Factors associated with arthritis self-efficacy in people living with knee osteoarthritis

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Thesis submitted to the University of Nottingham for the degree of Doctor of Philosophy

March 2019

Abstract

Background: People living with knee osteoarthritis (OA) have unrelenting pain and functional limitations and are less likely to self-manage their knee OA through exercise, especially those with activity-related knee pain. Previous research has shown that self-efficacy has a consistent relationship with knee OA symptoms, depression, and physical limitations. Thus, it is important to target the determinants of sub-optimal self-efficacy perceptions, as it could be helpful for people living with knee OA to increase their self-beliefs in successful self-management of arthritis. There is a gap in the literature to investigate the relationship between the different variants of self-efficacy and psychosocial factors, and whether any of these are predictors of arthritis self-efficacy.

Aim: Investigate and explore which self-efficacy and psychosocial factors predict arthritis self-efficacy in people living with knee OA who have experienced participating in an OA-specific education and exercise programme and those who have not.

Methods: Sequential explanatory mixed methods design comprising of an initial quantitative phase followed by a qualitative phasewas used. In the quantitative phase, the data was collected through questionnaires to investigate the relationship and predictors of exercise self-efficacy, multidimensional outcomes expectations for exercise, general health status, knee confidence, knee pain perception, depression with arthritis self-efficacy, using multiple linear regression models. In the qualitative phase, semi-structured interviews were used to explore the predictors of arthritis self-efficacy from the patients' perspectives. Interviews were analysed using Thematic Analysis.

Results: The quantitative analyses identified that knee confidence, female sex, depression, knee pain perception, and exercise self-efficacy were statistically significant predictors of arthritis self-efficacy in people with knee OA who have not had recent experiences of participating in an OA-specific education and exercise programme. The strongest predictor of increased

arthritis self-efficacy was higher knee confidence (unstandardized coefficient (β) = 1.037, *p*= .009). The questionnaire findings from participants who have been involved in an OA-specific education and exercise programme revealed that knee confidence, knee pain perception, general health status, and exercise self-efficacy were predictors of arthritis self-efficacy, again, with high knee confidence being the strongest predictor of increasing arthritis self-efficacy (β= .667, *p*= .001). The participants from the interviews reflected on the importance of receiving appropriate information on self-management of arthritis, the knowledge of exercises that are safe for their knee and receiving long-term follow-up with their clinician for them to perceive a better sense of successful self-management of arthritis. Similarly, participants with knee OA who had participated in the GLA:D® programme also reflected the importance of maintaining continue contact with their physiotherapist after the programme for support and reassurance that they were still performing their exercises in the correct manner and to help with motivation to maintain the GLA:D® exercises in the long-term. These comments suggested by participants in both studies of this thesis demonstrated components of BCTs which may benefit from inclusion in design of future intervention research aimed at enhancing arthritis self-efficacy in people living with knee OA. These BCTs include "Instruction on How to Perform the Behaviour" and "Demonstration of Behaviour" to gain knowledge on safe exercises and "Verbal Persuasion about Capability" and "Feedback on Outcomes of Behaviour" for regular follow-ups with clinicians.

Conclusion This thesis has identified factors that can predict low arthritis self-efficacy (i.e. those who have less knee confidence/more incidences of their knee giving way, less self-beliefs in exercise, more depressed, severe knee pain, and being male). Participants perceived that receiving long-term follow-up with their clinician would provide them with reassurance and encouragement to maintain therapeutic exercises in the long-term.

Acknowledgements

Firstly, I would like to say a huge thank you to all of the patients who have given up their time to participate in the studies for this thesis. Tusind tak for din tidog hjælp til min ph.d.-projekt, jeg er så taknemmelig! Without your contributions, none of this would have been possible. I would also like to thank the Patient and Public Involvement members at the Arthritis Research UK Centre for Sport, Exercise, and Osteoarthritis and the Arthritis Research UK Pain Centre for giving up their time to provide invaluable feedback and advice for the studies in this thesis.

A special thank you to my three supervisors, Dr Kim Edwards and Dr Shirley Thomas for your continued support, and guidance you have provided me. I always leave our supervisory sessions feeling hopeful! Professor Mark Batt, thank you for the encouragement and support you have given me throughout my PhD and beyond, especially with applying for the OARSI Collaborative Scholarship, it has provided me with the most amazing experience that I will cherish.

I would like to thank Jo Burkitt, Beth Norton, Jo Bartram, and Bronya Norton for your help and support, especially with finding rooms within university and hospital at short notice for my interviews! Thank you to Laura Buckley for all your help and support, this could not have happened without you!

Tusind tak til Professor Ewa Roos og Dr Søren Skou for giving me an invaluable opportunity to collaborate with you and making me feel a part of your team when I was in Denmark. It was inspirational to see all yourhard work and passion you have put into making the GLA:D® Initiative the best it can be for patients living with OA. I would also like to say thank you to Sarah, Anne-Marie, Eric, and Louise, for your help and time that you have spent with me teaching me about GLA:D®, the Danish language and culture. A special thanks also go to Heidi Flegal for your professionalism and for going above and beyond your call of duty with your translation and interpretation work.

I would like to express my gratitude to Professor Brigitte Scammell for being such a supportive and understanding employer, especially during the last month, to allow me time to finish my thesis.

Thank you to my family (mum, dad, Atheeta, Steve and Paulette, and my aunties and uncles in Thailand), I know you have not seen me out of my writing den for a long while, so thank you for being patient with me and for always sending your love and support my way! They have pulled me through this stressful period. I would also like to dedicate this thesis to my late aunt,

Mamee, thank you for being with me every step of the way. I love you and I miss you.

Johny, thank you for flying our bamboo flag oh so high and for believing in me! Your support throughout my PhD has been endless. Thank you for your love, words of encouragement, hugs, and a shoulder to cry on when morale was low. I really appreciate all the delicious meals you have cooked me and taking one for the team when I was busy writing up; now it is my time to bake banana bread for you! I am forever grateful and thankful to have you in my life.

Thank you to my besties - Zareen, Rafeah, Ami, Reena, Kafia, and Fiona for always being there for me, for listening to me, and for showering me with love and hugs. I appreciate all of the support you all have given me and making special trips up to Nottingham to see me when I was too busy to come home!

I would also like to thank my friends on the QMC F floor - Hessam, Arfan, Dale, Richard, Paul, Seán, Adel, and Kelvin. I have been incredibly fortunate to have met you all and to call you my friends. Thank you for always being so caring, thoughtful, and for listening to me when times were tough.

To my friends around the globe – Lindsey, thank you for all the giggles you have given me every time we chat. They always cheer me up after a long day. Kun, I'm thankful to have met you during that fire alarm incident – you have enhanced my social life in Nottingham. I finally had a buddy to eat out with! Alessio, Elerita, and Michael, thank you for welcoming me into your home and making my time in Denmark so memorable and fun!

Last but not least, I would like to thank Arthritis Research UK Centre for Sport, Exercise, and Osteoarthritis and the University of Nottingham for giving me the opportunity to undertake my PhD. And to the Osteoarthritis Research Society International for awarding me with the Collaborative Scholarship to make the project in Denmark possible.

