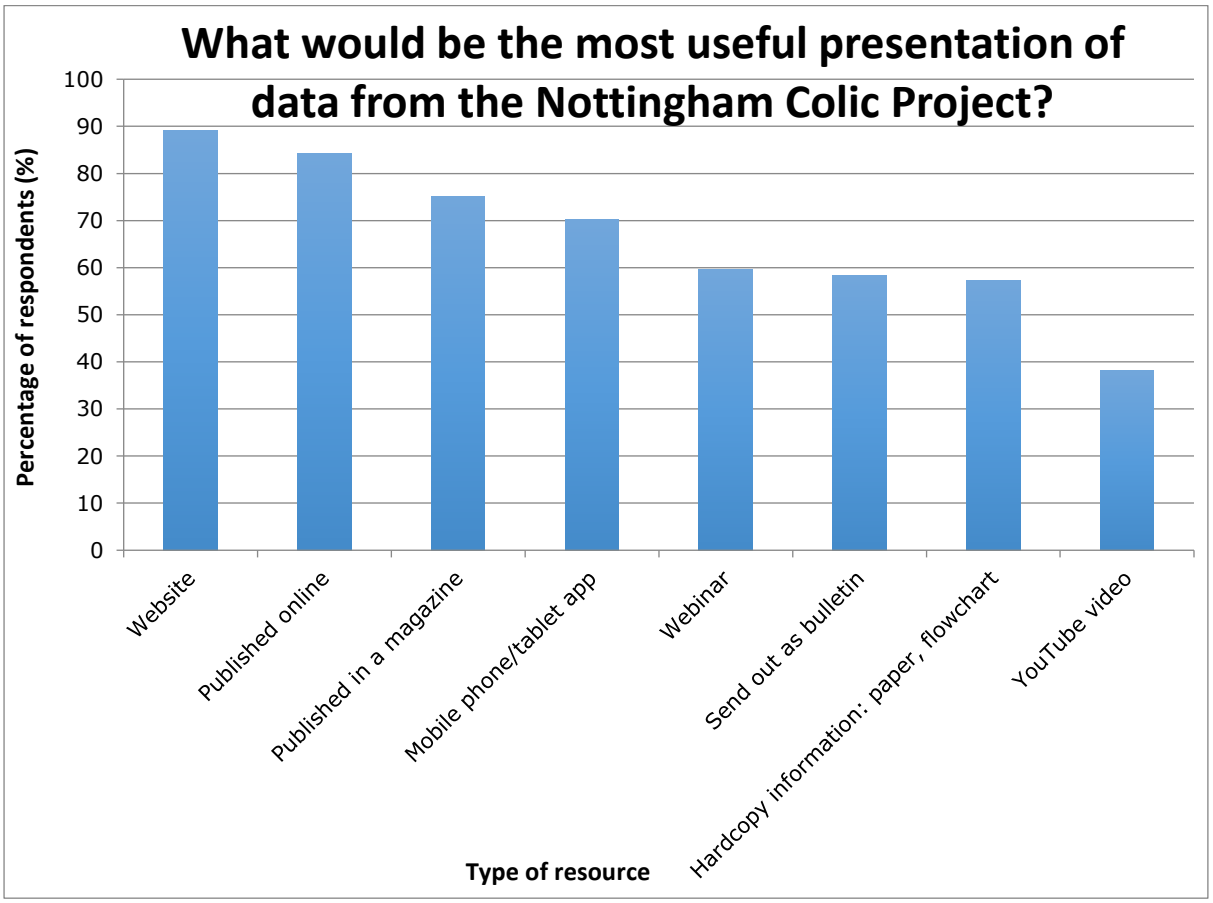


Figure 5. Bar chart showing the likelihood of usage of the following resources using information from the Nottingham Colic Project.

2.3.10 Web-based information

In the next section, participants were asked to give information on the types of resources they used, and how frequently they accessed them. This first part asked about web-based resources, and where these were accessed on a daily, weekly, monthly, 6 monthly or greater than 6 monthly basis. Participants stated they used a small number of websites on a daily basis the VIN (Veterinary Information Network) (accessed on a daily basis by 5.2% of participants), AAEP (American Association of Equine Practitioners) (2.5% of participants), BEVA (British Equine Veterinary Association) (2.5% participants) and IVIS (International Veterinary Information Service) (2.4% participants). Veterinary practitioners were most likely to access the different resources on a six monthly or longer duration basis.

Resources that were accessed by more than 20% of participants were: BEVA (21.5%) and In Practice (21.5%) accessed on a monthly basis; RCVS (26.6%), FEI (21.5%) and Merck Veterinary Manual (21.5%) on a 6 monthly basis; FEI (31.7%), British Horse Racing Authority (24.1%), AVMA (22.2%), RCVS (20.3%) and HBLB (20.0%) on a greater than 6 monthly basis.

Participants were asked whether they were aware of other veterinary health education campaigns. 42.6% (55/129) of participants responded to this section. Most had visited/used the 'Talk about Laminitis' scheme (96.4%, 53/55), the majority had used Strangles (61.8%, 34/55), Atypical Myopathy (60.0%, 33/55) and Grass Sickness (52.7%, 29/55) websites and a smaller number had used the 'Feel Good Colic' rectal resource (34.6%, 19/55).

Participants were asked whether they had access to a library for resources, and how they accessed these resources (able to select multiple options). This section had an overall response rate of 42.9% (54/129). Most access to libraries was through association/membership (90.8%, 49/54), or by working in association with a university (29.6%, 16/54), with the smallest number using RCVS Knowledge (11.1%, 6/54).

60.2% of respondents indicated that they had difficulty accessing research and information online.

2.3.11 Hard copy information: papers, magazine, leaflets (83/129)

The next section on resources asked participants whether and how often they used hard copy resources.

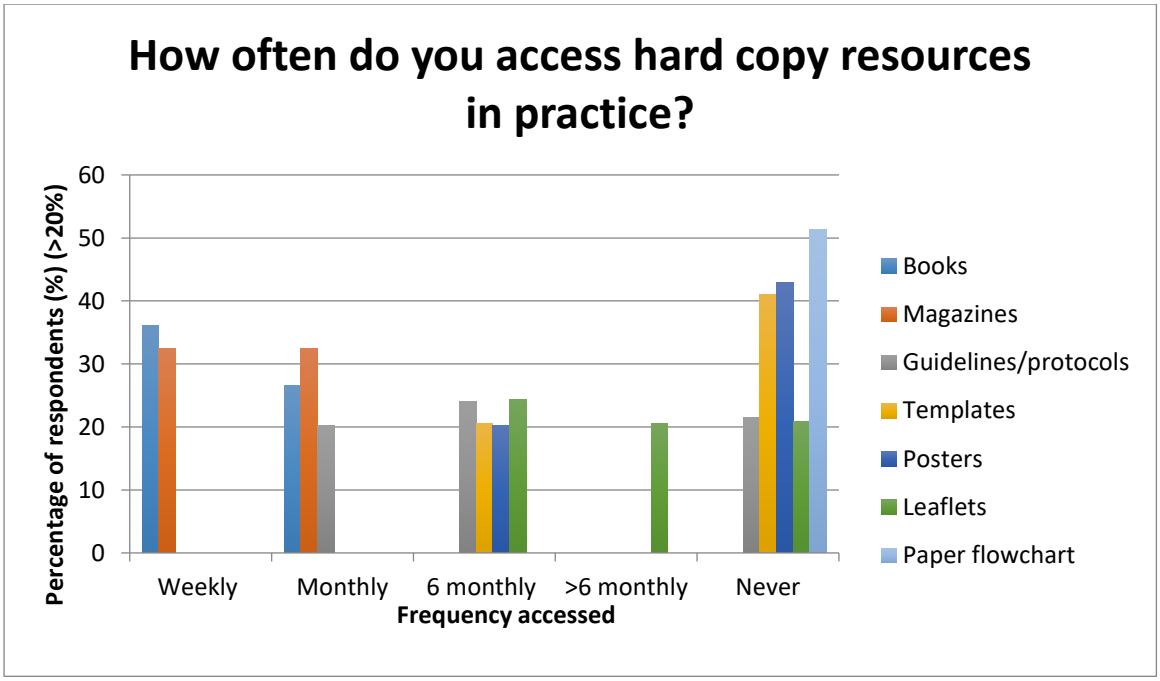


Figure 6. Bar chart showing how often each hard-copy resource is accessed by the respondents (%). Only responses with >20% of respondents are shown, in order to highlight the key responses.

The majority of participants subscribed to magazines as part of a membership package e.g. BEVA including EVE (81.8%), EVJ (66.7%), Veterinary Record (49.3%), In Practice (44.1%) and JAVMA (33.8%). The only magazine which was predominantly subscribed to directly through the publisher was Veterinary Times (30.00%).

2.3.12 Mobile phone/tablet apps (82/129)

Participants were asked how frequently they used mobile phone and table apps, and which apps they used. Apps were used by veterinary practitioners on a frequent basis. The top three apps which were accessed on a weekly or more frequent basis were: BEVA Drug (28.0%), a drug dosage calculator (17.4%) and BEVA Lab (7.4%). The ranking of most accessed apps overall, across any frequency were: BEVA Drugs (55.9%), FEI Clean Sport (48.6%), BEVA Joints (40.3%), drug dosage calculator (36.2%), BEVA How To (35.3%), BEVA Lab (33.8%), BEVA Podcasts (EVJ and EVE) (27.94%), HBLB EquiBioSafe (16.4%) and AliveCor ECG (16.4%).The top three most important (rated as either 'very

important' and 'important' out of a total of 5 options) were: BEVA Drugs (numbers and 66.0%), BEVA Joints (40.0%) and BEVA How To (38.6%).

The participants were asked to feedback how useful certain features would be for an app on colic (please tick all that apply), those that were identified by more than 50% of participants were:

- Education demonstrations to show owners (e.g. animation showing anatomy or pathology) (78.5%)
- Clinical signs and prognosis/likelihood of critical cases linked to peer reviewed papers (72.2%)

2.3.13 Veterinary education (73/129)

Participants were asked their opinion on how well prepared new graduates were for different diagnostic tests by selecting from categories of physical examination, rectal examination, abdominocentesis, abdominal ultrasound and nasogastric intubation (very well prepared, adequately prepared or poorly prepared). It was thought that new graduates are best prepared for physical examination (29.5% very well prepared, 62.8% adequately prepared) followed by nasogastric intubation (10.3% very well prepared, 51.3% adequately prepared). Participant opinion was split for abdominocentesis approximately by 50-50 (6.4% very well prepared, 47.4% adequately prepared, 46.2% poorly prepared). Participants thought that new graduates were poorly prepared for rectal examination (76.9%) and abdominal ultrasound (74.4%).

Areas for further education were suggested by 54 participants in a free text section. The most frequent areas were: rectal examination and interpretation and abdominal ultrasound.

Thirty two participants thought there was not enough practical education and training for graduated vets on colic, with the main areas being rectal examination, FLASH scan/ultrasound practical, and new graduate education.

2.3.14 Owner education (73/129)

Veterinary practitioners were questioned on the owner education used within their practice. Resources used on a daily basis were posters and leaflets, distributed by approximately (11% of practitioners. The most common form of client education was six monthly client evenings (43.5%), followed by six monthly practice newsletters (35.7%), >6monthly client evenings (31.9%), monthly practice newsletters (25.7%) and publishing new information on their website on a monthly basis (24.3%). Fifty five participants (90.2%) said they never use practice magazines, 45.3% said they would never publish case studies on their website, and 41.3% said they would never distribute posters. When asked how important they considered these different approaches to owner education were, participants considered that client evenings were most important (77.6%, sum of very important and important), followed by publishing new website information (64.4%) and practice newsletters (41.8%). Three participants out of the 73 who answered this section commented they don't use any of the client education types specified above.

2.4 Discussion

This is the first study to assess how veterinary practitioners access evidence, information and resources in equine practice. Previous studies have been conducted looking at the veterinary profession across different areas and species (Nielsen et al., 2015) but these did not investigate barriers or ask participants' their own ideas for knowledge transfer. The key findings were that there were three main barriers to accessing information in equine practice: experience of veterinary practitioner, lack of time and access to resources. There are a number of challenges to providing resources in equine practice - across the different questions in the interviews there was significant variation in practitioner opinion, with no consensus on one 'go-to' method of accessing evidence in practice, and this was reflected in the online survey. Research into dissemination of evidence is essential to develop resources which will have a significant impact on clinical practice.

2.4.1 Methodology

This phase employed the use of qualitative research in partnership with a quantitative survey to explore the same research question. Qualitative research is defined in its most simplistic form as using words as data (Braun and Clarke, 2013). As a broad comparison, qualitative research forms a more subjective approach in comparison to quantitative techniques (Westmarland, 2001). The value of this subjectivity in addition to personal involvement and partiality plays a positive an important role in this research paradigm (Braun and Clarke, 2013). Quantitative research allow hypothesises to be tested and is deductive. It looks for consensus and broad patterns in a larger group, reducing diversity.

Six face-to-face and one telephone interview were conducted in this study. The telephone interview was conducted due to the geographical location of the participant, who was keen to participate and contribute their thoughts on the topic. Care was taken to reduce bias in the interview process, using open, standardised questions for each participant. However, a degree of interview bias will be introduced.

The data from the interviews was subject to thematic analysis. Thematic analysis is described as 'A method for identifying, analysing and reporting patterns within data' (Braun and Clarke, 2006). The choice of subthemes was not necessarily related to quantification of topic occurrence, although this did play some part, value was also placed on the importance of the topic. For example, the subtheme of safety wasn't frequently occurring, but one participant articulated at length the importance of this, and it was seen to be linked with some of the subthemes in the group. The advantages of thematic analysis include: it is a flexible technique, requires minimal qualitative research experience, summarises fundamental features of a large dataset, used to highlight relationships and disparities within the dataset and the generation of unexpected insights. However there are also limitations to this technique. The flexibility also is a disadvantage in that it may be difficult for the researcher to decide the focus, with broad options. It may also be hard to interpret the results beyond description. The interpretation of the findings may further be confounded by bias. The researcher is young and inexperienced with a strong interest in EBVM, which will affect the outcomes and analysis.

A limitation of thematic analysis conducted in this study was saturation. It was decided that enough data was achieved from the seven interviews to observe substantial saturation. No new themes were emerging when the interviews were concluded; the subtheme 'safety' however was only mentioned by one candidate, so this may indicate more interviews may have been required to validate this and to see if any more new themes may be found. As such, true saturation may not have been reached. However, given the time frame of this aspect of the project, it was deemed that the same core themes were appearing repeatedly across the interviews, and decided saturation was largely achieved and the study was closed to focus on the other areas.

The online questionnaire was developed based on the interview questionnaire structure, and findings from the interviews. Both interviews and questionnaires have their merits and limitations which complement each other. The use of mixed-methods in this study is a form of triangulation and was used to validate the results from each sections. Given the limitations of each study, this should ensure a robust set of final results. The thematic analysis of the interviews was used to identify key themes, and insights into a 'practice culture' were found. The online questionnaire was a quantitative measure on similar questions, it was presented to a larger cohort of veterinary practitioners including those based internationally.