Table of Contents

Chapter 1: Introduction 20

1.1 Setting the Scene 20

1.2 Purpose of this Thesis 22

1.3 Outline of this Thesis 23

Chapter 2: Background 27

2.1 Chapter Introduction 27

2.2 Systematic search strategy 27

2.3 Osteoarthritis 29

2.3.1 Knee Osteoarthritis 32

2.4 Symptoms of Knee Osteoarthritis 33

2.4.1 Knee Pain and Physical Function 34

2.4.2 Psychosocial Factors of Pain Management 36

2.5 Management of Knee Osteoarthritis 38

2.5.1 Non-Surgical Management of Knee Osteoarthritis 38

2.5.2 Knee Replacement Surgery 40

2.6 Exercise Therapy as a Treatment for Knee Osteoarthritis 42

2.6.1 Adherence to Exercise Therapy 45

2.7 Behaviour Change to Manage Knee Osteoarthritis 49

2.8 Self-Efficacy in Managing Knee Osteoarthritis 52

2.8.1 Self-efficacy and behaviour change 54

2.8.2 Arthritis Self-Efficacy 55

2.8.3 Exercise Self-Efficacy 58

2.9 Interventions and Behaviour Change Techniques for People Living with Osteoarthritis 61

2.9.1 Arthritis Self-Management Program/The Better Choices, Better Health® for Arthritis Program 61
2.9.2 Fit and Strong! Programme 64
2.9.3 Good Life with osteoArthritis in Denmark (GLA:D®) Initiative ... 67
2.10 Chapter Summary 71

Chapter 3: Methodology 75
3.1 Chapter Introduction 75
3.2 Worldviews 76
3.3 Mixed Methods Methodology 80
3.4 Methods of Data Collection 83
3.5 Chapter Summary 88

Chapter 4: The Association between Psychosocial Factors and Arthritis Self-Efficacy 90
4.1 Chapter Introduction 90
4.2 Methods 91
4.2.1 Patient and Public Involvement in Research 91
4.2.2 Questionnaire Measures 94
4.2.2.1 Demographics and Clinical Characteristics 94
Knee Pain Perception 95
4.2.2.2 Psychosocial Components 98
Arthritis Self-Efficacy 98
Exercise Self-Efficacy 101
Outcomes Expectations for Exercise 104
Knee Confidence 106
Depression 108

4.2.2.3 Physical Activity 110

International Physical Activity Questionnaire (Craig et al., 2003)..... 110

4.2.2.4 Knee functions and Quality of Life..... 115

Knee functions 115

General Health Status and Quality of Life 118

4.2.2.5 Follow-Up Questionnaire Measures 121

4.2.3 Sampling 123

4.2.3.1 Sampling Procedure 123

4.2.3.2 Eligibility Criteria 125

4.2.3.3 Sample Size..... 125

4.2.4 Questionnaire Survey Procedure..... 127

4.2.5 Informed Consent for a Questionnaire 128

4.2.6 Data Analyses 128

4.2.7 Ethics Approval 131

4.2.8 Ethical Considerations..... 131

4.3 Results 133

4.3.1 Description of Questionnaire Respondents at Baseline 133

4.3.2 Description of Questionnaire Sample Characteristics at Baseline 136

4.3.3 Missing Data..... 141

4.3.4 Factors Associated with Arthritis Self-Efficacy 143

4.3.4.1 The relationship between the Changes in Arthritis Self-Efficacy and Independent Variables 143

4.3.4.2 Variances in Arthritis Self-Efficacy Explained by the Independent Variables 151

4.3.5 Changes in Arthritis Self-Efficacy and its Associated Factors Overtime 158

4.3.5.1 Description of Follow-Up Questionnaire Respondents 158

4.3.5.2 Changes in Arthritis Self-Efficacy and its Factors Overtime 162

4.3.6 Investigation of Participants Lost to Follow-Up 166

4.4 Discussion 174

Chapter 5: Exploration of Factors Associated with Arthritis Self-Efficacy: Patients' Perspectives 179

5.1 Chapter Introduction 179

5.2 Key Risk Factors of Arthritis Self-Efficacy to Explore 180

5.3 Methods 181

5.3.1 Semi-Structured Interview Sampling 181

5.3.2 Interview Sample size 183

5.3.2.1 Theoretical saturation 183

5.3.3 Interview Guide 184

5.3.4 Interview Procedure 185

5.3.4.1 Interview Venue 185

5.3.4.2 Pilot Interviews 185

5.3.4.3 Interviews 185

5.3.4.4 Transcribing 187

5.3.5 Valid Informed Consent and Data Confidentiality 187

5.3.6 Data Analysis 188

5.3.6.1 Thematic Analysis Process 189

5.3.7 Inter-Coder Agreement 192

5.3.8 Ethical Approval 196

5.3.9 Ethical Considerations 196

5.3.10 Author's Perspective 198

5.4 Results 200

5.4.1 Description of Interview Respondents 200
5.4.2 Description of Interview Sample Characteristics 202
5.4.3 Qualitative Interview Findings 210
5.4.3.1 Attitude from self and others towards knee OA 213
5.4.3.2 Self-awareness of their knee OA 222
5.4.3.3 Beliefs about exercise and physical activity for the management of knee OA 232
5.4.3.4 What's lacking in the healthcare system 238
5.5 Discussion 251

Chapter 6: Factors Associated with Arthritis Self-Efficacy in People Living with knee OA who have had an Education and Exercise Programme 258

6.1 Chapter Introduction 258
6.2 Methods 259
6.2.1 Good Life with osteoArthritis in Denmark Initiative (GLA:D®) Initiative 259
6.2.2 Questionnaire Sampling 263
6.2.2.1 Questionnaire Sampling Procedure 263
6.2.2.2 Questionnaire Eligibility Criteria 264
6.2.2.3 Questionnaire Sample size 265
6.2.3 Questionnaire Measures 266
6.2.4 Questionnaire Procedure 269
6.2.5 Informed Consent for the Questionnaire 270
6.2.6 Questionnaire Data Analyses 270
6.2.7 Interview Sampling 271
6.2.8 Interview Sample Size 272
6.2.9 Interview Guide 272
6.2.10 Interview Procedure 273

6.2.10.1 Interview Venue 273
6.2.10.2 Interviews 273
6.2.10.3 Transcribing 274
6.2.10.4 Cross-Language in Qualitative Research 275
6.2.10.5 Conceptual Equivalence and Translator Credentials 275
6.2.10.6 Role of an Interpreter in the Interviews 277
6.2.11 Considerations for a Different Qualitative Approach 278
6.2.12 Valid Informed Consent and Data Confidentiality 279
6.2.13 Interview Data Analyses 280
6.2.14 Inter-Coder Agreement 280
6.2.15 Ethical Approval 283
6.2.16 Ethical Considerations 283
6.3 Results 284
6.3.1 Description of Questionnaire Respondents 284
6.3.2 Description of Questionnaire Sample Characteristics 286
6.3.3 Missing Data 291
6.3.4 Differences between Danish and UK Populations 292
6.3.5 Factors Associated with Arthritis Self-Efficacy in Participants who have had an Education and Exercise Programme 296
6.3.5.1 The relationship between the Changes in Arthritis Self-Efficacy and Independent Variables 296
6.3.5.2 Variances in Arthritis Self-Efficacy Explained by the Independent Variables 303
6.3.6 Patients' Perspectives of Factors Influencing their Arthritis Self-Efficacy 310
6.3.6.1 Interview Respondents 310
6.3.6.2 Interview Sample Characteristics 311

Themes from the Interviews 319
6.3.6.3 Managing and Awareness of knee OA 321
6.3.6.4 Symptoms of knee OA 323
6.3.6.5 Thoughts of the GLA:D® Programme 325
6.3.6.6 Payment for the GLA:D® Programme 329
6.3.6.7 Life after the GLA:D® Programme 334
6.3.6.8 Adherence to GLA:D® Exercises 338
6.4 Discussion 342
Chapter 7: Discussion 351
7.1 Chapter Introduction 351
7.2 Discussion of Findings 351
7.2.1 Factors Associated with Arthritis Self-Efficacy 351
7.2.1.1 Exercise Self-Efficacy 353
7.2.1.2 Depression 358
7.2.1.3 Knee Pain Perception 361
7.2.1.4 General Health Status 364
7.2.1.5 Female Sex 365
7.2.1.6 Knee Confidence 366
7.2.1.7 Other Factors Not Investigated 368
7.2.2 Links to Behavioural Change Techniques and the Theories 371
7.3 Strengths of the Studies in this Thesis 373
7.4 Limitations of the Studies in this Thesis 376
7.5 Implications of this Thesis 381

7.6 Chapter Summary 389

Chapter 8: Conclusions 391

References…. 393

Appendices Appendix 1 Study 1 participant information sheet 416

Appendix 2 Study 1 Questionnaire 418

Appendix 3 Study 1 interview guide 426

Appendix 4 Study 1 Extract of Billy's interview transcript 427

Appendix 5 Study 1 Henrietta's NVivo coding density 429

Appendix 6 Study 1 Interview screenshot of coding table on Microsoft Excel…… 430

Appendix 7 Study 2 participant information sheet 431

Appendix 8 Study 2 Questionnaire 433

Appendix 9 Study 2 interview guide 441

Table of Tables

Table 1 Kellgren-Lawrence grading scale of knee OA (Kellgren and Lawrence, 1957) 33

Table 2 Further treatments recommended by the NICE guidelines for knee OA in addition to the core treatments 39

Table 3 Demographics of Study 1 participants compared to the population in Nottingham and England 135

Table 4 Questionnaire return rate and deprivation rate of general practices in Study 1 136

Table 5 Participants' demographics of baseline questionnaire participants . 137

Table 6 Clinical characteristics of baseline questionnaire participants 138

Table 7 Study variables from respondents of the baseline questionnaire 139

Table 8 Missing data from baseline and follow-up questionnaires regarding participants' demographics and clinical characteristics 142

Table 9 Missing data of the study variables from baseline and follow-up questionnaires 143

Table 10 Variances and *F*-statistics between arthritis self-efficacy and study independent variables for the baseline questionnaire data..... 146

Table 11 Simple linear regressions for the baseline questionnaire data..... 149

Table 12 Multiple linear regression model with the variables included from the simple linear regressions 152

Table 13 Final multiple linear regressions model from the baseline questionnaire study..... 153

Table 14 Comparison of baseline and follow-up participants' demographics and clinical characteristics 159

Table 15 Study variables from respondents of baseline questionnaire..... 160

Table 16 Paired t-test for baseline and follow-up questionnaire data 164
Table 17 Wilcoxon signed-rank test for median difference between non-parametric variables at baseline and 6-month follow-up 165
Table 18 Demographics and clinical characteristics of questionnaire study participants lost to follow-up compared to those who completed the follow-up questionnaire 168
Table 19 Study variables of questionnaire study participants lost to follow-up compared to those who completed the follow-up questionnaire 169
Table 20 Differences between responders and non-responders to the follow-up questionnaire (independent-sample t-test† or the Welch t-test‡) 172
Table 21 Mann-Whitney U test for median difference or mean rank between non-parametric or ordinal variables for responders and non-responders to the follow-up questionnaire 173
Table 22 A blank example to show cross-tabulated table for the sampling of participants interviewed 183
Table 23 A cross-tabulated table for the sampling of participants interviewed (pseudonyms used) 203
Table 24 Demographics for interview participants compared to the questionnaire participants 204
Table 25 Clinical characteristics for all baseline questionnaire participants and interview participants 205
Table 26 Study variables for all baseline participants and interview participants 206
Table 27 Demographics and clinical characteristics of interview study participants 208
Table 28 Study variables of interview study participants 209

Table 29 Themes within the main theme of ‘Attitude from self and others towards knee OA’ 213
Table 30 Themes and sub-themes within the main theme of ‘Self-awareness of knee OA’..... 222
Table 31 Themes and sub-themes within the main theme of ‘Beliefs about exercise and physical activity for the management of knee OA’..... 232
Table 32 Themes and sub-themes within the main theme of ‘What’s lacking in the healthcare system’..... 238
Table 33 Participants' demographics of people with knee OA who has recently participated in the GLA:D® programme 287
Table 34 Clinical characteristics of people who have recently participated in an education and exercise programme..... 288
Table 35 Study variables from GLA:D® participants 289
Table 36 Missing data from questionnaire respondents (demographics and clinical characteristics)..... 291
Table 37 Missing data from questionnaire respondents (study variables) ... 292
Table 38 Demographics of baseline participants in Study 1 and Study 2 293
Table 39 Clinical characteristics of baseline participants in Study 1 and Study 2 294
Table 40 Variances and *F*-statistics between arthritis self-efficacy and study independent variables for the questionnaire data..... 299
Table 41 Simple linear regressions for questionnaire data..... 301
Table 42 Multiple linear regression model with the variables from the simple linear regressions 305
Table 43 Final multiple linear regressions model from the Denmark questionnaire study..... 306

Table 44 Participant demographic characteristics comparing the interview participants to the other questionnaire participants. 312
Table 45 Participant clinical characteristics comparing the interview participants to the other questionnaire participants. 314
Table 46 Participant study variables comparing the interview participants to the other questionnaire participants. 315
Table 47 A cross-tabulated table for the sampling of participants interviewed (pseudonyms used) 316
Table 48 Demographics and clinical characteristics of interview participants 317
Table 49 Study variables of interview participants 318
Table 50 Themes and sub-themes within the main theme of 'Managing and awareness of knee OA 321
Table 51 Themes for the main theme of 'Symptoms of knee OA'..... 323
Table 52 Themes within the main theme of 'Thoughts of the GLA:D® programme' (no sub-themes)..... 325
Table 53 Themes within the main theme of 'Payment for the GLA:D® programme' (no sub-themes)..... 330
Table 54 Themes within the main theme of 'Life after the GLA:D® programme' 334
Table 55 Themes and sub-themes within the main theme of 'Adherence to GLA:D® exercises' 338

Table of Figures

Figure 1 Structure of the Thesis 23

Figure 2 Search strategy used for the Ovid Medline database 29

Figure 3 A summary of the new OARSI 2014 guidelines for non-surgical management of knee OA; permission to use image granted from McAlindon et al. (2014), Stefan Lohmander (Editor-in-Chief of Osteoarthritis and Cartilage at time of request) on 24th July 2014 40

Figure 4 Three Basic Mixed Methods Designs taken from (Creswell, 2014) . 81

Figure 5 Study design flow diagram 85

Figure 6 The Knee injury and Osteoarthritis Outcomes Score (KOOS) profile comparing baseline with follow-up questionnaire respondents 161