Triangulation of results was undertaken using a multiple method approach. The process of triangulation involves reviewing a research question or finding from two or more points; the method used to reduce bias, validate studies and improve study rigour (Flick, 2004). Firstly the results in this study have undergone 'triangulation of data'. This included comparing responses between different interview participants, both in the same practice and also between different practices. 'Investigator triangulation' was undertaken by comparing outcomes with research supervisors. 'Within-method triangulation' was used by asking similar questions in different ways throughout the interview schedule and online survey, to ensure maximum information was gathered from each area of interest. Furthermore, 'between-method triangulation' was also undertaken as discussed previously, using a mixed-method approach; this used both interviews

and online survey to ask similar questions and overcome each method's shortcomings.

One limitation of both study designs is that it is a survey of opinions, and response bias may be present. To determine what the participants actually do, they would need to be observed and interviewed on their decision-making for example. The participant may be choosing the options that they think they should be doing, but may not actually be doing in real life. This should be taken into consideration when interpreting the results.

2.4.2 Demographics

A small number of veterinary practitioners were interviewed, however interviewing members from four different practices aimed to give an insight into how different practices might operate. It was useful to have two veterinary practitioners from three of the practices for comparison of results, and this provided some interesting findings. The practitioners interviewed covered a range of ages and experience, and so it was useful to see the effect this had on the resources accessed. For example, the older generations were more inclined to use hard-copy resources, and the younger generations more interested in app development. A potential bias in this study is that veterinary practitioners who agreed to participate in this study may be more interested in/ involved in evidence-based practice. However, there still was significant variation in their understanding and use of evidence-based practice. The interviews did not involve any 'one-man-band' practitioners, despite efforts to contact practitioners working in this type of practice. The practices were all fairly similar in size with varying hospital facilities, although all vets interviewed worked in ambulatory, first opinion aspects of their practices.

The online survey was used to widen the demographics of participants and triangulate the effects of small study population. The response rate to this survey was low (129) despite efforts to prompt and remind veterinary practitioners to participate. The actual response rate cannot be calculated since it was not possible to identify how many contacts were reached via the social media and 'contacts of contacts' distribution options. This low response rate was

also seen in the consensus process survey, which is discussed in detail in Chapter 3 and has been noted in other studies (Nielsen et al., 2006). Low response rate for surveys of veterinary practitioners may be attributed to some of the barriers expressed in the above results including time pressures. There was one negative comment about the length of the survey out of the 129 responses, despite multiple pilots to optimise the ease of use, but this may be a reason participants were deterred.

2.4.3 Barriers to knowledge transfer

There are a number of different barriers to change described in the human literature (Cabana et al., 1999), and applicability within clinical situations is often cited. In the interview study, one participant voiced: 'I suppose having been in practice ten years, I've looked at quite a lot of colics and kind of have my own guidelines and templates.' This may reflect the individual's general manner of working, or the education they received. Additionally, with regards to the first opinion colic case, this may also be attributed to the paucity of evidence currently available, which prevents clinicians applying EBVM in this area, as they either can't access evidence they want or consider the evidence available not to be relevant to their scenario. Overall, a statement like this is likely to be linked to a complex web of barriers, which need to be overcome to implement change in this type of practice. In human healthcare, this paper describes some methods for overcoming barriers and implementing change (Grol and Grimshaw, 2003) and methodology that may help with material generation and dissemination.

It was apparent that the veterinary practitioners interviewed did not describe a strategic approach to accessing evidence, with resources such as google and textbooks being used. There was also no mention from any of the participants of basing their filtering of resources on the quality or level of evidence. This shows that veterinary practitioners might not be aware of the best, most reliable places to access evidence to be able to practice EBVM successfully.

The outcomes of the questionnaire also found that practitioners used evidence in practice in a variety of manners. 83.9% considered evidence as either very

important or important in their clinical approach, this indicates that the majority of equine practitioners are keen to use an evidence-based approach. It should be noted that survey participants may be biased towards using evidence in practice, since this was the title of the survey and a cohort willing to complete a survey may be considered to be more open to accessing resources in practice. The top ten ways in which participants used evidence were: for new or up-to-date treatments, new or up-to-date techniques, for optimising and improving efficacy of treatments, to inform the client including prognosis, for new or up-to date management of cases, for more unusual cases or those unresponsive to treatment, keeping up to date with resources and evidence available, to review and optimise clinical practices, to create protocols/guidelines, using colleagues/referral colleagues. These all illustrate how evidence has an influence on the current thinking of equine veterinary practitioners.

The largest barrier to finding information was deemed to be 'lack of time' (76.4% of questionnaire participants), this was also the most frequent response in the interview questionnaire with 75% reporting this answer to the same question. This may also be related to a resistance to change, since it is hard to interpret whether this statement means the participant would like to have the time to carry out the methods or just cannot or would not make time in their schedule. Time was raised throughout the interviews in participants responses to other questions, which demonstrates how this impacts on knowledge transfer through a variety of different aspects, for example how frequently practitioners were able to access resources and also the requirement for easily accessible and concise resources, which also was indicated by a number of comments in the interviews. These time pressures are particularly seen in ambulatory first opinion equine work, where the practitioner will spend a proportion of their day driving to clients. This indicates a lack of time to spend on accessing EBVM and also searches and reading being time consuming. This was also raised in the free text comment section of the questionnaire regarding how veterinary practitioners access resources. It is difficult to directly address and change the time pressures of the profession, instead it is important that full consideration of this barrier should be factored. When developing materials, it will be important that they are developed to meet the time demands of a

veterinary practitioner, so that they are not deterred from accessing the evidence.

'Access' is linked to 'time' as aforementioned, since if information is more easily accessible it is more likely to fit into schedule with time pressures. The mention of access issues recurred across the interview study, and was mentioned in all eight of the interviews. Access covers a range of aspects relating to issues accessing resources, including the 'on the road' nature of practice, and the expense and reliability of resources, which were sub-themes that frequently appeared in responses (flowchart). In the questionnaire, the two main barriers after 'time' were 'difficulty accessing articles' (65.2%) and 'expense of subscriptions' (59.6%). Expense was a subtheme of 'access' in the interviews, and was mentioned both in terms of accessing journals and articles and the use of smartphone Apps in practice. These repeated findings around accessibility issues highlight the need for need for easily accessible resources, with clinically relevant evidence.

One subtheme that was mentioned in the interviews was 'safety of practice'. Whilst this wasn't a theme regarding the barriers of knowledge transfer as such, it is an important and topical consideration when developing resources, guidelines for safety in equine practice are available (BEVA, 2014). This subtheme didn't occur frequently but rather deemed important and noteworthy as a barrier to implementing recommendations. Some procedures in veterinary practice such as rectal examination have important safety considerations, and one of the participants stressed the importance of making sure resources were developed with safety in mind. There are other studies that have reported concerns around safety with regard to rectal examination. Curtis et al. (2015) reported that veterinary practitioners stated that 'risk to personal safety' was the most common reason for not undertaking rectal palpation in the colic case at primary assessment level. This is particularly applicable in ambulatory practice, where horses may be examined in a field situation, and facilities such as stocks are unlikely to be available. Changes in the consensus recommendations on diagnostic tests in Chapter 3, to take account of situations where there are limited facilities and safety concerns resulted in higher degree of consensus and acceptance of some statements which had been previously rejected. This

highlights the importance of safety considerations in decision-making in equine practice.

2.4.4 Practice culture

Throughout the interviews, it was found there were common beliefs or 'cultures' within each practice. This was found just with interviewing two veterinary practitioners from each practice, as vets from the same practices gave similar responses to the interview questions. Despite all three practices being involved in equine ambulatory work, there were key differences in attitude and approach to cases and research.

The interviews illustrated a wide variation in the veterinary practitioner's understanding of EBVM, and again this was similar between practices. Responses were also linked in terms of how the individual understood and applied evidence within practice. Those who articulated in more detail an understanding of EBVM, also accessed papers and articles more frequently. For example 2A) 'EBVM is a medicine that is conducted based on various degrees of evidence and there's various criteria for that level of evidence and ideally you should be basing your decision-making on that evidence from research' and 'Every day', in comparison to 1B) 'Not very good to be honest' and 'Not that frequently'. In summary, within this study, the vets that accessed original research more frequently also showed a clearer understanding of EBVM and its application. From the group of vets who were interviewed, those from the same practice often had similar understanding and use of EBVM within practice. This is an example of the 'practice culture' as discussed above, a recurring aspect of the interviews. The views of the senior partners appears to funnel down to the more junior members of the team and also how the practice approaches cases and applied EBVM as a whole. This 'practice culture' effect is interesting, as it might be anticipated that other factors, such as time since graduation, or undergraduate education, might be more important. However Vet 2A (graduated 27 years) and 4A (graduated 8 years) gave some of the best descriptions of EBVM, whereas a relatively recent graduate (1B,. graduated 3 years), described their understanding of EBVM as 'Not very good to be honest'.

2.4.5 Current approaches to accessing resources

The requirement for a visual easy to read resource was frequently mentioned in the interviews. It was interesting to note the range of interviewee responses from each of these questions:

- 'What do you think are the best ways of disseminating evidence to veterinary practitioners?'
- 'What are the main ways you access information for assessing and managing cases in practice?'
- 'What format do you think would be the most useful and accessible presentation of this research to vets?'

These three interview questions were deliberately similar but with different wording to try and gauge different opinions. There was seen to be incongruence between their current methods of accessing information, versus what they would like to see. The first question generated a wide range of responses with a host of different resources described from journals, to CPD, clinical clubs, certificates and BEVA resources. The second had a narrower response including: journals, expert opinion, websites and apps. The final question had the most popular answer of an app, which was only touched upon slightly in the previous two questions but also emphasised the importance of concise, visual information. The answers to each question also demonstrated variation in individual preference between practitioners.

This online survey indicated that veterinary practitioners used a variety of different resources, with the 'frequency of access' not necessarily reflecting 'importance'. Apps were the most frequently accessed on a daily basis, but were ranked sixth in terms of importance out of the listed resources. On a weekly basis, hard copy resources were most commonly accessed (research journal articles and textbooks), these were also ranked third and first in terms of importance. The highest percentage of access was seen in the monthly basis, where online peer reviewed review articles, printed peer reviewed review articles and clinical textbooks were most popular. Both the interviews and questionnaire highlighted the range of resources accessed, and shows there is not just one 'go-to' resource.

The two previous studies looking at sources of information used nationally (Nielsen et al., 2015) and internationally (Huntley et al., 2016) obtained an array of results too, with both hard copy and electronic resources being accessed. In the UK, the most read journal was the Veterinary Times (79%), with In Practice (82%) and Veterinary Record (34%) deemed the most valuable by practitioners and non-practitioners, respectively (Nielson). Electronic resources were also analysed, with Google used most frequently (71%) and also the most useful for use by practitioners and Pub-Med non practitioners (17%). Internationally, the most common resource used was reported to be journals (65.8%) over electronic resources (58.7%)(Huntley). Both these previously published studies had a larger cohort of participants with veterinary practitioners of varied background. In the current online survey, out of the journals listed for 'information on equine conditions', most were equine specific journals: Equine Veterinary Education (EVE) and Equine Veterinary Journal (EVJ). EVE was also reported to be the second most useful and EVJ 5th most useful journal accessed by equine practitioners in the study by Nielson. Both the current and previously published surveys illustrate the wide array of resources utilised across the veterinary profession. This highlights the importance of developing a range of resources, which will enable wider accessibility.

Interview participants were questioned on the British Equine Veterinary Association (BEVA) Protect ME template, as this is a flexible template that has been reported to improve the practice of antimicrobials. It is an antimicrobial stewardship toolkit which has influenced and reduced the use of third and further generation cephalosporins by 30% since 2012 and by 90-95% in one clinical practice that has audited the use of such medicines (Bowen, 2016). This has been a key development in equine practice, and reflects the impact that a large scale campaign may have on both veterinary surgeon and client demands, which could be applied to the Colic Project Research.

There was a variety of feedback in the interviews on the BEVA Protect ME resources. A large proportion of the survey respondents, who were aware of BEVA Protect ME, found the template helpful (93.6% out of the 52.9% that were aware of its existence). Comments were either positive or constructive, indicating areas in which the template could be improved: such as improving

user friendliness and making it easier for all equine veterinary practitioners to access. These are factors that should be considered in the development of the colic resources, given that 61.9% thought that an adjustable template similar to the one described would be useful for colic.

2.4.6 Recommendations for dissemination of information

When survey participants were asked about their preferences for methods of disseminating research from the colic project, the most popular hard copy resource was publication in a magazine (75.0%) and other types of hard-copy information, such as poster, flowchart (57.2%) were the third and seventh most useful out of the resources listed (Figure 5). When questioned on a list of resources that might be developed from the research, the most popular resources were information sheets on when and how to use diagnostic tests from both the participant's perspective and for junior assistants; client resources: consent form templates were considered to be most useful for senior practitioners. The second most useful resource across all brackets was client resources: owner fact sheets. Generally it was shown that participants considered hard copy resources to be useful for junior assistants. The comments indicated that many practices have their own protocols in place already, or that they would rather make their own resources. This indicates the requirement for something that can be adjustable for the user, and shows this type of resource will not suit some practitioners. Many of the currently available information resources such as on Atypical Myopathy, or the Liverpool colic website, are structured and cannot be changed, which may reduce uptake. In human medicine, although limitations have been described, guidelines or protocols are widely used (Grol and Wensing, 2004) but the key differences between the professions must be noted before developing such resources, to improve the accessibility and practicality.

2.4.6.1 Web-based information

Web-based resources were some of the top ranked for the question on what would be the most useful and accessible presentation of colic research for vets. The top ranked was website (89.2%), followed by published online (84.3%),

webinars (59.5%) ranked fifth, out of a mix of hard-copy and web-based resources. These could be expected since a website should be able to publish information in a more accessible format rather than a paper online which may be more clinically useful. YouTube videos, although used frequently in the wider population were not favoured as a resource. The most visited websites on a >6 monthly basis were: BEVA (63.3%), AAEP (51.9%) and RCVS (48.1%). There was range of different websites, including extra websites listed in comments which were visited in varying frequency. Websites created specifically to be disease or research specific were accessed by 42.6% of participants, with the website most commonly used being Talk About Laminitis (41.0%). It should be noted that even the highest ranked websites were not accessed that frequently. One participant proposed a solution for this: 'I would use websites more often if I could receive an email that was new information available. I don't have time to visit websites just to find out if anything new has been added.' Email updates or alerts are used by a by number of organisations including BEVA and BHS.