Figure 7 The Knee injury and Osteoarthritis Outcomes Score (KOOS) profile comparing baseline, follow-up questionnaire respondents, and participants lost to follow-up 170

Figure 8 Coding scheme from thematic analysis of interviews 211

Figure 9 Thematic map of themes from Study 1 interviews 212

Figure 10 Participants for Study 2 285

Figure 11 Locations of GLA:D® programme patients who were interested in participating in the interview phase of the study 311

Figure 12 Coding scheme from thematic analysis of interviews 319

Figure 13 Thematic map of themes and links between the themes from interviews with GLA:D® participants 320

Chapter 1

Introduction

Chapter 1: Introduction

1.1 Setting the Scene

Osteoarthritis (OA) is the most common joint disorder, which affects approximately 8 million people in the United Kingdom (UK) (Arthritis Research UK, 2013). The knee is the most common site in the body to have OA (Arthritis Research UK, 2013). People with knee OA have pain, limited physical function, muscle weakness and psychosocial limitations (van Dijk et al., 2009, Marks, 2014). Current published research in this field emphasise the importance of minimising pain and improving function in people living with OA by assessing and treating both the biological as well as the psychosocial consequences of this condition (Somers et al., 2009)

A recent systematic review and meta-analysis from Uthman et al. (2013) concluded there was sufficient high-quality evidence of the significant benefit of exercise over no exercise in people with lower limb OA in terms of relieving pain and improving function. Despite the immediate and short-term benefits of exercise (Fransen et al., 2015, Uthman et al., 2013), adherence to exercise declines significantly over time (Ettinger et al., 1997, Pisters et al., 2010). Adherence is important, as it is a predictor of the long-term effectiveness of therapeutic exercise (Pisters et al., 2010).

Social Cognitive Theory (SCT) started as the Social Learning Theory (SLT) in the 1960s by Albert Bandura. It developed into the SCT in 1986 and theorises that learning occurs in a social context with a dynamic and reciprocal interaction of the person, environment, and behaviour (Bandura, 1986). The

unique feature of SCT is the emphasis on social influence and social reinforcement (internally and externally) (Bandura, 1986). SCT considers the unique way to explain how people regulate their behaviour through control and reinforcement to achieve goal-directed behaviour that can be maintained over time, while also considering the social environment in which individuals perform the behaviour (Bandura, 1986). Self-efficacy is a construct unique to the SCT, as this was added when the SLT evolved into the SCT. Self-efficacy is defined as an individual's beliefs about his or her capabilities to execute a specific task or perform a behaviour within a given context (Bandura, 1986).

There is a consistent link between self-efficacy, arthritis pain, disability, and adherence to recommended therapeutic strategies (Maly et al., 2005, Maly et al., 2007, Marks, 2014, Sharma et al., 2003). Also, self-efficacy is a strong explanatory factor in efforts to help people manage their arthritis (Sperber et al., 2014). Previous research has identified self-efficacy as a common cognitive mechanism mediating behavioural change to improve OA management and health outcomes, such as pain and physical function (Bandura, 1986, Marks, 2014, McAuley et al., 1991, Rejeski et al., 1998). Those with higher self-efficacy had a higher pain threshold, fewer symptoms, better quality of life (Marks et al., 2005a, Marks et al., 2005b) and better physical function compared to those with lower self-efficacy (Maly et al., 2005). Self-efficacy can influence one's choice of activities, motivation towards an activity, effort expended during the performance of the activity, and the degree of persistence with the activity (Bandura, 1986). However, very few current OA related publications focus on the possible important assessment and treatment opportunities afforded by the application of self-efficacy and its

theoretical principles, with regards to behaviour change and maintenance of this behaviour change over time.

1.2 Purpose of this Thesis

The overarching aim of thesis:

To investigate and explore the factors associated with arthritis self-efficacy from the perspectives of people living with knee OA.

Objective 1: Review the literature around arthritis self-efficacy and knee OA (Chapter 2)

Objective 2: Using factors identified in objective 1, investigate what factors are associated with arthritis self-efficacy in people living with knee OA (Chapter 4)

Objective 3: Investigate the changes over time in arthritis self-efficacy and its associated factors in people living with knee OA (Chapter 4)

Objective 4: Identify the key risk factors of arthritis self-efficacy, which would thus benefit from an in-depth exploration of patients' perspectives (Chapter 5)

Objective 5: Explore patients' perspectives on how and why they feel certain factors influence their self-beliefs in their abilities to successfully manage the symptoms of their knee OA (Chapter 5)

Objective 6: Investigate and explore the relationship between key factors participants identified as being associated with arthritis self-efficacy (Chapter 5), in people living with knee OA who have recently participated in an OA-specific education and exercise programme (Chapter 6)

1.3 Outline of this Thesis

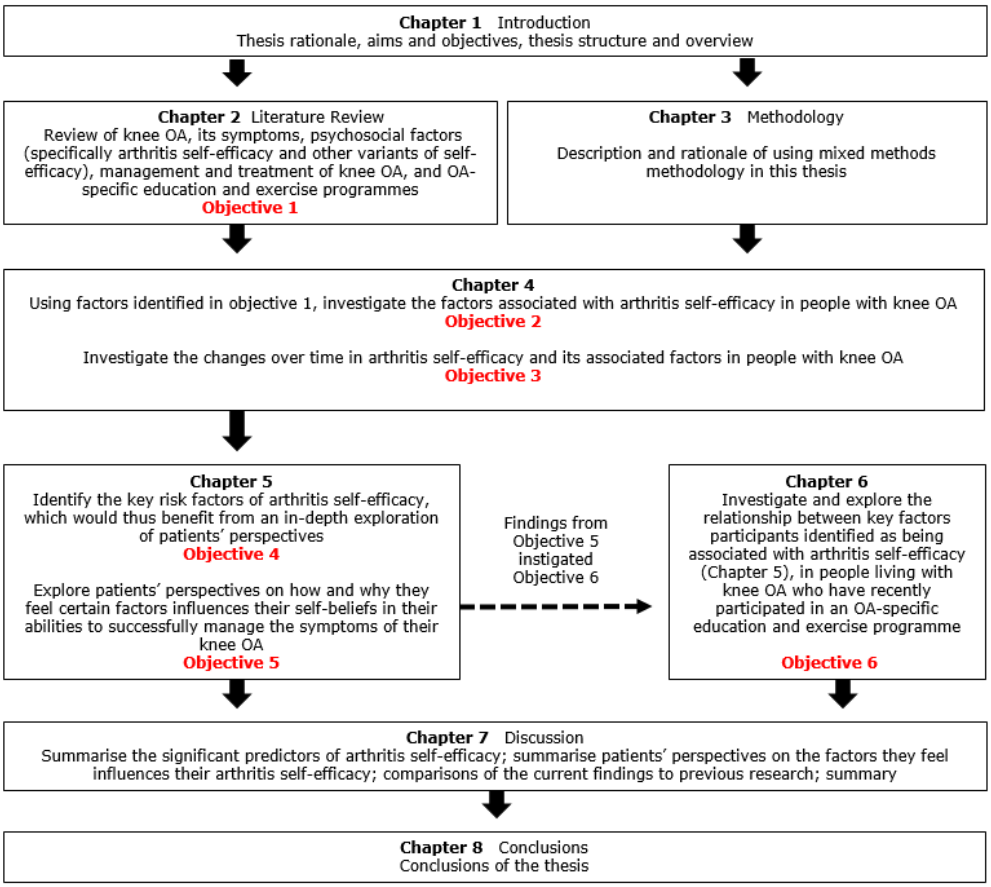


Figure 1 Structure of the Thesis

This thesis comprises of eight chapters (Figure 1). The next chapter (Chapter 2) provides a background of OA, specifically knee OA and its symptoms. The recommended management methods are then described, explicitly focusing on exercise therapy as treatments for people living with knee OA. To follow is a discussion of exercise adherence and behaviour change techniques and self-efficacy. Then, intervention programmes to improve self-efficacy and their links with behavioural change techniques will be described and discussed. The knowledge gained from the literature review will help meet Objective 1.

Chapter 3 provides a description of mixed methods methodology and the rationale for the choice of using a mixed methods methodology to meet the objectives of this thesis. The methods of data collection will be briefly described in this chapter, but the detailed study-specific methods of data collection and data analyses will be described in each chapter (Chapters 4, 5, and 6) accordingly in the 'Methods' sections.

The structure of Chapter 4 begins with a chapter introduction, then the methods used for the study discussed in this chapter, the results, and discussion of the key findings. Chapter 4 follows on from the identification of factors associated with self-efficacy from the literature review in Chapter 2, and this chapter aims to investigate which factors are associated with arthritis self-efficacy in people living with knee OA (Objective 2). Furthermore, the changes in arthritis self-efficacy beliefs and its associated risk factors in people living with knee OA will be observed over 6 months (Objective 3).

Chapter 5 begins with a chapter introduction, followed by the methods used to explore the patients' perspectives of factors associated with arthritis self-efficacy. The results section will begin with an explanation of the key risk factors of arthritis self-efficacy, which are worth exploring in more depth (Objective 4) and justification of using a mixed methods design. Subsequently, the patients' perspectives of why and how certain factors influenced their arthritis self-efficacy (self-beliefs in their abilities to successfully manage their arthritis) will be described and discussed (Objective 5).

A main theme identified by people living with knee OA from the semi-structured interviews described in Chapter 5 was ‘the lack of education around knee OA, its treatment, and exercise programmes available’. Therefore, this finding instigated Objective 6 (Chapter 6) to explore the perspective of people living with knee OA who had recently been involved in an education and exercise programme to see if they felt the education and exercise programme was beneficial and what factors were associated with arthritis self-efficacy in this population. This chapter begins with a chapter introduction and an explanation of why the study in this chapter was conducted, the methods used for this study, the results will be described and discussed.

Chapter 7 will bring together the discussion of significant predictors of arthritis self-efficacy identified by people living with knee OA, comparisons will be made of current research in this field, and the contributions of the findings from this thesis to research in this field. The strengths, limitations, and implications from the results of this thesis will be discussed.

Chapter 8 will bring together the summary of the key findings from this thesis and conclusions of this thesis.

Chapter 2

Background

Chapter 2: Background

2.1 Chapter Introduction

OA is the most common joint disorder, which affects approximately 8 million people in the United Kingdom (UK) (Arthritis Research UK, 2013). The knee is the most common site in the body to have OA and the most common symptom reported by individuals with knee OA is knee pain (Johnson and Hunter, 2014). Biochemical and mechanical problems with the joint and psychological factors can influence an individual's knee pain perception (Johnson and Hunter, 2014). This chapter will begin with exploring the symptoms of knee OA and the current management guidelines for knee OA, focusing on the benefits of exercise therapy as a form of treatment for knee OA. Issues surround adherence to therapeutic exercise will be discussed. Then, behaviour change factors linked with self-efficacy will be discussed along with three intervention programmes aimed at enhancing self-efficacy in people with OA.

2.2 Systematic search strategy

A systematic search strategy was used to ensure a thorough search for the studies and papers in the areas relevant to the aims of this thesis (OA; self-management; self-efficacy; and theories of behaviour change). The design of the search strategy was an iterative process, and required revisions before the final articles were chosen for this chapter. As this chapter focuses on people living with OA and psychological factors that could influence their self-efficacy in their ability to manage their condition, the following relevant databases were

used to conduct the searches: PsycINFO 1806-2019; Ovid MEDLINE(R) and In-Process & Other Non-Indexed Citations 1946-2019; and Cumulative Index to Nursing and Allied Health Literature (CINAHL) 1982-2019. An example of the search terms is shown in Figure 2. Searches in the other databases used identical or similar search terms (variations in search terms were due to different terminologies used in different databases). Search terms were centred around four key terms: behaviour/theories; self-management/pain management; exercise; and osteoarthritis. The 'explode' (shown as 'exp' in Figure 2) and free-text (shown as 'mp.' in Figure 2), and 'OR' functions were used to expand the search terms before the 'AND' function was applied at the end of the search strategy to produce the final combination of hits (Figure 2).

Some search combinations produced too many articles, so the author decided that if the search combinations returned with over 1000 hits, the search combinations were reviewed and refined, as it was too broad. The 1000 hits threshold was based on results of a similar search conducted in a critical review of self-efficacy and arthritis disability by Marks (2014); the author accepted only English language publications concerning arthritis disability and self-efficacy. However, the search strategy in this thesis included additional topic areas such as behavioural change and theories, which narrowed down the number of hits when the 'AND' function was used, so the threshold was reduced to 500 hits, as this search was more specific than the previous search conducted by Marks (2014). From the searches that returned less than 500 hits, the author assessed the titles and abstracts and discarded those that were not related to aims of the study (i.e. not related to OA or self-efficacy or self-management). These searches were completed for each database:

Medline Ovid (103 hits); PubMed (308 hits); PsycINFO (27 hits); and CINAHL (91 hits).

Ovid MEDLINE(R) and In-Process & Other Non-Indexed Citations 1946-2019

1 exp Behavior/

2 behavio*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]

3 behavio* change technique*.mp.

4 behavio* mechanisms.mp.

5 exp Behavioral Sciences/

6 exp Pain Management/

7 pain management.mp.

8 self-management.mp.

9 exp Self-Management/

10 exp Social Theory/

11 exp Exercise/

12 exp Exercise Therapy/

13 exercise.mp.

14 physical activity.mp.

15 exp Osteoarthritis/

16 theor*.mp.

17 behavio* theor*.mp.

18 1 or 2 or 3 or 4 or 5 or 10 or 16 or 17

19 6 or 7 or 8 or 9

20 11 or 12 or 13 or 14

21 **15 and 18 and 19 and 20 (final combination)**

Figure 2 Search strategy used for the Ovid Medline database

2.3 Osteoarthritis

Osteoarthritis (OA) is the most common chronic degenerative joint disorder, which affects the cartilage, subchondral bone, and synovial membrane (Felson et al., 1988). The earliest manifestation of OA is the presence of cartilage degradation, subchondral bone thickening, and osteophytes

formation (new bony spurs), which leads to joint space narrowing (Gelber, 2014). Additionally, the synovium may thicken and produce excess synovial fluid causing the swelling and inflammation of the joint (synovitis) (Arthritis Research UK, 2013, Felson et al., 1988).