2.4.6.2 Mobile phone/tablet apps

Apps were considered to be the fourth most useful and accessible presentation of colic research for vets (70.2%). This is likely due to the ambulatory nature of practice, widespread use of smartphones and new development of apps for veterinary practitioners. It is likely to be an area of growth and has a good potential for providing a quick and accessible resource. Three participants additionally mentioned apps in the 'further comments' at the end of the survey. This popularity was also seen in some of the interviews with veterinary practitioners. The four most accessed apps used in practice were: BEVA Drugs, FEI Clean Sport, BEVA Joints and drug dosage calculator, and the apps considered most important were: BEVA Drugs, BEVA Joints and BEVA How To. It is clear from this research that BEVA has developed some of the most useful apps available for equine practitioners. More research is required to find out which apps are most useful and how they can be improved. There is currently no available literature on veterinary apps, but healthcare apps have been discussed as having many benefits to healthcare professionals especially at point-of-care applications to assist with clinical decision making (Ventola, 2014).

2.4.6.3 Education

The key area in which veterinary education was to be lacking by survey participants was practical skill development. Key findings were that there should be more practical based courses including rectal examination and ultrasound, particularly for new graduates, also for some of the older practitioners. Participants noted that it is difficult to replicate practical situations, especially rectal examination taking into account the welfare and ethics surrounding this.

There were quite a few negative comments and resistance to change in both the interviews and questionnaire, which is a vital consideration; an example is the more experienced veterinary practitioners not wanting to use forms, flow charts or guidance, and the differences described between newer graduates and more senior practitioners.

Owner education was an aspect that proved popular. Client education evenings were the most common form of owner education used on a six monthly basis, and were also rated the most important. Publishing new information on their practice website and practice newsletters were also considered important for client education. A number of participants also commented about the importance of social media, in particular Facebook to assist with client education.

2.5 Overall outcomes

This is the first study on the use of evidence in equine practice, and has given a unique perspective into the different methods used and barriers faced. This study has highlighted the significant challenges faced in equine practice, with three main areas identified: lack of time, experience of practitioner and access to resources. Another notable feature was the 'practice culture' observed in the interview phase.

Moving forward, trialling a range of resources will be key to understanding what is most clinically useful in practice; this will be the next stage of the project. The five main recommendations from this phase are:

1. The largest barrier against EBVM in both this study and the interview section was lack of time. Access and variability in experience are also important to consider
2. A range of resources needs to be developed to benefit the range of experiences, ages and preferences for the range of veterinary practitioners. This will include web-based, hard-copy and app resources.
3. Recommendations, not 'rules' should be developed to increase compliance
4. Information and evidence must be clinically useful, applicable to primary practice, concise and visual
5. There is a requirement for better education on safety and practical techniques.

Chapter 3. Development of consensus statements on the primary evaluation of colic by veterinary practitioners

3.1 Introduction

There is currently limited evidence on the primary approach used by veterinary practitioners in the assessment of horses displaying clinical signs of colic. An evidence-based approach can assist in the decision making process. This can optimise outcomes of cases and reduce possible detrimental variation in the primary assessment.

Guidelines such as 'Best Practice Guidelines' are widely used in human medicine; a list of two hundred and seventy guidelines is currently available on the National Institute for Health and Care Excellence (NICE) website (NICE, 2017). Such resources are less common in veterinary practice, which is limited by a few factors. One of the largest confounding factors, is the lack of available evidence applicable to primary veterinary practice, critical for guideline development.

A framework, AGREE II (Appraisal of Guidelines for Research and Evaluation) (agreetrust.org), is an internationally used tool in the development of practice guidance. This is divided into the following sections:

Domain 1: Scope and Purpose: what the guideline aims to address, the clinical questions required and the determining the target population.

Domain 2: Stakeholder Involvement: To ensure the guideline embodies the views of the users of the guideline.

Domain 3: Rigour of Development: optimising the process used to generate evidence.

Domain 4: Clarity of Presentation: guidance language, structure and format.

Domain 5: Applicability: addresses the barriers to utilisation of the guideline, maximising uptake.

Domain 6: Editorial Independence: minimising bias and competing interests.

This framework has been the basis for the first few stages in developing guidelines on equine colic.

3.1.1 Work leading up to this study

The first two stages of developing evidence-based statements were undertaken previously. Current evidence on risk factors and diagnostic techniques was reviewed and critically appraised. Recent research on primary assessment of horses with colic from the University of Liverpool and University of Nottingham (Scantlebury et al., 2014, Curtis, 2016) was summarised for distribution to participants in the following workshop stage. Two workshops were held in November 2014 and February 2015, involving primary stakeholders. Equine colic has a number of stakeholders including the owner, veterinary practitioner involved in the primary assessments, referral veterinary practitioner dependent on case progression, and organisations involved in equine health and welfare.

The workshop involved forty-seven participants including horse owners/carers, veterinary practitioners and representatives from equine charities (Freeman and Curtis, 2015). Facilitated discussion in small groups were undertaken to generate statements on clinical signs, signs of critical cases, history and signalment. These statements were based on evidence source, and stakeholders experience and opinion; the degree of consensus and source of statement (e.g. evidence, experience, opinion) noted for each statement.

Two online surveys were developed for each horse owners/carers and veterinary practitioners separately based on the outcomes from the workshop by researcher S. Yeoman. The survey for owners was completed and outcomes generated by a separate researcher A. Bowden. This first survey round was undertaken by veterinary practitioners, however, the results were yet to be analysed and the full consensus process not completed.

3.1.2 Aims and objectives of this study

The impetus of this study was to develop evidence-based resources to help inform decision-making for veterinary practitioners.

The aim of this study was to carry out a survey process for veterinary practitioners on the primary assessment of colic cases, based on the results of

the multi-disciplinary workshop. These surveys would determine frequency rating on the common signs and develop consensus statements on aspects of history taking, physical examination, diagnostic tests, further education (research, veterinary training, owner training) and information dissemination.

The objectives of the study were:

- To identify common and critical signs of colic through veterinary practitioners' opinions on how often they occur in colic
- To identify consensus statements on history taking, physical examination, diagnostic tests and further education by determining which statements are agreed (>75%), rejected (<25%) or did not reach consensus (25-75%)

3.2 Materials and methods

Based on the aims and objectives, a number of steps were carried out:

1. Analysis of results from the first round of consensus survey on the primary assessment of colic cases (S. Yeoman, 2015).
2. Compiled a list of accepted and rejected statements and those that did not reach consensus.
3. Adapted the statements that did not reach consensus, including rewording or adding input from the feedback in the comments box of each section.
4. Rerun these statements in a second consensus round.
5. Repeat steps 1 to 4 for the second round to develop statements for a third consensus round.
6. Repeated steps 1 and 2 for the third round and assimilate a list of all the accepted statements, rejected statements and those that did not reach consensus.
7. Generated recommendations based on the accepted statements

As mentioned above, the author's involvement started following the development and completion of one round of the survey. The survey was divided into sections based on the outcomes of the workshop. These were: common signs of colic, critical signs of colic, history taking, physical examination, diagnostic tests, further education (research, veterinary training, owner training)

and suggestions for distribution of information. Three rounds of the survey were undertaken in a method using aspects of Delphi process to develop consensus statements.

3.2.1 Development of surveys

The three rounds of surveys were piloted within the colic research group and Centre of Evidence-based Veterinary Medicine, and minor amendments made before generating the final draft. The surveys were published on SurveyMonkey (SurveyMonkey, 2017). The introductory section included consent, gathered information on demographics, email address if they wanted to be involved in further rounds and an compulsory question: 'Are you a vet or an owner?', since only veterinary practitioners were required to complete this survey, owners were redirected to the owner survey. The consequent questions were divided into sections as detailed above.

3.2.2 Question type

Three different types of question were used in the survey.

3.2.2.1 Frequency rating

For example, how frequent a particular sign is seen in a horse with colic: >75%, 50-75%, 25-50%, 1-25%, 0%, which was used for ranking common and critical signs of colic.

3.2.2.2 5-point Likert scale

This was used to determine the extent of agreement of the statements by the participants: 1. Strongly agree, 2. Agree, 3. Neither agree nor disagree, 4. Disagree, 5. Strongly disagree. A 9-point Likert scale was used for the Headsmart Campaign (Wilne et al., 2007) and was adapted to a 5-point scale for this study. This was used to generate consensus on statements on the assessment and diagnosis of horses with colic, and on further education / training

3.2.2.3 Comment box

An open text box for suggestions and opinions to be written, following the end of each section. There were fifteen comment boxes used in the first round for veterinary practitioners to leave their opinion across all sections.

3.2.3 Survey distribution

The survey link was disseminated electronically. An email containing the survey link was sent to all previous participants in a previous survey of colic cases (L. Curtis, S. Yeoman), practices which had been closely involved in the research previously (Oakham Veterinary Hospital, Chine House Veterinary Hospital, Scarsdale Veterinary Group, Rase Veterinary Centre), and Alumni of the School of Veterinary Medicine and Science at the University of Nottingham. It was also distributed through the colic research group's social media (Nottingham Colic Project Twitter and Facebook). Specific organisations were contacted directly with requests to share the information through their news information, websites or social media links. These included: BEVA, European College of Veterinary Surgeons (ECVS), European College of Equine Internal Medicine (ECEIM), RCVS, RCVS Knowledge, The British Horse Society (BHS), Specialist Equine Insurance Brokers (SEIB), National Farmers Union (NFU), World Horse Welfare, Bransby Horses, Redwings, Vet Record, Vet Times, Equus Magazine, The Horse, Horse & Hound, Horsetalk NZ, Horse Collaborative, Horse and Rider, CABI, University of Guelph Equine Studies Online, and My Science.

3.2.4 Survey rounds

There were three survey rounds used in the development of consensus statements (Figure 7). Statements which were accepted were those which had greater than 75% of participants either selecting 'Agree' or 'Strongly agree'. Statements with less than 25% 'Agree' or 'Strongly agree' were rejected. Statements which didn't meet consensus fell into the 25-75% bracket.
These were modified using the suggestions made from the free-comment box, if applicable. Alternatively if there were no specific comments, they were reviewed and some rephrased by the research group. Furthermore, new statements for inclusion in the subsequent rounds were generated based on the free text comments and feedback assimilated throughout the survey.

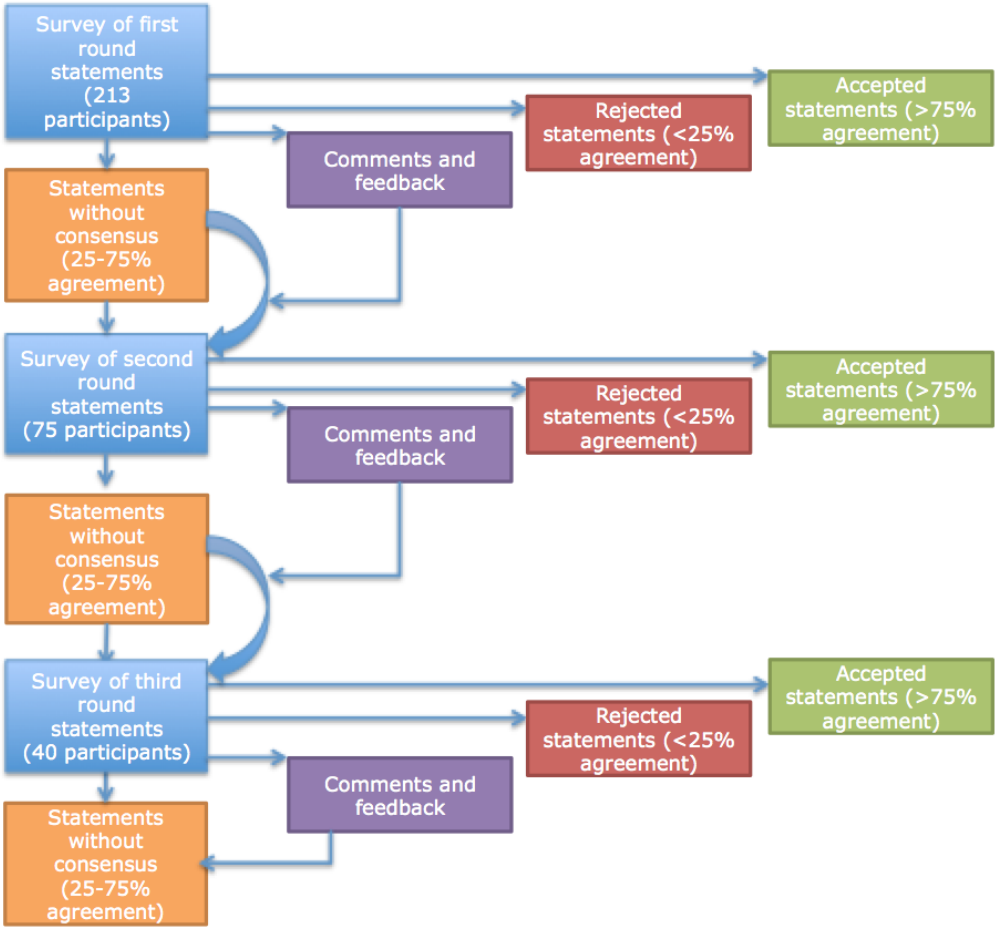


Figure 7. The iterative consensus process. Recommendations were developed through three rounds of surveys. The same cohort of participants were invited back each time to participate (with drop off in participation). Statements were accepted (>75%), rejected (<25%) and those that did not reach consensus (25-75%) were modified using the comments from the survey and redistributed.

The comments were systematically analysed, with responses grouped to identify the frequency and/or importance of the comments.

Participants were asked to provide a contact email address if they consented to participating in the second and third rounds. The second and third round surveys were sent out to these participants, with a reminder sent within two weeks of the initial emails.

3.3 Results

3.3.1 Participation and demographics

The first round of the consensus survey was completed by 213 veterinary practitioners and second and third round 75 and 40 respectively. The first round of the survey consisted of 67.26% female participants; Participants ranged in age from 20-51+years, the modal age category was 31-40 years, accounting for 38.46% of responses. The majority of participants worked in equine first opinion practice (41.05%), the next most common was equine referral hospital (39.29%), and mixed practice (equine AND farm/small) (19.64%). There was international participation in the survey with 33.14% of responses from the USA, 31.6% UK, 21.89% Europe, 10.65% other and 2.96% Ireland.

In the following rounds, the cohort were derived from the participants in the initial round. As such, there was not much variation in demographics. In the second and third rounds, there was a higher proportion of equine referral hospital vet participation (53.52% in the second round and 41.03% in the third round). In the third round, there were a greater proportion of veterinary practitioners in the older age brackets.

3.3.2 Frequency rating of signs of colic

A 'Frequency rating' style question was used for the 'Common Signs' section. Participants were asked 'Approximately how many horses with colic do you think show this clinical sign', the options were: >75%, 50-75%, 25-50%, 1-25%, 0%. This was used for changes in behaviour (e.g. pawing at the ground), changes in demeanour (e.g. changes in activity levels), and other signs of colic (e.g. wide base stance).

3.3.2.1 First round

Practitioner's opinions of how frequently different changes in behaviour occurred are described in (Figure 8). More than 50% of participants thought that inappetence (83.89%), pawing the ground (75.84), attempts to lie down (68.45%) and flank watching (59.06%) were behavioural signs shown in more than 50% of horses with colic. Inappetence was identified as the most common

sign, with 59.73% or participants agreeing that this was seen in more than 75% of horses with colic. Ear twitching was considered to occur less frequently with 26 participants considering that this occurred in 0% of cases, and 44 participants 'Unsure' whether this was a sign of colic.

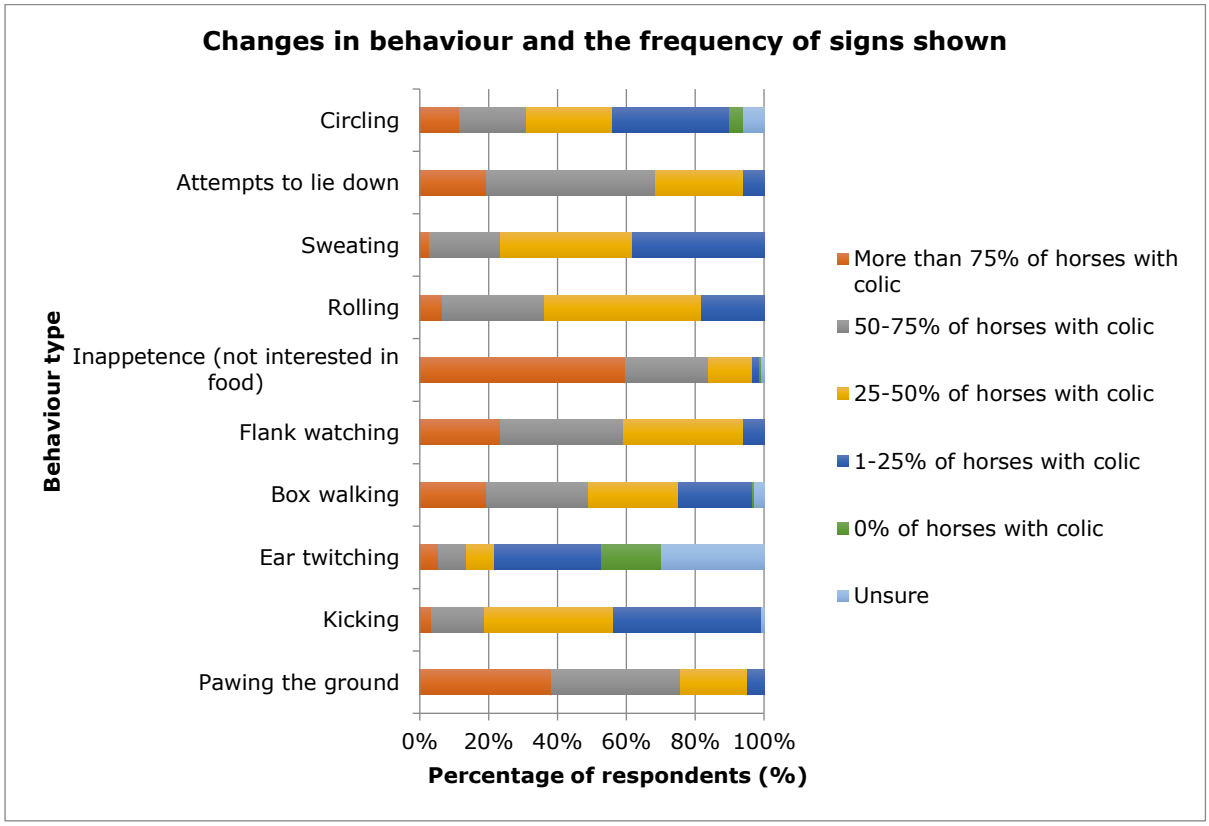


Figure 8. Changes in behaviour – opinions of veterinary practitioners on how frequently signs are shown, from an online survey.

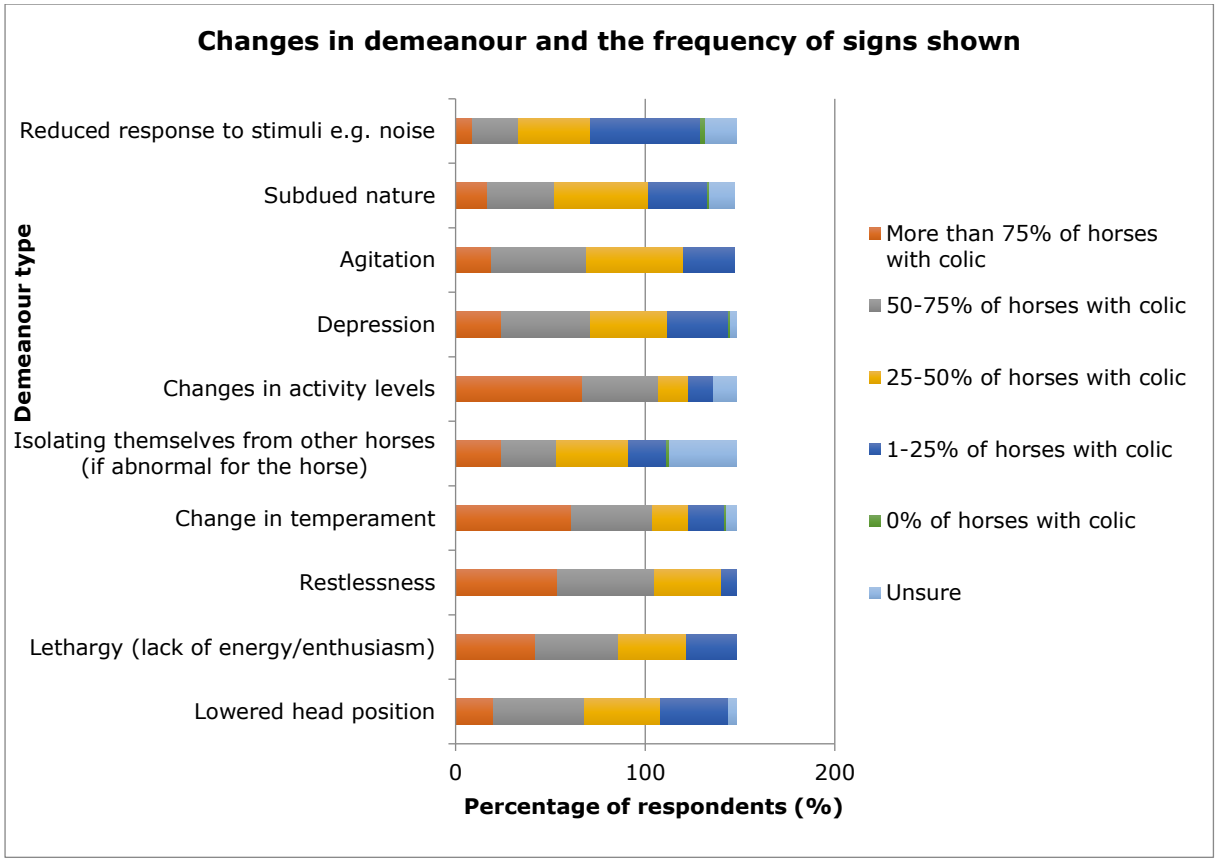


Figure 9. Changes in demeanour - opinions of veterinary practitioners on how frequently signs are shown, from an online survey.

The next section asked practitioners their opinion of how frequently changes in demeanour occurred (Figure 9). More than 50% of participants thought that changes in activity levels (identified by 72.3% of participants), restlessness (70.95% of participants), change in temperament (70.27% of participants), and lethargy (lack of energy/enthusiasm) (58.11% of participants) are shown in more than 50% of horses with colic. Some practitioners were unsure if specific signs occurred in horses with colic, including isolating themselves from other horses (35 practitioners), reduced response to stimuli (16), subdued nature (13) and changes in activity levels (12.

When asked about 'other signs of pain', there was less agreement. The mode response was that these occurred in 1-25% of colic cases, for the following signs: wide base stance (65.3% of participants), lip curling (49.3% of participants), yawning (53.4% of participants), bruxism (teeth grinding) (70.3% of participants) and straining to urinate (44.6% of participants).

3.3.2.2 Second round

Based on feedback from the first round, some statements were adjusted, added or re-submitted from the first round. For changes in behaviour, 'trembling/shivering' was added however, only the mode response was that this was shown in 1-25% of horses with colic (51.47% of participants).

For changes in demeanour, four of the signs were adjusted in the second round to add further details or descriptions as suggested by participants, for restlessness, change in demeanour/behaviour, abnormal posture, depression, subdued nature and/or reduced response to stimuli. These amendments only changed agreement only for restlessness and change in demeanour, where >50% of veterinary practitioners agreed that these signs were displayed in >50% of colic cases.

For 'other signs of pain', two options were amended in response to feedback (respiratory rate and skin abrasions/lacerations), but the mode responses were that these signs occurred in less than 50% colic cases.

3.3.3 Consensus statements

A five point Likert scale was used to determine the extent of agreement on statements (1. Strongly agree, 2. Agree, 3. Neither agree nor disagree, 4. Disagree, 5. Strongly disagree).

Statements with >75% agreement (percentage of Agree and Strongly Agree added up) were accepted, those with <25% agreement were rejected, and statements with 25-75% agreement 'did not reach consensus' and were adjusted and modified based on feedback from each of the comment boxes and recirculated in subsequent rounds (Appendix II). Any new statements generate in each round from free text comments were circulated in subsequent rounds. A maximum total of three rounds were carried out, each using this iterative approach.

ACCEPTED STATEMENTS		
Statements on other colic signs	***Statements accepted in the first round***	***Percentage of participants that agreed or strongly agreed***
	Changes in appetite can indicate colic (e.g. reduction, inappetence, anorexia, selective appetite, picking at feed, disinterest, reduced drinking, not drinking)	**89.9%**
	Changes in defecation (passing of faeces) can indicate colic (e.g. reduced frequency, altered consistency, volume, colour, odour)	**87.8%**
	Clinical signs of colic may be milder or more subtle in donkeys and ponies that tend to be stoical	**86.9%**
	Second round	
	Changes in appetite can indicate colic (e.g. reduction, inappetence, anorexia, picking at food, selective appetite, disinterest, reduced drinking, not drinking, *playing with water*)	**93.9%**
	Signs of pain and changes in appetite; these equids may show variation and reduced signs of pain: *donkeys*	**82.1%**
	Third round	

	Do you consider that some breeds e.g. Draught breeds and cold bloods (cobs) may show reduced signs of pain, behavioural changes, or changes in appetite compared to other breeds of horses?	**76.5%**
ACCEPTED STATEMENTS		
Statements on signs of critical colic	***Statements accepted in the first round***	
	Pain despite analgesia	**99.3%**
	Significant NG reflux	**97.2%**
	Distended small intestinal loops	**95.1%**
	Tachycardia	**91.6%**
	Abnormal mucus membrane colour	**91.6%**
	Abrasions (skin wounds from rolling/thrashing/being cast)	**86.7%**
	Thrashing	**86.3%**
	Prolonged CRT	**77.6%**
	Unresponsiveness	**75.0%**
	Second round	
	Rapid deterioration of signs	**100%**
	Distended small intestinal loops, *large intestinal distension, large intestinal displacement*	**98.4%**
	Significant reflux (*including spontaneous reflux and/or foul odour from mouth)*	**98.4%**
	Rolling continuously (including and/or throwing themselves on the ground)	**95.2%**

	Mucus membrane changes (*including colour, dry, toxic ring)*	**91.9%**
	Abnormal peritoneal fluid	**91.8%**
	Abnormal peritoneal ultrasound	**88.5%**
	Severe abdominal distension	**82.2%**
	Elevated lactate	**82.0%**
	Thrashing and/*or continuous box walking*	**80.7%**
	Sudden alleviation of signs (rupture)	**80.3%**
	Elevated PCV	**78.7%**
ACCEPTED STATEMENTS		
Essential questions to ask during history taking	***Statements accepted in the first round***	
	When the horse was last seen normal	**99.3%**
	Whether referral/surgical treatment is an option	**99.2%**
	Whether the horse has had previous history of colic	**98.6%**
	If yes, the owner should be asked how frequently and the nature of the episodes	**99.2%**
	Whether the horse has had any previous colic surgery or abdominal surgery	**98.6%**
	Any recent change in stabling/pasture turn-out	**97.9%**
	When the horse last passed faeces and what they looked like	**97.2%**
	Any recent changes in forage feed	**95.7%**
	Whether the horse is on any treatment	**95.7%**

	Any recent change in exercise regime	**95.0%**
	Whether the horse has any other medical issues	**95.0%**
	Any recent changes in hard feed	**94.3%**
	How the horse has been managed since the call-out	**94.3%**
	Any recent change in access to water	**94.2%**
	An exact description of the signs their horse has been exhibiting and if they have changed over time	**93.6%**
	The age of the horse	**88.7%**
	When the horse was last treated with anthelmintic (wormer)	**86.4%**
	What the horse's reproductive status is	**83.7%**
	Whether there have been any previous episodes of colic on the yard	**79.4%**
	How painful the horse is based on their experience of that individual and other horses with colic	**78.7%**
	If the horse crib bites or windsucks	**76.6%**
	Second round	
	An exact description of the signs their horse has been exhibiting and if they have changed over time (*including change in appetite etc.)*	**96.7%**
	Whether it has been given any treatment/analgesics	**96.7%**
	Whether there is any parasite control/treatment strategies in place	**93.3%**

	Any recent changes in weight/condition	**86.7%**
	Whether the horse has access to sand	**86.4%**
	Whether the owner uses strategic parasite control (e.g. faecal egg count and strategic worming)	**78.3%**
	Any recent history of sedation/anaesthesia	**78.3%**
	Is the horse usually stoic/expressive about pain	**76.7%**
ACCEPTED STATEMENTS		
	Statements accepted in the first round	
Physical examination (should be an assessment of…)	The minimum primary assessment in every case should include measurement of rectal temperature, heart rate, gut sounds, capillary refill time, mucus membranes and pain assessment	**100%**
	Heart rate	**100%**
	CRT	**98.5%**
	Mucus membrane colour	**97.8%**
	Gut sounds	**97.8%**
	Attempts to lie down	**97.8%**
	Rectal temperature to indicate diseases such as peritonitis, colitis and enteritis	**95.6%**
	Rolling	**95.6%**
	Sweating	**94.9%**
	Clinical signs of pain may be more subtle/milder in some animals (stoic, ponies, stressed, donkeys)	**94.1%**

	Abrasions	**89.6%**
	Inappetence	**89.0%**
	Digital pulses and posture to rule out laminitis as possible cause of similar clinical signs (false colic)	**78.7%**
	Posture to rule out pleuropneumonia as possible cause of similar signs (false colic)	**75.6%**
	Second round	
	Lung or tracheal auscultation in cases with elevated respiratory rate	**76.7%**

After the first round, six of the statements were rejected, 92 statements accepted and 43 statements did not reach consensus or agreement. In the second round, 48 statements reached consensus, 89 statements did not reach consensus, and no statements were rejected. In the final round, only one statement reached consensus. One statement was rejected and three did not reach consensus. In this results section, the accepted and rejected statements are presented. Statements that did not reach consensus are presented in Appendix II.