OA is a metabolically active, dynamic process that involves the repair process of the synovial joint from tissue loss to new tissue synthesis (The National Collaborating Centre for Chronic Conditions, 2008). Trauma to the joint will initiate the repair process resulting in a structurally altered joint; the occurrence of this repair helps limit the symptoms of OA. However, the exposure of the joint to repeated or overwhelming trauma in which the repair process cannot compensate for the joint damage and continuous tissue loss, this may result in symptomatic OA (The National Collaborating Centre for Chronic Conditions, 2008).

Furthermore, the OsteoArthritis Research Society International (OARSI) have recently developed a standardised definition of OA as *"a disorder involving movable joints characterised by cell stress and extracellular matrix degradation initiated by micro- and macro-injury that activates maladaptive repair responses including pro-inflammatory pathways of innate immunity. The disease manifests first as a molecular derangement (abnormal joint tissue metabolism) followed by anatomic, and/or physiologic derangements (characterized by cartilage degradation, bone remodelling, osteophyte formation, joint inflammation and loss of normal joint function), that can culminate in illness"* (page 8; (Kraus et al., 2015)).

The diagnosis of OA is made clinically and then confirmed by radiography (Hunter and Felson, 2006). Confirmation of OA by radiographic imaging is a well-established method for evaluating the pathology of OA, as they can reveal joint space narrowing, the presence of osteophytes, subchondral bone thickening, subchondral bony cyst formation, and calcification (Johnson and Hunter, 2014).

The most recent National Institute for Clinical Excellence (NICE) guidelines, version CG177, for the care of people with OA provides guidance for a clinical diagnosis of people with OA without further investigation if a person is 45 years old or over, has activity-related joint pain, and has either no morning joint-related stiffness that lasts no longer than 30 minutes (The National Institute for Health and Care Excellence, 2013). Additionally, other features include reduced joint movement, swelling, and crepitus (Hunter and Felson, 2006). Also, clinicians are advised to be aware of atypical features, such as a history of trauma, prolonged morning joint-related stiffness, rapid worsening of symptoms or the presence of a hot swollen joint, as these might indicate alternative or additional diagnoses, such as gout, rheumatoid arthritis, septic arthritis, or malignancy (bone pain) (The National Institute for Health and Care Excellence, 2013). Evaluation of clinical OA consists of using the visual analogue scale (VAS) for pain and the Western Ontario and McMaster Universities OA Index (WOMAC) for pain, stiffness, and physical function as the outcome measures for OA (Kinds et al., 2011).

2.3.1 Knee Osteoarthritis

The knee is the most common joint in the body to have OA (Johnson and Hunter, 2014). The knee enables the leg to flex, extend, and rotate, while also bearing the entire weight of the body. The stress and impact of weight, movements such as twisting and turning can make the knee susceptible to OA (White et al., 2013). Knee OA can make everyday activities, such as walking, standing, and sitting extremely painful, and thus can diminish people's energy levels in the effort expended to carry out daily tasks (White et al., 2014).

In the UK, 4.71 million people have sought treatment for knee OA compared to 2.12 million for hip OA (Arthritis Research UK, 2013). Of the 4.71 million people who have sought treatment for knee OA, 50% are of working age, 25% are between 65-74 years old, 25% are 75 years old or over (Arthritis Research UK, 2013). Considering the growing population, increase in longevity, and the increasing rate of obesity in the UK, the number of people with knee OA is estimated to reach 6.5 million by 2020 and 8.3 million by 2035 (Arthritis Research UK, 2013).

The high-risk factors for OA include being aged 45 years old or over, female sex, obesity, African-American and Caucasian ethnicities, genetic factors, high level of high-impact sports participation, previous joint injury, and occupations that involve repetitive joint use (Johnson and Hunter, 2014). In addition to personal risk factors, local mechanical factors, such as misalignment, muscle weakness, or alterations in the structural integrity of the joint environment (through meniscal damage) can facilitate the progression of the disease in people at risk of knee OA (Hunter and Felson, 2006). Also, joint loading can

be affected by obesity and joint injury, both of which increases the likelihood of developing OA or progression of OA (Hunter and Felson, 2006).

A radiological tool which is traditionally and widely used to define the presence and the severity of knee OA is the Kellgren-Lawrence grading scale ranging from 0-4, with grade 2 or more defined as radiographic knee OA(Kellgren and Lawrence, 1957, Kellgren and Lawrence, 1963) (Table 1).

Table 1 Kellgren-Lawrence grading scale of knee OA (Kellgren and Lawrence, 1957)

Grade	Criteria
0	Normal
1	Doubtful narrowing of joint space – possible osteophytes
2	Definite osteophytes, absent or questionable narrowing of joint space
3	Moderate osteophytes, definite narrowing of joint space, some sclerosis, possible deformity
4	Large osteophytes, marked narrowing of joint space, severe sclerosis, definite deformity

2.4 Symptoms of Knee Osteoarthritis

Symptoms of knee OA often include activity-related joint pain, morning stiffness (lasting less than 30 minutes), and reduced physical function of the joints. Other symptoms also include knee giving way due to muscle weakness or unstable joint structure, reduced range of motion in the knee joint, joint crepitus, tenderness, bony swelling, and knees becoming bent or bowed (Hunter and Felson, 2006). Furthermore, those with severe knee OA may experience nocturnal knee pain and poor quality of sleep (Sasaki et al., 2014).

2.4.1 Knee Pain and Physical Function

OA commonly presents as joint pain in adults and pain is the most common reason people seek medical attention (Hunter and Felson, 2006). Knee pain may be worsened by activity and relieved by rest. However, people with more advanced knee OA also report knee pain at rest and during the night (Hunter and Felson, 2006). Furthermore, knee pain is a major reason for knee replacement surgery in those with knee OA (Nguyen et al., 2011).

Pain is defined as "*an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage"* by the International Association of the Study of Pain (page 210 (Merskey, 1986)). Pain is a complex and subjective phenomenon, and individuals have a unique interpretation and perception of pain (Simon, 2012). Pain is influenced by biological factors (i.e. the extent of the illness genetic factors that affect pain tolerance); psychological factors (i.e. anxiety, fear, depression, helplessness to manage the pain); and social factors (i.e. the response of others to the pain) (Simon, 2012). Pain usually has a protective role in warning someone of a particular threat that something is wrong, for example, pain from touching a hot stove; this type of pain is usually relieved over time (Neogi, 2013). However, pain in OA is chronic and does not always relieve or heal with time. There are two types of OA pain: one which is an intermittent, intense pain that can be unpredictable and has a more significant impact of quality of life compared to the other type of OA pain, which is a more persistent background pain and ache (Dubin and Patapoutian, 2010, Hawker et al., 2008). Both types of pain have adverse effects on mood, sleep, and limits physical activity and tasks (Hawker et al., 2008).

Even though the primary symptom of OA is joint pain, the literature describes discordance between radiographic and clinical OA (Hannan et al., 2000). People with radiographic OA were more likely to have joint pain compared to those without radiographic changes, but severe radiographic changes could be present with few or no symptoms (Hannan et al., 2000). Therefore, joint damage seen radiographically predisposes to joint pain, but the severity of OA seen on the radiograph bears little relation to the severity of the pain experienced by the patient (Dieppe and Lohmander, 2005). The level of pain associated with OA often fluctuates and can be affected by factors such as weight, physical activity level, climate, and time of day (Liddle et al., 2013). Therefore, biomechanical problems with the knee joint may not be a sole factor causing the feeling of pain.

Furthermore, a systematic search and summary of the literature on the discordance between clinical and radiographic knee OA concluded that different sources of chronic knee pain exist simultaneously (Bedson and Croft, 2008). Even though plain radiographs are a well-established method in evaluating knee OA pathology, it should not be used in isolation when assessing individuals with knee pain (Bedson and Croft, 2008), as people with radiographic knee OA may not be experiencing knee pain or disability and vice versa. Chronic knee pain is linked to non-physical, cognitive, and emotional sources, such as depression, systematic disease (e.g. cancer), and non-OA pathology (e.g. tendonitis) (Bedson and Croft, 2008). Most published studies assume that knee joint pathology is the primary cause of knee pain, but the search for factors other than radiographic changes that cause knee

pain has become increasingly important to explain the variance in knee pain in people with knee OA (Dieppe and Lohmander, 2005).

2.4.2 Psychosocial Factors of Pain Management

There is a complex interaction between local events in the knee joint, pain sensitisation, the experience and perception of pain, and what people are doing in their everyday lives (Dieppe and Lohmander, 2005). Psychosocial factors have been identified as important determinants of pain (Dieppe and Lohmander, 2005) because the experience of pain is modulated by psychological, social, economic, and other contextual factors (Hunter and Felson, 2006). Thus, the context of pain is essential in these complex interactions (Dieppe and Lohmander, 2005).

Backman (2006) defined psychosocial factors as being comprised of two dimensions of experiences: 1) the psychological component (cognitive and emotional) and 2) the social component (interacting with others and engaging in life activities). Potential psychosocial factors associated with pain management and self-efficacy in people with arthritis include factors associated with poor pain control (such as, catastrophising, anxiety and fear, helplessness) and factors associated with effective pain control (such as, self-efficacy, pain coping strategies, readiness to change) (Keefe et al., 2004).

Furthermore, psychosocial manifestations such as depression and anxiety, limitations in activities, sleep disturbances, and poor quality of life from arthritis may impact self-efficacy perceptions (Marks, 2014). Anxiety is the presence of feeling fear or nervousness about what might happen (Sharma et al., 2016)

and is considered an anxiety disorder when this fear produces behavioural and physiological change (American Psychiatric Association, 2013). Whereas, depression is the presence of feeling sad, empty, or an irritable mood (Sharma et al., 2016). Both anxiety and depression are accompanied by somatic and cognitive changes that can significantly affect an individual's capacity to function (American Psychiatric Association, 2013), which may predispose patients to experience pain more often by altering their pain threshold levels (Neogi et al., 2010). Furthermore, chronic pain can cause or aggravate anxiety and depression (Neogi et al., 2010), and thus leads to a vicious cycle, which can significantly impact the progression and management of knee OA.

There is considerable overlap in reporting of the impact of anxiety and depression in patients with OA in the literature, as there is comorbidity in people with anxiety and depression (Sharma et al., 2016). Anxiety and depression are interrelated with pain and physical limitation, which are the primary outcomes of knee OA, and can significantly impair patient's quality of life by altering their pain perception and functional capacity (Sale et al., 2008).

However, the literature reports conflicting results for the success of intervention programmes for people with OA, anxiety, and/or depression (Sharma et al., 2016). Some reported that self-management interventions do not improve pain, quality of life, or depression (Crotty et al., 2009), but on the contrary, self-management does produce improvement in exercise in patients with depression although not as much as in patients without depression (Nour et al., 2006). The different self-management programmes, telephone support programmes, and pharmacological treatments reported in the literature

indicate a lack of standardised intervention programme for people with these comorbidities and thus may have led to the conflicting results. Also, recruitment and retention of people who have depression into self-management programmes are challenging, as this group of patients may have a lack of interest from the beginning and have less interest in starting or maintaining a self-management programme.

2.5 Management of Knee Osteoarthritis

2.5.1 Non-Surgical Management of Knee Osteoarthritis

The National Institute for Health and Care Excellence (NICE) provides a guideline to the National Health Service (NHS) for treatment and care of people with all forms of OA (The National Institute for Health and Care Excellence, 2013). The current NICE guidelines version CG177 recommends for all patients with OA to 1) have access to the appropriate information about OA and self-management, 2) encourage patients to be active and participate in physical activity or exercise, and 3) achieve weight loss (through diet and exercise) if patients are overweight or obese. Only if these measures fail to improve patient's health should interventions that require medical supervision, such as pharmacological treatments, physiotherapy, and the use of walking aids and appliances be considered (Table 2).

Table 2 Further treatments recommended by the NICE guidelines for knee OA in addition to the core treatments

Non-pharmacological Treatment	Pharmacological Treatment
Walking aids and braces	Paracetamol
Local heat and cold therapy	Oral or topical non-steroidal anti-inflammatory drugs (NSAIDs)
Shock-absorbing shoes and insoles	Opioids
Transcutaneous electrical nerve stimulation (TENS)	Capsaicin

Recently, the OsteoArthritis Research Society International (OARSI) updated their guidelines for non-surgical management of knee OA (McAlindon et al., 2014) to include additional treatments tailored to individual patient's type of OA and the presence of any co-morbidities. Tailored strategies are needed to consider an individual's self-beliefs, confidence, and prior exercise experiences to ensure the best treatment is prescribed to them (Martin et al., 2001). Figure 3, taken from McAlindon et al. (2014), provides a summary of the recommended treatments for different circumstances of knee OA.

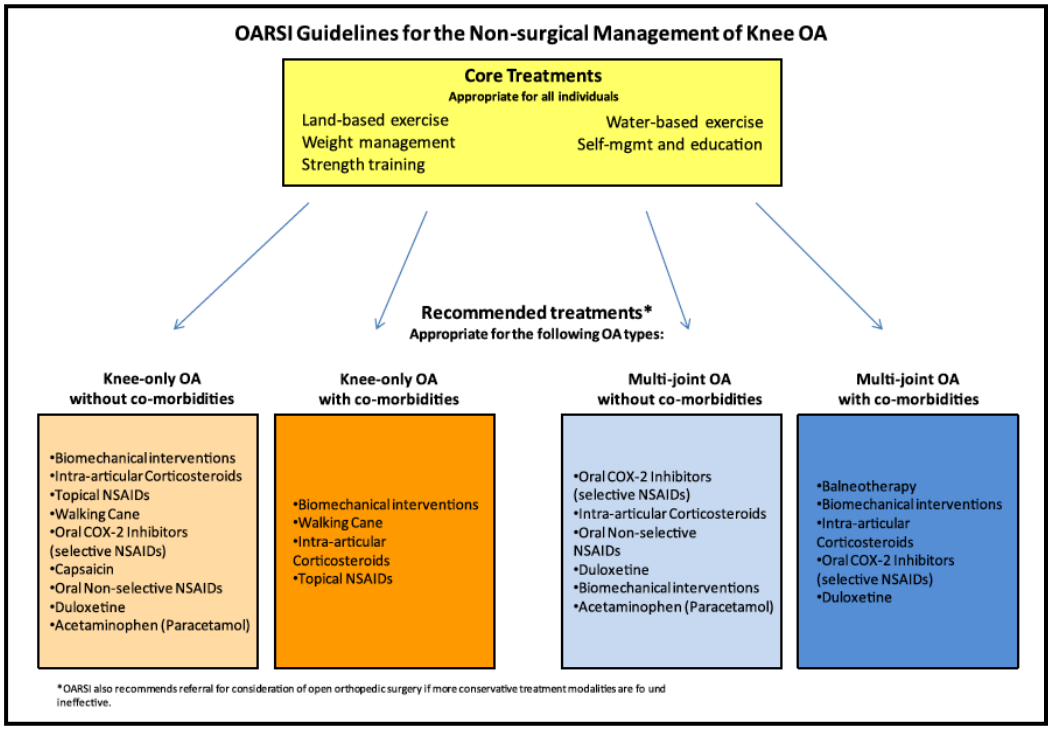


Figure 3 A summary of the new OARSI 2014 guidelines for non-surgical management of knee OA; permission to use image granted from McAlindon et al. (2014), Stefan Lohmander (Editor-in-Chief of Osteoarthritis and Cartilage at time of request) on 24th July 2014