3.3.3.1 Accepted statements

Table 5. These tables below contain the statements accepted following three rounds of the survey, which were then used to development resources and recommendations. Rewording of the second and third round statements is shown in italics.

ACCEPTED STATEMENTS		
Rectal examination	***First round***	
	Rectal examination should not be performed where the vet considers there is an excessive risk to the vet or handler	**96.2%**
	Rectal examination should not be performed where the vet considers there is an unacceptable risk of rectal tear	**94.7%**
	Rectal examination should be performed in all cases with evidence of severe pain on clinical examination except where safety of horse or personnel is compromised	**93.2%**
	Rectal examination should be performed in any cases of colic which are suspected to be surgical or critical in nature	**88.7%**
	Rectal examination should be performed in all cases with a high heart rate on clinical examination except where safety of horse or personnel is compromised	**78.8%**
	Second round	
	Lubrication should be used in every case prior to rectal	**100%**
	Owners should be informed immediately of any complications/tears	**94.7%**
	Rectal examination should be considered in all cases with a history and/or clinical signs of colic, *except where safety of horse or personnel is compromised*	**82.5%**

ACCEPTED STATEMENTS		
Nasogastric intubation	***First round***	
	Nasogastric intubation should be performed in cases with spontaneous reflux	**99.2%**
	Nasogastric intubation should be performed in cases with distended small intestine on rectal examination	**99.2%**
	Nasogastric intubation should be performed in suspected critical cases of colic	**97.7%**
	Nasogastric intubation should be performed in cases which are showing signs of severe pain	**92.4%**
	Nasogastric intubation should be performed in horses that require oral fluids	**92.2%**
	Nasogastric intubation should be performed in cases with a high heart rate on clinical examination	**90.1%**
	Nasogastric intubation should be the first procedure performed in cases with spontaneous reflux	**87.7%**
	Nasogastric intubation should be performed in cases with a primary impaction on rectal examination	**82.4%**
	Owners can find the procedure of passing a nasogastric tube unpleasant or distressing, and therefore the procedure and any potential complications should be explained before it is performed	**78.5%**
	Second round	
	Nasogastric intubation should be performed in cases with a high heart rate *and respiratory rate* on clinical examination	**83.3%**

	Obtaining greater than 2 litres of reflux in a horse or pony is indicative of a critical or surgical case	**83.3%**
	May require repeated attempts to access reflux	**80.4%**

ACCEPTED STATEMENTS		
Abdominocentesis	***First round***	
	Abdominocentesis is indicated in cases with suspected peritonitis	**99.2%**
	Assessment of peritoneal fluid should include evaluation of gross appearance	**98.4%**
	Assessment of peritoneal fluid should include measurement of total protein	**90.6%**
	Abdominocentesis is indicated in cases where it has not been possible to determine whether the case is surgical	**89.0%**
	Abdominocentesis is indicated in cases with suspected surgical lesions where surgical treatment is not an option to help decision-making for euthanasia	**82.7%**
	Abdominocentesis is indicated in cases with a suspected abdominal mass	**77.0%**
	Assessment of peritoneal fluid should include measurement of lactate	**75.6%**

	Second round	
	Abdominocentesis is indicated in cases with suspected intestinal rupture	**94.2%**
	Contraindications for performing abdominocentesis in primary practice are where safety of horse or handler is compromised	**94.2%**
	Assessment of peritoneal fluid should include measurement of total protein, *white blood cells and cytology*	**88.5%**
	Contraindications for performing abdominocentesis in primary practice are where sterility may be compromised	**75.0%**
	Contraindications for performing abdominocentesis in primary practice are where this would delay a referral	**75.0%**

ACCEPTED STATEMENTS		
Ultrasound examination	***First round***	
	Ultrasound is indicated in foals where rectal examination cannot be performed	**99.2%**
	Ultrasound is indicated in small ponies where rectal examination cannot be performed safely	**96.8%**
	Ultrasound can help identify suitable sites for abdominocentesis	**93.6%**

	Ultrasound is indicated for suspected small intestinal lesions that cannot be palpated on rectal examination	**92.0%**
	Ultrasound is indicated in cases where it has not been possible to determine whether the case is medical or surgical	**89.5%**
	Ultrasound is indicated in cases where the owner and/or vet requires further information before deciding on referral	**76.8%**
	Second round	
	Ultrasound is indicated in cases with suspected abdominal mass	**96.2%**
	Ultrasound is indicated in cases with suspected enteritis	**80.8%**
	Contraindications for performing ultrasound in primary practices are where safety of the horse or handler is compromised	**78.9%**
	Contraindications for performing ultrasound in primary practices are where there are limited facilities or equipment	**78.9%**
	Ultrasound is indicated in cases with suspected peritonitis	**76.9%**

3.3.4 Rejected statements

The following statements did not reach 25% agreement, as such they were rejected.

Table 6. Rejected statements from the consensus process, achieved <25% agreement.

REJECTED STATEMENTS		
FIRST ROUND		
History taking	Whether tapeworm ELISAs are performed on this horse	**22.3%**
Nasogastric intubation	Nasogastric intubation is not essential in critical cases which are being referred	**9.9%**
Abdominocentesis	Abdominocentesis should only be performed in a hospital environment	**14.2%**
	Abdominocentesis should be performed on primary assessment	**4.7%**
	Abdominocentesis is contraindicated in cases with large intestinal disease	**8.7%**
	Abdominocentesis is contraindicated in cases with large intestinal impaction	**21.3%**
THIRD ROUND		
Other diagnostic tests	In-house/laboratory blood lactate tests should be considered in primary assessment of critical cases prior to referral	**23.1%**

3.3.5 Other accepted statements

There were 27 statements that reached consensus on future research, training and disseminating information.

Future research

First round

- More research is needed regarding the effect of management and diet change on risk of colic **77.2%**
- More research is needed regarding the effect of different analgesics for colic cases **76.6%**

Second round

- Risk factors for specific causes of colic **92.3%**
- Feeding regime and management post medical colic **88.2%**
- Post-op ileus **80.8%**
- Role of bacterial gut populations **80.8%**
- Critical care for surgical and infectious diseases **76.9%**
- Role of parasites in colic **75.0%**

Veterinary training

First round

- Undergraduates and new graduates need more practical training in performing rectal examination **84.7%**
- Undergraduates and new graduates need more practical training in performing nasogastric intubation **77.4%**
- Undergraduates should be taught "red flag" signs for colic as part of the core veterinary curriculum **92.7%**
- Undergraduates should receive training in nutrition, so that they can advise on appropriate diets **86.3%**
- Training on colic should be delivered through a range of organisations to ensure that mixed practitioners also have access to this CPD **82.0%**

Second round

- Undergraduates and new graduates need more training on communicating options to owners **80.4%**
- CPD (Continued Professional Development) for graduates on colic should be made more widely available and less expensive to allow vets to practice skills **75.0%**

Owner training

First round

- Owners need more education/information on the importance of early intervention in horses with colic **87.8%**
- Owners should have an emergency plan for their horse, including how they would arrange transport and permissions for procedures if they were not available **100%**
- Owners need more education/information on the costs of treatments including referral and euthanasia **82.8%**
- Owners need more education/information on insurance policies and how these may or may not cover different costs **86.1%**

Second round

- Owners need more education/training on what is normal for their horse (including respiratory rate, temperature and faecal output.) **78.4%**

Circulating information

First round

- Client education evenings would be useful **95.1%**
- Fact sheets for owners on normal values for the horse would be useful **83.7%**
- Fact sheets for owners on recognising colic, diagnosis and treatment options would be useful **86.1%**
- Information talks at equine organisations such as the Pony Club would be useful **95.93%**
- Webinars on recognising colic, diagnosis and treatment options would be useful **81.2%**
- Vet discussing colic and showing owner how to assess normal values at routine visits/vaccinations would be useful **80.3%**
- Articles within lay magazine/"horsie press" would be useful **83.7%**

3.3.6 Comment boxes

The fifteen comment boxes were well used throughout the survey, with veterinary practitioners keen to give opinions on both the phrasing of questions and the content of the survey. Analysis of the comments was undertaken,

including tallies of frequency, with comments categorised into ideas that were used to modify questions in the further rounds.

3.4 Discussion

3.4.1 Key findings

This study identified areas of consensus and highlighted differences in opinions between veterinary practitioners on the approach to colic. Despite three rounds of a consensus process, 132 statements did not reach consensus, almost as many as the 140 statements that were accepted. Seven statements in total were rejected. The lack of agreement across equine veterinary practitioners on the primary assessment of colic, emphasises the need for further research and evidence in this area. One hundred per cent consensus was achieved for the statements on 'Other signs of colic' and that: 'The minimum primary assessment in every case should include measurement of rectal temperature, heart rate, gut sounds, capillary refill time and mucus membranes'. The ultrasound (85%) and physical examination (75%) sections also had good consensus. Rectal examination is a commonly used diagnostic test, but was an area where there were variations in opinion; there was only 38% consensus in the first round on rectal examination, which had the lowest consensus overall, out of all of the statements.

3.4.2 Response rates and demographics

Despite the promotion of the survey through a range of different methods, the response rate was low and the retention rate through the three rounds was challenging. This is a recognised key limitation of Delphi surveys (Hsu, CC, 2007) and is attributed to the multiple feedback rounds required. The survey had the highest response rate in the first round, with 213 responses however this fell by 75% (75) in the second round and a further 6% in the final round (40), despite repeated reminders. In this study, one reason this might be attributed to is the delay between the first and second round release, which was nine months. This was due to a change in primary researcher in the survey development, and as such the interest of participants may have waned. The

reduction in numbers of participants means that care should be taken when interpreting some of the statements from the second and third rounds.

Response to surveys for veterinary practitioners does vary, with studies reporting twenty to fifty per cent response (Nielsen et al., 2006, Roberts and Murray, 2013) and specifically in Delphi studies, highly variable: eight to one hundred per cent (Bradfor, 1996). The response rate cannot be calculated for this study, since organisations were contacted to disseminate the survey, in addition to individuals. Lower response rates reduce the validity of the research, since bias may be introduced. There is likely to be an increased involvement with those with a particular interest in research (e.g. practitioners working in research or referral organisations) however, the outcomes of this study were aimed at primary assessment or colic cases.
Ideally the survey should reflect demographics within the veterinary profession: in the 2014 RCVS Survey of the Veterinary Profession (Buzzeo et al., 2014), 16% of practitioners in the UK work in mixed practice versus just 5% in purely equine practice and 8% in referral practice (it should be noted that this figure also included small animal referrals, so the percentage of equine referral employment would be much lower). The demographics of participants varied between rounds. In the first round, practitioners mainly worked in equine first opinion practice (41.1%), followed by equine referral hospital (39.3%) and mixed practice (equine AND farm/small) (19.6%). There was increased participation of equine referral hospital veterinary practitioners in the second and third round (53.5% and 41.0%), and a greater proportion of older veterinary practitioners. These factors suggest bias in the later rounds, and should be considered when implementing recommendations to ambulatory veterinary practitioners.

The international participation in the survey provides a broader spectrum of opinion. However this is also a limitation, since only there were only a small number of participants, this may have led to a greater divergence of opinion and results due to the different backgrounds and experiences.

3.4.3 Developing consensus

A consensus process is a useful method for developing clinical guidelines (Murphy et al., 1998) where there is limited available evidence. A Delphi process is described as 'an iterative multistage process' (Hasson et al., 2000), which involved a series of rounds and feedback, aiming to achieve reliable consensus of expert opinion (Powell, 2003). This process has been widely used in the medical profession and also in veterinary research and guideline development (Wapenaar et al., 2011, Merola and Mills, 2016)

There are clear advantages of using a Delphi process in the development of guidelines. Having a formal consensus process reduces the limitations of developing guidelines using unstructured meetings or committees, which include the dominance of more powerful personality types and the issue of only one person able to voice an opinion at a time (Murphy et al., 1998). A Delphi process is structured and democratic, with anonymous participants reducing some bias.

The methodology for producing consensus statements in this study followed a similar development as a Delphi process. Methodology varies between Delphi studies, with a variety of different processes described in the literature. Seventy-five per cent has been described in some literature to be a suitable agreement level (Keeney et al., 2011) and was used in this study, in addition to the owner study. Statements were still able to be ranked in addition to this based on agreement. The first round contained semi-structured questions based on outcomes from the workshop. Three rounds was decided to be sufficient to collect information in this study; in previous studies this has been a common choice (Hsu and Sandford, 2007); in theory, this author also mentions continuing until consensus is fully reached, however this was thought to be impractical for this project. Having three rounds suited the timescale of this project and also aimed to cater for the time pressures of veterinary practitioners, and prevent a drop off of participants. Participating in a Delphi process requires commitment and the ability to give up time to undertake a series of questionnaires. There are significant time pressures in the veterinary profession (as described in Chapter 2) which undoubtedly contributed to participation levels.

This study did not meet all the criteria of a Delphi survey. The methodology varied in that the participants were not able to view and comment on the feedback ascertained from each round. In this study, time and financial pressures limited this additional feature. The requirement for large blocks of time to carry out Delphi studies has been discussed in the literature: 'a drawback to the Delphi was the questionnaire method may slow the process greatly as several days or months may pass between rounds.' (Ludwig, 1997), and this was not feasible within this project timeframe. However consensus was still reached on some statements in subsequent rounds, and participants were aware which statements were new or modified. The decision not to circulate all feedback was made as it was thought that the increased amount of material may have reduced participation in future rounds, due to the increased time commitment and requirement for additional feedback and discussion to generate the modified statements.

3.4.4 Consensus statements

In the first round, the statements had a wide range of agreement. Notably, there was 100% agreement of the participants that the minimum primary assessment in every case should include measurement of rectal temperature, heart rate, capillary refill time, mucus membranes and pain assessment, with 84% of veterinary practitioners selecting 'Strongly agree'. This demonstrates that the majority of practitioners have a similar 'minimum' approach. Consensus (>75%) was also reached on 'Other signs of colic'.

The section on diagnostic tests had comparatively large amount of variation in agreement in the first round. Consensus was only reached on 42% of statements regarding rectal examination, 47% statements on nasogastric intubation, 54% on abdominocentesis. There was however 85% agreement on statements on ultrasound. Many of these were rephrased. In the second round, 77% of statements regarding rectal examination were accepted, 79% for nasogastric intubation, 60% for abdominocentesis and 60% for ultrasound, but a number still did not reach agreement. The variation indicates differing opinion of practitioners on diagnostic approach also found in this study (Curtis et al., 2015). This is likely attributed to the lack of research in these areas too, in

comparison to using ultrasound for diagnosis (Ness et al., 2012, Klohnen et al., 1996, Sheats et al., 2010). Therefore a consensus process based on opinion may not be the best option, especially since there was quite a lot of disagreement, often with opposing ideas. This highlights the need for more evidence and understanding in this area.

There are other factors that may affect test choice, in addition to lack of evidence. Decision-making in veterinary practice is linked to a number of dynamics, and variations between veterinary practitioners approach is common (Everitt, 2011). These factors include age/experience, value of the test, safety of the animal and personnel and financial contributors (Vandeweerd et al., 2012). This recent study (Curtis et al., 2015) found that with rectal examination, nasogastric intubation and abdominocentesis, facilities, costs and safety of the veterinary practitioner were reasons not to undertake these particular tests. These are all reasons why some practitioners may have varying ideas on the use of these tests, potentially giving rise to this lack of consensus in this study.

Haematology and biochemistry are used relatively infrequently in the primary assessment of cases (15.2% of participants in a survey of practitioners (Curtis et al., 2015). There were no statements on the use of haematology and biochemistry developed in the stakeholder workshops, other than lactate and total protein from abdominocentesis. However, eighteen practitioners commented about the use of such diagnostic techniques and as such, a section on 'Other diagnostic techniques' was include in both round two and three of the survey. Nine statements were developed based on these comments, with zero accepted, six rejected and three not reaching consensus. This probably reflects their infrequent use, but also indicates that more evidence is needed to identify when they are of most value.

The final list of recommendations on the primary assessment of colic is based on the statements which reached consensus, with those lacking consensus omitted. These omitted statements are still useful, since they strengthen with evidence the argument that there is significant variation in practitioners approach to the colic case, also reported in this study (Curtis et al., 2015). These statements

highlight areas for future research, particularly regarding the use of diagnostic tests and the evolving methods that are becoming available.

3.4.5 Input of comments and adjusting statements

Input from the comment boxes was used to adjust the statements between rounds as an iterative process. Participants were not limited by a word count and were encouraged to leave comments at multiple points in the survey (15 times in the first round). These were tallied and combined to form new statements. These new statements were then rerun in the following round. This approach allowed participants to be in involved in generating the evidence, with the aim of bringing opinions together and developing consensus.

An example of this was regarding the use of blood lactate as a diagnostic tool. This was added following feedback in the comments from the initial round as: 'Blood lactate should be considered in primary assessment of colic case prior to referral'. It did not reach consensus and was split into two statements one with 'portable field-side/stall-side' versus 'in-house/laboratory' blood lactate measure, however this did not allow consensus to be reached, albeit with the second statement rejected. Consensus was reached well in the second round for some of the signs of critical cases. For example, 'rapid deterioration of signs' was added and achieved 100% agreement.

In the first round, 92 statements were accepted, and 43 did not have consensus. Following the consolidation and amendment process after the first round, a further forty-eight statements were accepted which consisted of statements which were modified and new statements generated based on feedback. However, there was still a large amount of variation in opinion and eighty-nine statements still did not reach consensus. It was decided not to re-run all these statements as a further re-wording would have caused a significant deviation from the original statement content and comments from this round did not assist with the adjustment of many of the statements. Additionally, declining numbers of participants was likely to produce bias. As such, the third round only had five questions based on feedback from the prior round. It has been noted in the literature that in the third round of a Delphi survey, there is likely to be minimal

increase in consensus (Hsu and Sandford, 2007), which was reflected in this study where no statements were agreed.

One manner in which the questions were changed was the actual question phrasing itself. An example of this was in the diagnostic tests section where the phrasing of the question was changed from 'should be performed' to 'should be considered' i.e. first round: 'Rectal examination should be performed in all cases with a history and/or clinical signs of colic except where safety of horse or personnel is compromised' Second round: 'Rectal examination should be considered in all cases with a history and/or clinical signs of colic except where safety of the horse or personnel is compromised'. This wording was adjusted to portray the statement more as a recommendation rather than a rule, especially since the aim of the project is to generate recommendations that can be used alongside clinical judgement rather than strict rules to be adhered to. Emphasis wants to be placed on this to promote uptake, especially since critics of EBM say it 'oversimplifies the complex and interpersonal nature of clinical care' (Williams and Garner, 2002). Conversely, a number of articles in healthcare sciences say that 'weasel words' such as 'should be considered if clinically appropriate' ought to be avoided and replaced with clear, action words which are more likely to be followed (Grol, 2001, NICE, 2017). The caveat 'except where safety of horse or personnel is compromised' was used in many of the first round statements but was added to some where it had not been included for the second round. This reflects the risks involved in some of the procedures, BEVA has produced informative guidance on safety (BEVA, 2014) which could be usefully additionally to practitioners.

3.4.6 Frequency rating

The frequency rating statements cannot be involved in the list of consensus statements or be directly compared due to their different question design. This is a limitation of including this type of question. However, what is useful is that this data indicates some of the more subtle signs, such as inappetence to be the most important signs displayed in the colic case. Again, there was a wide variation in opinion between veterinary practitioners with some clinical signs voted as being seen in over 75% of colic cases but also in 0% of cases but other veterinary practitioners. A small number of practitioners thought that some of

these changes in behaviour were never seen in horses with colic (reduced response to stimuli, isolating themselves from other horses, change in temperament, depression, subdued nature). Clinical signs which were answered as 'Unsure' as occurring in horses with colic were: isolating themselves from other horses (if abnormal for the horse) (35 veterinary practitioners), reduced response to stimuli e.g. noise (16), subdued nature (13), changes in activity levels (12), change in temperament (5), lowered head position (4), depression (3). This lack of certainty and also the opinion that some of these signs are never seen in colic cases is a cause for concern, and indicates some veterinary practitioners could be missing some key signs in the diagnosis of cases.

3.4.7 Guidelines

The overall aim of this study was produce evidence-based recommendations on the primary assessment of colic cases. These will be based on agreed statements from the common signs of colic, critical signs of colic, history taking, physical examination, diagnostic test sections. As discussed in the introduction, the following steps will be utilised in the development of guidelines: Domain 4: Clarity of Presentation**:** guidance language, structure and format. Domain 5: Applicability: addresses the barriers to utilisation of the guideline, maximising uptake.

In terms of Domain 4, language is important so as not to deter the use of the guidelines by professionals. It was seen that changing the wording 'should be performed' to 'should be considered' increased the consensus of certain statements in the diagnostic tests. Presenting the guidelines as 'recommendations' rather than strict 'rules' may help with uptake of such guidelines. Guidelines are commonly used in the medical profession (Grol et al., 1998), but less common in veterinary practice; these are successful if developed well (Hasson et al., 2000). This study has consolidated best available evidence using the workshops, however it should be noted that a consensus process is of lower evidence hierarchy than scientific testing. Referring back to the definition of Evidence-based Veterinary Medicine, evidence is should be used to optimise one's clinical judgement. These guidelines should be considered alongside each

practitioner's expert opinion in the context of each individual case, used as an ancillary tool to assist with decision-making.

3.4.8 Future research and education

3.4.8.1 Research

There were many areas of research suggested for future use, shown as statements that did not reach agreement, eight areas of research were agreed on. These areas of research are broad and show there is uncertainty across the different stages of colic from rick factors and causes, to diagnosis and treatment, surgical and critical cases and the future management of these cases.

Areas that also require further research are the survey statements that did not reach consensus. There was lack of consensus especially regarding the use of diagnostic tests and further research into the different diagnostic tests used in primary practice would prove valuable. It should be noted that a consensus process cannot be a replacement for scientific testing, since it is a collaboration of opinion (Keeney et al., 2011).A key finding of this study is highlighting where further research is required.

3.4.8.2 Veterinary training

These outcomes illustrate areas that may be developed in the future to assist with training; a list is available in the results section. There was an emphasis on some of the diagnostic tests e.g. rectal examination which reflects the lack of consensus in the diagnostic test section, specifically on rectal examination, which indicates a clear need for more research and educational resources in this area.

3.4.8.3 Owner training and circulating information

The initial survey was written alongside an owner survey with the aim of developing materials for use by horse owners/carers. Much of this information is applicable to that project but some of this information can be used in the development of materials and disseminating information from this project.

Recognition of colic at an early stage plays a pivotal welfare role in the horse. If signs can be detected by owners this will benefit the outcome of cases. Additionally, having a background knowledge will assist with owners in the making of an informed choice in the event of emergency. During the development of this survey, a campaign was launched from this research group in partnership with The British Horse Society (The BHS). Evidence-based resources have been developed and disseminated amongst the equine community, and are available to owners and veterinary practitioners from their website. The results of the owner campaign should help with the development of veterinary resources, improving understanding of colic for all stakeholders involved.

3.5 Overall outcomes

Overall, one the key aspect to highlight from this section is the variation in consensus between the different topics. There was good consensus and agreement for the following areas: clinical signs and critical signs of colic, history taking and the physical examination. There was a lack of consensus regarding the use of diagnostic tests, this was particularly evident with rectal examination, a commonly used test which has a lack of evidence and research to assist with its use and interpretation. The recommendations will therefore be focussed on the areas with greater consensus e.g. history taking and physical examination. Veterinary practitioners require more research and information on diagnostic tests to assist with their diagnostic approach.

Chapter 4. Project outcomes: development of materials for dissemination

4.1 Introduction

The aim of the project has been to explore methods of disseminating evidence-based materials in equine veterinary practice. This involved use of a consensus survey, structured interviews and online questionnaires to explore which methods of knowledge transfer were likely to be most effective. Summarising these findings, there appeared to be a clear preference for:

- Development of a variety of resources to suit different preferences
- Development of web-based, hard-copy and app resources
- Concise, visual information
- Overcomes the barriers of time, access and variability in experience, outlined in the questionnaire sections
- Recommendations, not 'rules'
- Clinically useful research, applicable to primary practice
- Better education on safety and practical techniques

In the scope of this project, it was decided to develop an openly accessible web page, hard copy resources and to undertake talks/educational sessions. A website format was the top ranked resource in the online questionnaire (89.2%) when asked about presentation of colic research to vets. It was also clear from both the online and face-to-face questionnaires that there was a preference for a range of resources and that some veterinary practitioners prefer hard-copy materials. Finally the talks and educational sessions were included as it was highlighted there was a lack of education available for colic cases especially in the interviews.

4.2 Development

4.2.1 The BHS React Campaign

A collaboration between the University of Nottingham and the British Horse Society (The BHS) has led to the development of resources on colic for horse owners/carers (BHS, 2017). This was developed from outcomes of the multidisciplinary workshops and consensus surveys for horse owners.



Figure 10. The BHS REACT Campaign logo

The underlying research was undertaken by (Bowden, Unpublished), which demonstrated potential for good uptake by horse owners/carers. The resources for horse owners/carers focus on the early recognition of colic, since the carer can play a pivotal role in in recognising colic at an early stage and making an informed decision in an emergency situation.

The resources were developed with an evidence-base, from the multidisciplinary workshops and consensus process and are available on the BHS website (BHS, 2017). The resources include information packs including leaflets and posters and a short information video. REACT was used as an acronym to highlight the key signs of colic to horse owners:

Restless or agitated
Eating less or droppings reduced
Abdominal pain
Clinical changes
Tired or lethargic

This has had a positive response from the equine community: from September 2016 -May 2017, the webpage had 1805 page views, emails have been sent to nearly 100,000 horse owners /carers, Facebook posts have reached nearly 400,000 people, an information video has had over 100k views and over 10,000 information packs have been distributed nationwide.

4.2.2 VetReact

Following the BHS REACT campaign, a similar campaign called VetReact was established. The researcher's role was to develop and design the campaign website and content, based on the outcomes of findings from the previous studies. The campaign was called VetReact to ensure a consistent message, continuity with the previous material and implied connotations of rapid response in an emergency situation.

The initial stages involved reviewing other campaigns, and developing concepts for webpage design and campaign logos. It was noted that a wide range of logos were used, but it was important to design something eye-catching, simple and relevant. The primary researcher has experience in art and logo design and produced the following designs:



Figure 11. The VetReact logos

It was thought that the first logo could be used universally across the different projects as a brand. Drawing attention to the importance of time in emergency conditions was considered, using a stopwatch at the centre of the logo. Surrounding this, an equine ECG and silhouette of a horse's head was used to highlight the relevance to equine veterinary practice.

4.2.3 Website development

A webpage was the first step of development for the launch of the recommendations and will be used a platform from which the other resources may be developed. It was important to compare and research other webpages used for similar campaigns both in the veterinary and medical fields.

In the online questionnaire, participants were questioned on some of the available websites and how often they accessed them, since these were resources used by the participants. These were all reviewed by the researched, and a summary of their opinion of the positives and negatives of each website was generated, and used as a basis for designing the VetReact website (Table 7).

Table 7. Review of key features of veterinary websites, that identified by equine practitioners in an online survey of dissemination of evidence-based medicine in equine practice.

Website	Positives	Negatives
Talk about Laminitis (TAL)	- Videos in some sections and useful diagrams/photos - Good lay summaries of each including references for easy access	- Logo not particularly eye catching/relevant
Equine Grass Sickness Fund (EGSF)	- Easy to navigate - Includes interesting history section - Colour scheme appropriate - Case studies on recovery - Advice section short but informative	- Logo pixelated - Not a huge amount on the disease, presenting signs etc. More of a summary for owners than for vets - Photo on first page doesn't load

Care about Laminitis (CAL)	- Good content with some references when click on further info on each of the chapters - Interactive website design - Relevant logo	- Slightly outdated graphics
Atypical Myopathy (AHT)	- Use of bold typing effective - Leaflets on Animal Health Trust via Care about Laminitis	- No references
Strangles (AHT)	- Short section on Animal Health Trust	- Plain text, not hugely informative
HBLB Guidelines (HBLB)	- Info clear	- Not very easy to navigate, can only navigate right once opened - Plain text - No references - Rigid 'rules' - No clear signposts on where to find research on the topic
BI Academy: Feel Good Colic Rectals (Academy)	- Webinar very good - Very useful diagrams and animations	- Tricky to find with simple search engine search - Could be cut into shorter sections
Headsmart Campaign (Headsmart)	- Very clear bullet points on symptoms on the website homepage - Information for different stakeholders clearly laid out	- This underwent a costly media development campaign, such finances are less readily available in veterinary medicine.

	- Links to the research and further information on the evidence - Relevant logo	Useful for comparison, nonetheless.

It was decided to build a website based on the layout of the HeadSmart campaign, since it provides similar resources: recommendations for medical professionals and other stakeholders in childhood brain cancer. The design was considered to be very eye catching and website easy to use. Additionally, it had a very clear layout of evidence-based information for all stakeholders, which is lacking on many veterinary websites, which frequently use lay summaries or opinion reviews for owners.

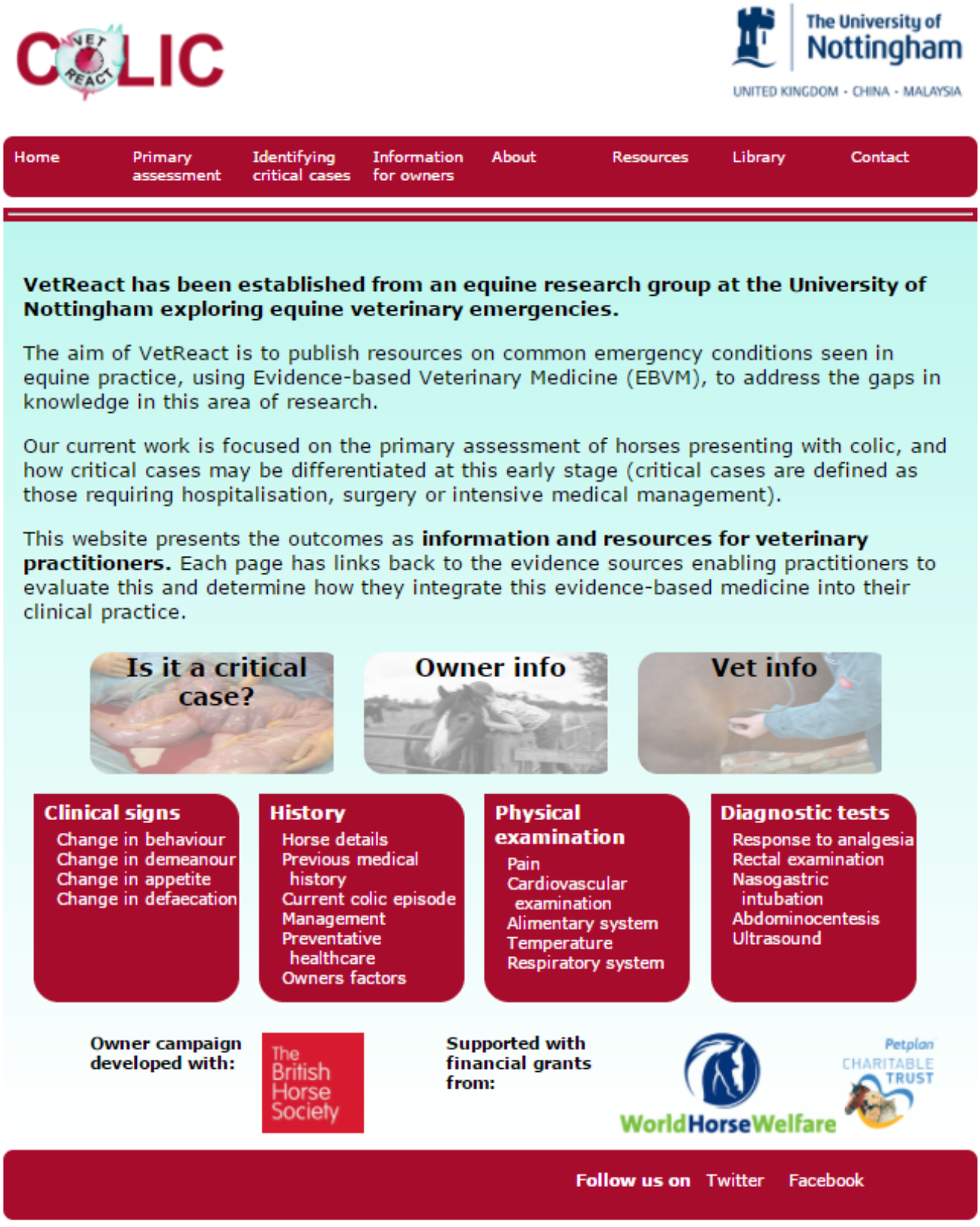
Figure 12 is a screenshot of the homepage, highlighting positive features that included the prioritisation of symptoms on the first page important to highlight their important, and clear links to further information.



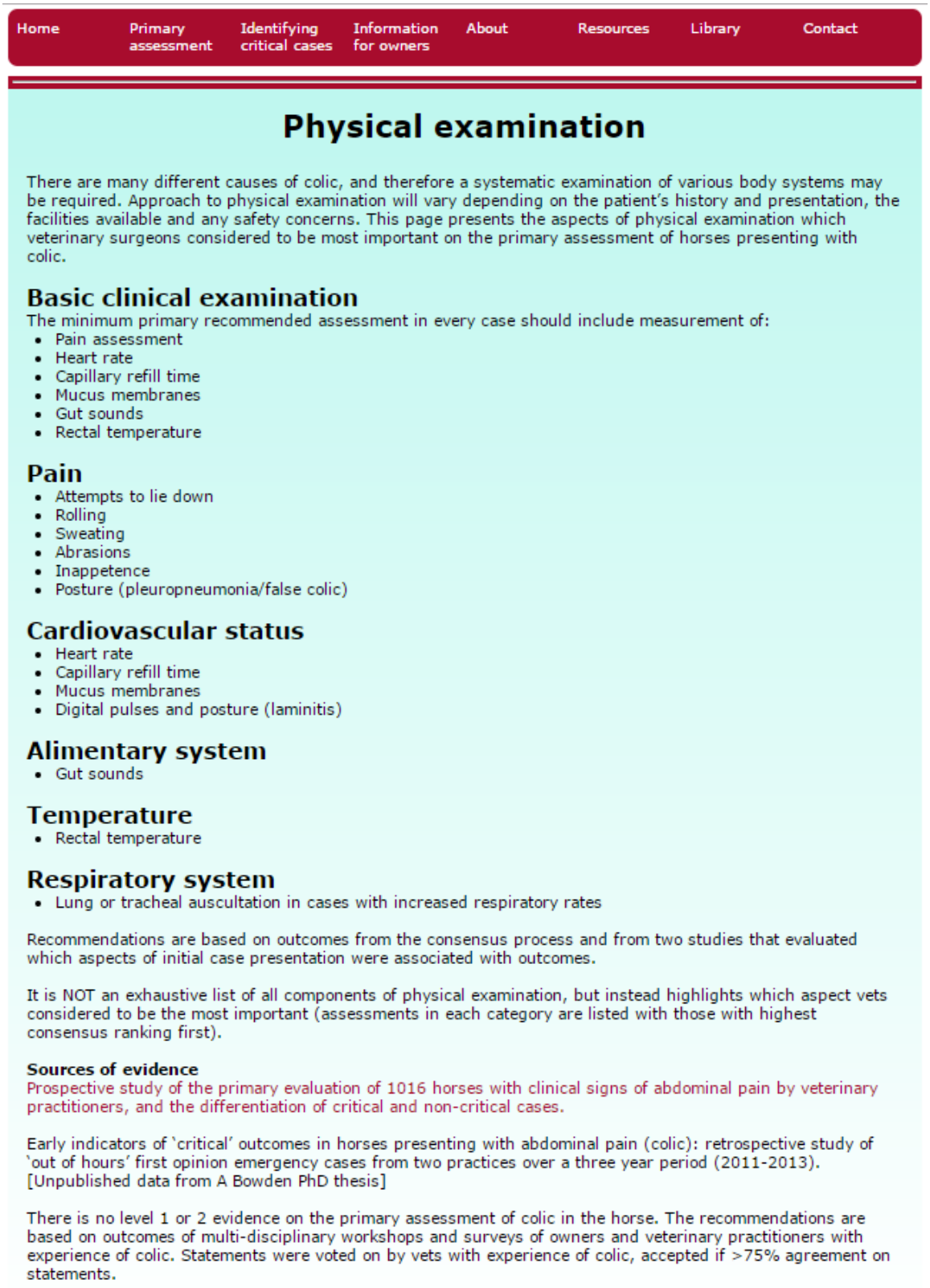
Figure 12. Homepage of Headsmart

Using the Headsmart website as a guideline for layout, the website was developed by researchers Dr John Burford and Isabella Wild. This was undertaken using Dreamweaver (Adobe) and coded in HTML5, CSS3 and JavaScript. One of the key aims of the website was to make it easily accessible and straightforward to navigate, for veterinary practitioners on the road. As such information, has been presented concisely with minimal photos to prevent slow-loading on mobile devices.

Figure 13. Homepage of www.react.vet (VetReact).



The homepage (I. Wild, 2017) highlights that the information available is specifically for veterinary practitioners, with emphasis on that the



recommendations were developed using an evidence-base. There are links to each section on the homepage: 'Is it a critical case?', 'Owner info' and 'Vet info'. There are also links to the main information on: clinical signs, history, physical examination and diagnostic tests. The navigation bar at the top contains drop down menus on each of the key sections. 'Primary assessment' was divided into:

clinical signs, history, physical examination and diagnostic tests, each presented in a similar manner the example below.

At the end of each section, sources of evidence were presented for further information on the evidence-base, so the origins of the information was clear. This meant that users had access to the details, and could assess the levels and validity of evidence if they wished, but a concise summaries were provided in the main information on the webpage (in response to feedback from interviews and surveys). Additionally at the bottom of each section, printable versions of each page were linked in, so leaflets and posters may be printed out as required, which provided hard copy options for those that preferred this, as frequently highlighted in the interviews and surveys.

'Identifying critical cases' was created as a separate tab from other aspects of primary assessment, since this was considered a particularly important aspect of the website, and therefore needed to be quickly and directly accessible from the front page. 'Information for owners' consisted of a link to the BHS React Campaign to redirect owners to these resources. 'Resources' contains a list of leaflets that can be printed as hard copy resources. It is hoped that further resources will be added to this section in the near future including a history-taking form, how-to videos and diagrams. The 'Library' tab contains links to useful papers and websites.

4.2.4 Pilot

The website was piloted with a number of different individuals and organisations. The website content was reviewed by Professor Sarah Freeman. Pilots were undertaken by the following. The website was trialled with previous members of the research group, including Laila Curtis and Adelle Bowden. Feedback was sought from veterinary students in their final year, and from post graduate researchers from the Centre of Evidence-based Veterinary Medicine (CEVM). Feedback was also obtained from World Horse Welfare, The BHS and Petplan, who had provided financial or other contributions to the projects, and who had experience of public engagement and campaigns through websites and other media.

Some key feedback is outlined below:

- Make it more obvious on first access that the website is for veterinary practitioners
- Add an option to print off each section as posters/fact sheets
- Add Google analytics
- Add a 'Contact us' tab
- Move sources of evidence to end of pages
- Positive feedback included: 'As a phone user of the site I found it really easy and straightforward to navigate. There aren't too many main menu options apart from the most relevant ones and links to immediate resources is a fantastic idea.
- 'The fact that there aren't photos or pictures means that the site works quickly which will be really important to those who are out and about and in a rush'
- A comment that it was clear where all the evidence was from

4.2.5 Dissemination of the website

A press release was formulated and sent out to national and international press for the website launch on 31st March 2017. Information about the website was included in the Veterinary Times, Veterinary Record and Horse Talk New Zealand. It was also disseminated to the list of veterinary practices contacted for the online questionnaire in Chapter 2, and was posted on social media from The Nottingham Colic Project page.

4.2.6 Hard copy resources

Hard copy resources were developed based on the same format of the website pages, these were made available to print out on each of the website pages. Additionally, a mail-out of hardcopy resources was compiled.

4.2.7 Education

Talks were undertaken at the Student Equine Veterinary Association (SEVA) Symposium and Surrey Vet School in February by researchers John Burford and Isabella Wild to spread the outcomes of the project, this was to start a 'roadshow' of education nationwide. Information is due to be presented

additionally at the International Colic Symposium in Kentucky and BEVA Congress, as part of research abstracts which have been accepted for the scientific programmes.

4.2.8 Impact from the campaign

There was an initial peak in hits on the website but this since subsided. This contrasts to the BHS REACT campaign, which continues to have hits. This is likely due to veterinary practitioner compliance versus owner compliance, but also due to the strength of marketing employed by the BHS welfare team, who have allocated a % time of person time to continuous promotion and development of this campaign, which represents a significant time and financial investment. There are more resources in development, it is hoped with the continual addition of new material, interest will be retained. Ideas for future work and suggestions for steps to ensure success are listed in the future recommendations below.

4.3 Final discussion, future recommendations, conclusions

In carrying out this project, the initial aims and objectives stated in the introduction have been achieved.

4.3.1 Aims and Objectives

The aim of this project was to determine the most appropriate strategies for dissemination of evidence to the equine veterinary profession. This was divided into three phases.

1. Assess how equine veterinary practitioners use evidence in practice, including their preferred methods and barriers to knowledge transfer.

This had the following objectives:

- Develop a questionnaire which was used to interview seven vets from four equine practices involved in the primary assessment of the colic case.
- Using feedback from the interviews, an online survey was generated and distributed to a representative sample of first opinion equine practitioners.

The interviews and survey aimed to identify the best ways of disseminating information to first opinion practitioners and understanding the key barriers which prevent vets from accessing evidence in practice.

2. Completion of a consensus survey on the primary evaluation of the colic case. The objective was:
    - Create an online surveys which were distributed to veterinary practitioners, based on the outcomes of a multidisciplinary workshop
    - Development consensus statements was undertaken based on agreement which was used to generate recommendations
3. Dissemination of information
    - Based on outcomes of the above two aims, a campaign was conducted to successfully transfer knowledge into practice

Understanding the methods of accessing evidence by equine veterinary practitioners is key to improving knowledge transfer and ensuring clinically-relevant research reaches those who it could benefit. It was found that practitioners access a wide range of resources, and is likely to be influenced by practitioner age, experience, interest and 'practice culture'. Barriers to accessing EBVM in veterinary practice were outlined as: lack of time or time pressures, accessibility of resources and experience of the individual veterinary practitioner. These are described in other literature, but some of the barriers may be more challenging because of the ambulatory and dispersed nature of equine practice. These findings have been beneficial in the context of this study in helping to develop recommendations that are specifically developed to meet the challenges of accessibility and use for equine practitioners involved in the primary assessment of colic cases. The outcomes of this research should however also help with the dissemination of evidence from other studies applicable to general equine veterinary practice. It has addressed some of the lack of evidence in this area, but also highlighted where there is a need for further research and educational resources.

The development of evidence-based recommendations is new to equine veterinary practice, however has shown to be effective in the field of human medicine (Wilne et al., 2007). It will be interesting to attain feedback from veterinary practitioners who utilise the resources, whether they are helpful and whether this changed their approach to the primary assessment of the colic case. A consensus process, similar to that used in the Headsmart campaign was used to generate these recommendations. It should be noted this type of

evidence should not be acknowledged as a replacement for primary research studies, which are lacking in this area. Interest in other areas of colic was also highlighted in the online questionnaire and this may also be referred to as ideas for future research.

The website, www.react.vet will continue to be updated with new resources to ensure interest is retained with users, something that was suggested in the online questionnaire comments. Furthermore, there are many resources that were considered for development which did not fit the timeframe of this project, these will be developed and added the website over time, including an app based on suggestions from the interviews and questionnaires, practical technique videos, and evidence summaries on prognosis. Hard-copy resources are due to be sent out to practices, hopefully targeting those who prefer a tangible research resource. It must be ensured that the is a continuous process, not only should resources be added to retain interest, but the research presented reviewed and audited with time to prevent out-of-date practices being recommended, which has been described as a limitation of guidelines (See Chapter 1).

Research which is currently underway includes a critical review on the long term prognosis following colic surgery, and surveys of how the owner and vet campaign materials are being used in practice. Feedback from the latter analysis will be used to review and develop the materials for VetReact, ensuring a continuous evolving process.

The main findings from this project are centred on the major challenges of accessing and using EBVM in equine practice.

- There is a need for a range of resources which are freely accessible, easy to access from both hospital and field situations.
- There is a need for resources that cover a range of needs (e.g. inexperienced versus experienced veterinary practitioners, owners versus veterinary practitioners, electronic versus hard-copy).
- This project involved the development of a brand new resource which aims to address some of these issues (www.react.vet)
- Recommendations have been developed on the primary assessment of colic cases.

- Above are some recommendations for the future development of resources. Essentially, resources must be kept contemporary and information regularly audited and improved to maintain the relevance of the project and validity of evidence.
- Recommendations for future research: more research is required on the use of diagnostic tests in the diagnosis of colic, indicated by the lack of consensus in this section. Furthermore, as summarised before there is a wide array of interest for research in this area including looking at the prognosis of colic cases.

This is the first study of its kind used to develop both evidence-based recommendations and evidence-based methods of dissemination, in the field of equine veterinary practice; these outcomes should assist not only with the primary assessment of colic in the horse but also in understanding on how EBVM is used as a whole in equine practice.

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Appendices

Appendix I - Interview schedule

	Question	Prompts	Further Questions
Preliminary info	1. Please may you briefly summarise your clinical experience	How many years have you had in: - Mixed practice - Equine practice	How comfortable are you with investigating, diagnosing and treating colic cases?
	2. Please may you describe your understanding of Evidence Based Medicine		
	3. What do you think are the best ways of disseminating Evidence Based Medicine to veterinary practitioners?		
	4. What are the main ways you access information for assessing cases in practice	Eg. Data, guidelines on procedures	a) Where would you like to access information?
	5. What are the main barriers for vets accessing information	Time Expense Reliability of information	
Use of Evidence Based Medicine in	6. Where do you go for sources of evidence for use in practice?		

practice and developing colic guidelines	7. How frequently do you access papers or articles	Barriers Peer reviewed	a) What do you read? b) What do you recognise as being the best sources of information?
	8. Do you use the BEVA Protect ME template?		a) Do you find the template helpful? Did this change your procedures? b) Did you tailor the template? c) Comments of accessing info and format?
	9. Would you choose to access guidelines on colic?	If not why? Length Accessibility Practicalities	a) What about your colleagues eg. New grads, senior partners?
	10. What format do you think would be the most useful and accessible presentation of guidelines for vets?	Website, published in a magazine, sent out as a bulletin, app, leaflets	a) Would you like an adjustable template similar to BEVA Protect ME Scheme? b) A framework that could be changed, your own protocol or a centralised protocol?

Web-based information	11. Do you access webinars or Youtube/online videos for information on conditions and carrying out procedures	Vets Owners	a) Do you deliberately access peer reviewed sites?
	12. What are the benefits and disadvantages of websites?	FAQs Papers, access Forums – moderated/non-moderated Misinformation	
Hard copy information: papers, magazines, leaflets	13. How effective are these methods at disseminating information to vets?	Barriers Peer reviewed papers requiring cost subscriptions	a) Do you deliberately access peer reviewed information?
Mobile Phone/Tablet App	14. Do you use any mobile phone apps within the field?	Dosage calculator BEVA apps AliveCor ECG	a) How useful do you find these apps

	15. What would you like to see included in an App	Information based: videos, how to perform, how to differentiate a critical case Colic data sheet collection to follow progress of cases Data collection for a national colic database Predictive app – becoming more common in human medicine eg. Likelihood of critical case, likelihood of survival etc.	
Veterinary education	16. Do you think the education for undergraduate vet students is adequate	Rectal Abdomiocentesis Ultrasound Nasogastric intubation	What should be done to increase the opportunities for students?
	17. Is there enough further education on colic available?	Internships CPD – colic diagnosis/treatment, ultrasound, rectal, abdominocentesis	Do you have access to the RCVS knowledge library or university online library?
Owner Education	18. Do you undertake any owner education within the practice?	During visits Information on website/hard copies Client evenings	
	19. Does your website publish information on veterinary conditions?	Fact sheets Case studies Social media sites (if so, which ones)	a) Is information on your website backed with clinical experience or evidence based medicine?

	20. How effective are hard copy resources for disseminating information to and/or educating owners?	Magazines Leaflets Practice newsletter	a) Do you produce/provide any hard copy information within the practice? i) What is the uptake? ii) Does this information reach all owners?

Appendix II – Statements that did not reach consensus

First round – statements that did not reach consensus (25-75%)

Is this a sign of critical colic case?

- Sweating
- Rolling
- Large intestine tympany
- Absence of borborygmi

Which aspects of history taking do you think are important for the vet to take during a clinical exam of a horse with suspected colic

- The breed of the horse
- The gender of the horse
- The use of the horse
- When the horse last received dental treatment
- Whether faecal worm egg counts are performed on this horse
- What anthelmintic (wormer) the horse was last treated with

Physical exam should be an assessment of…

- Jugular distension
- Lung or tracheal auscultation
- Status of lymph nodes through palpation

To what extent do you agree with the following statements regarding rectal examination

- Rectal examination should be performed in all cases with a history and/or clinical signs of colic except where safety of horse or personnel is compromised
- Rectal examination is not indicated in horses with a history of colic without clinical signs (of colic) on examination
- Rectal examination is indicated in donkeys with a history of colic without clinical signs (of colic) on examination as they can show minimal clinical signs
- Rectal examination should be performed in all cases with an absence of gut sounds on clinical examination, except where safety of horse or personnel is compromised
- Rectal examination is not indicated in cases which are passing faeces, have a normal heart rate and show minimal signs of pain
- Rectal examination should not be performed in recumbent horses
- Rectal examinations should be performed as the first diagnostic test after a clinical examination
- Owners should give informed consent before a rectal examination is performed, including being informed of the risk of rectal tears

To what extent do you agree with the following statements regarding nasogastric intubation?

- Nasogastric intubation should be used as a routine diagnostic procedure for every case presenting with colic
- Nasogastric intubation should not be used as a routine diagnostic procedure for every case presenting with colic

- Nasogastric intubation should be performed to help differentiate between medical and surgical cases of colic
- Nasogastric intubation should be the first procedure performed in severely painful cases
- Obtaining more than 2 litres of reflux in a horse or pony is indicative of a critical or surgical case
- Obtaining any reflux in a donkey is indicative of a critical or surgical case

To what extent do you agree with the following regarding abdominocentesis

- Abdominocentesis is indicated in cases with pyrexia of unknown origin
- Abdominocentesis is indicated in cases with suspected surgical lesions prior to referral to help determine prognosis
- Abdominocentesis is contraindicated in cases with severe or widespread intestinal distension

To what extent do you agree with the following statements regarding Ultrasound?

- Ultrasound should not be used as an initial diagnostic test in every case

To what extent do you agree with the following statements regarding research

- More research is needed regarding the risk/prevalence of rectal tears in horses through rectal examination in the UK
- More research is needed regarding the first assessment of colic cases
- More research is needed regarding the use of blood and peritoneal lactate as a diagnostic test for colic

To what extent do you agree with the following statements regarding veterinary training
Undergraduates and new graduates need more practical training in performing abdominocentesis

- More internship opportunities are required to help develop practical skills for new graduates
- Post-graduate equine tracking of day one competencies is required to help develop practical skills for new graduates
- CPD for graduates on colic should be made more widely available and less expensive to allow vets to practice skills
- Undergraduates and new graduates need more training on communicating options to clients

To what extent do you agree with the following statements regarding owner training

- Owners need more education/training on what is normal for their horse (including normal respiratory rate, temperature, and faecal output)
- Owners need more education/information on complications of procedures such as nasogastric intubation and rectal examination
- Owners need more education/information on the different types of colic, their different presentations, treatments and outcomes
- Online forums for owners to discuss colic would be useful

Second round – statements that did not reach consensus (25-75%, including comments from 1st round)

Signs of pain and changes in appetite; these equids may show variation and reduced signs of pain:

- Ponies
- Some breeds eg. coldbloods (cobs)

Is this a sign of a critical colic case?

- Sweating with no physiological reason
- Tachypnoea
- Cold extremities
- Pyrexia
- Trembling/muscle fasciculations
- No faeces passed/24 hours
- Profuse diarrhoea

- Abnormal posture (flank guarding, prayer position)
- Blood on rectal exam
- Difficulty standing/weakness

Which aspects of the history do you think are important for the vet to take during a clinical exam of a horse with suspected colic?

- Whether the horse has any known dental disease
- Whether the horse has received any dental assessment or treatment
- Whether the client uses any treatments for encysted cyathastomes (eg. moxidectin, fenbendazole)
- Whether there have been any previous episodes of grass sickness on the yard
- Whether there are any poisonous plants/trees on the premises
- Type of bedding used (e.g. hemp)
- Does the horse have vices/stereotypies
- How long has the horse been owned for/previous history prior to ownership
- Any recent travel
- Current vaccination status (including rabies in USA)
- Whether the horse is insured

Physical exam should include an assessment of:

- Whether there is jugular distension present
- Lung or tracheal auscultation in every case
- Status of lymph nodes through palpation

To what extent do you agree with the following regarding rectal exam?

- Rectal examination may not be required in horses with a history of colic without clinical signs (of colic) on examination
- Rectal examination should be considered in donkeys with a history of colic without clinical signs (of colic) on examination as they can show minimal clinical signs
- Rectal examination should be considered in all cases with an absence of gut sounds on rectal examination, except where the safety of horse or personnel is compromised
- Rectal examination may be required in cases which are passing faeces, have a normal heart rate and show minimal signs of pain
- Rectal examination may have limited diagnostic value in recumbent horses
- Rectal examination should be performed as the first diagnostic test after a clinical examination, except where factors affecting the safety of the horse and personnel (including availability of facilities, temperament and size of horse)
- Rectal examination should be performed as the first diagnostic test after a clinical examination except in severely painful cases
- Owners should give informed consent before a rectal examination is performed
- Owners should be informed of risks and reasons for performing rectal
- Hyoscine/buscopan/antispasmodic should be administered to every case prior to rectal examination
- Sedation should be administered to every case prior to rectal examination

To what extent do you agree with the following regarding nasogastric intubation?

- Nasogastric intubation should be considered as a routine diagnostic procedure for every case presenting with colic, except where the safety of the horse or personnel is compromised
- Nasogastric intubation should not be considered as a routine diagnostic procedure for every case presenting with colic
- Nasogastric intubation is not required if no intestinal distension is present on ultrasound
- Obtaining greater than 0.5 litres of reflux is indicative of a critical or surgical case
- Nasogastric intubation should be considered to be the first procedure performed in severely painful cases
- Obtaining any reflect in a horse or pony is indicative of a critical or surgical case
- Obtaining any reflux in a donkey is indicative of a critical or surgical case

- Obtaining greater than 0.5 litres of reflux in a donkey is indicative of a surgical case
- Obtaining greater than 2 litres of reflux in a donkey is indicative of a surgical case
- I do not have the experience of working with donkeys to make a decision on nasogastric intubation as a diagnostic test
- Difficulty in passing tube can be a sign of gastric impaction
- Gastric impaction may require repeated lavage for diagnosis

To what extent do you agree with the following regarding abdominocentesis?

- Abdominocentesis is indicated in cases with colic and pyrexia of unknown origin
- Abdominocentesis is indicated in cases with suspected surgical lesions prior to referral except if client and vet have already made a decision
- There may be an increased risk of complications of abdominocentesis in cases with severe or widespread intestinal distension
- Abdominocentesis is contraindicated in cases with large intestinal disease
- Abdominocentesis is contraindicated in cases with large intestinal impaction
- Contraindications for performing abdominocentesis in primary practice are where the vet does not have sufficient experience in performing this technique

To what extent do you agree with the following statements regarding the indications for using ultrasound in colic cases?

- Ultrasound should be considered as an initial diagnostic test in every case
- Ultrasound is indicated in cases where it has not been possible to determine whether the case is medical or surgical with suspected nephrosplenic entrapment
- Ultrasound is indicated in cases with suspected gastric distension
- Ultrasound is contraindicated where this would delay referral
- Ultrasound is contraindicated where the vet does not have sufficient experience with performing this technique
- Ultrasound should only be performed in a hospital environment

To what extent do you agree with the following statements regarding the use of other diagnostic tests in colic cases?

- Assessment of PCV/haematocrit should be considered in primary assessment of critical case prior to referral
- Total Protein should be considered in primary assessment of critical case prior to referral
- Blood lactate should be considered in primary assessment of critical case prior to referral
- Comparison of peritoneal versus blood lactate should be considered in primary assessment of critical case prior to referral
- Haematology profile should be considered in primary assessment of critical case prior to referral
- Biochemistry profile should be considered in primary assessment of critical case prior to referral
- Blood gases should be considered in primary assessment of critical case prior to referral

To what extent do you agree with the following statements regarding research?

- More research is needed regarding the risk/prevalence of rectal tears in horses through rectal examination in the UK
- More research is needed regarding the first assessment of colic cases
- More research is needed regarding the use of blood and peritoneal lactate as a diagnostic test for colic

Which of these avenues of research do you consider important?

- Management of colics with continuous oral/oesophageal administration
- Value of intestinal biopsies
- Evaluating subtypes of AST and CK to more specifically identify location
- Incidence of types of colic in primary practice
- Pain behaviours/expression in donkeys, ponies, cold blooded
- Differences in long term outcome/prognosis in different conditions
- Inflammatory Bowel Disease

- Management of large colon displacement
- Treatment regimes for resolving types of impactions
- Colic in miniature horses/ponies

To what extent do you agree with the following statements regarding veterinary training?

- Undergraduates and new graduate need more practical training in performing abdominocentesis
- More internship opportunities are required to help develop practical skills for new graduates
- Post-graduate equine tracking of day one competencies is required to help develop practical skills for new graduates

To what extent do you agree with the following regarding owner training and communication?

- Owners need more education/information on complications of procedures such as nasogastric intubation and rectal examination
- Owners need more education/information on the different types of colic, their presentations, treatments and outcomes
- Unmoderated online forums for owners to discuss colic would be useful
- Moderated online forums for owners to discuss colic would be useful

Third round – statements that did not reach consensus (25-75%)

- Do you consider that some ponies may show reduced signs of pain, behavioural changes, or changes in appetite compared to horses?
- Do you consider that some geriatric horses may show reduced signs of pain, behavioural changes or changes in appetite compared to younger middle aged horses?
- Portable field-side/stall-side blood lactate tests should be considered in primary assessment of critical cases prior to referral