2.5.2 Knee Replacement Surgery

A total knee replacement (TKR) surgery is considered for people who experience joint symptoms from knee OA and have typically exhausted the recommended non-surgical treatments (The National Institute for Health and Care Excellence, 2013). OA accounted for 98% of the indications for primary knee replacement procedures in the UK in 2012 and the demand for knee replacement surgeries is continuing to rise with just over 90,000 knee replacement procedures performed in England and Wales in 2012, a 7.3% rise from 2011 (National Joint Registry, 2013). The cost of joint replacement

surgeries in the UK was £852 million in 2010 (of which £426 million was spent on knee joint replacement surgeries) (Chen et al., 2012).

For those with severe symptomatic OA, joint replacement is very effective (Dieppe and Lohmander, 2005). The benefits of TKRs include a reduction in pain and improvements in joint mobility (Nilsdotter et al., 2009). However, despite these benefits, approximately 18% of patients were dissatisfied with the outcomes of their TKR (Bourne et al., 2010, Dunbar et al., 2013). Thus, TKRs may not be achieving the goal of pain relief and functional restoration in a proportion of patients.

Furthermore, there are discrepancies between clinician and patient satisfaction of TKR (Bourne et al., 2010). Surgeons were satisfied with findings on radiographs and range of joint movement post-surgery, whereas subjectively, patients were unsatisfied with their quality of life outcomes despite positive objective outcomes (such as radiograph findings and range of movement post-surgery) of the surgery (Drexler et al., 2013). In support of this, predictors of pain do not equate to functional outcomes, as patients can feel pain relief after the surgery, but they are still not as mobile as they had anticipated (Judge et al., 2012). Patient satisfaction is highly correlated with pain relief followed by improvement in function, and patient dissatisfaction is due to unmet expectations post-surgery (Dunbar et al., 2013), suggesting that patients may expect to go back to full functionality too soon after the surgery.

2.6 Exercise Therapy as a Treatment for Knee Osteoarthritis

The World Health Organization (WHO) defines physical activity as "*any bodily movement produced by the skeletal muscles that require energy expenditure"* (World Health Organization, 2016). For example, unstructured activities, such as housework and gardening. Whereas, therapeutic exercise is a sub-category of physical activity and is planned, structured, repetitive, and purposeful for the improvement or maintenance of a specific health condition or disease, such as aerobic exercises performed for a set duration of time to improve symptoms of knee OA (World Health Organization, 2016). This thesis will focus on the concept of therapeutic exercise.

A systematic review and meta-analysis from Uthman et al. (2013) concluded that as of 2002, there was sufficient evidence in the literature of the significant benefit of exercise over no exercise in people with lower limb OA, in terms of relieving pain (medium and large effect sizes) and improving function (medium effect size). For pain relief, exercise based on strengthening; flexibility plus strengthening; flexibility plus strengthening plus aerobic; aquatic strengthening; and aquatic strengthening plus flexibility were significantly more effective than no exercise control group (Uthman et al., 2013). A combined intervention of strengthening, flexibility, and aerobic exercise was also significantly more effective than no exercise control group for improving functional limitations (Uthman et al., 2013). Thus, the authors suggest that exercise programmes aimed at increasing flexibility and aerobic capacity seem to be the "best" exercise option that clinicians can offer to patients (Uthman et al., 2013). However, the findings from this review are most

applicable for people with knee OA, as the evidence presented was primarily based on trials in people with knee OA.

However, different systematic reviews on exercise for OA have suggested different recommendations on the type of exercise that is beneficial at relieving pain and improving function. A Cochrane systematic review by Fransen et al. (2015) reported high-quality evidence of the short-term (2-6 months post-intervention) benefits of land-based therapeutic exercise for people with knee OA in moderately reducing pain and improved quality of life compared to control participants (an active group given any non-exercise intervention or no treatment group). Moderate-quality evidence showed that land-based therapeutic exercise improved physical function in those with knee OA compared to control participants (an active group given any non-exercise intervention or no treatment group) (Fransen et al., 2015). However, the papers in this review only investigated the effectiveness of exercise using measures of self-reported pain, physical function and quality of life, rather than objective measures, and may result in bias of recall or reporting.

The review by Fransen et al. (2015) identified a variety of therapeutic exercise programmes varying in delivery mode, type of exercise, exercise duration, frequency, and intensity but many studies did not provide a clear rationale for their choice of treatment for people with knee OA (Fransen et al., 2015). For example, the treatment session duration reported in the studies in this review ranged from 20 to 60 minutes; exercise frequency for monitored classes or individual clinic sessions ranged from one to five times a week; and the aerobic components in the exercise intervention achieved through walking or cycling programmes ranged from low to moderate intensity (Fransen et al.,

2015). Despite the large variations in the findings of the types and dosage (i.e. programme duration, frequency, and intensity) of exercise deemed optimum at reducing pain and improving function in people with knee OA, the authors recommended that any type of exercise programme that is performed on a regular basis and is closely monitored by health professionals can improve the short-term outcomes of knee OA (Fransen et al., 2015).

In contrast, another systematic review and a meta-regression analysis of randomised controlled trials by Juhl et al. (2014), on the impact of exercise type and dose on pain and disability in knee OA recommended that exercise therapy programme should focus on a single type of exercise, as this was more effective in reducing pain and patient-reported disability than exercise programmes with multiple types of exercises (i.e. combination of resistance, aerobic and performance exercises). The exercise used should focus on improving quadriceps strength, lower extremity performance, and aerobic capacity (Juhl et al., 2014).

The findings from these systematic reviews suggest that exercise should be considered the cornerstone non-surgical management for people with lower limb OA. However, there are differences in their recommendations of which type of exercise or exercises are the most effective for reducing pain and improving function in people with OA. It should be highlighted that the studies included in these systematic reviews reported findings from participants from the local communities and specialist rheumatology and orthopaedics clinics. These different groups of people will have different severity of OA (the former may have milder severity of OA compared to the latter group). Furthermore, different types of exercise interventions could have been used and tailored to

people with different severity of OA, which could have explained the variations in types and duration of exercise interventions tested. Future studies are needed to identify factors (such as severity of OA; symptoms; physical function; and psychosocial well-being) that may affect how people living with OA respond to therapeutic exercise interventions to ensure recommendations are appropriate and effective. Also, OA is a chronic condition, but the findings from these systematic reviews demonstrated the immediate or short-term effectiveness of exercise for people with OA (Fransen et al., 2015). It is essential to investigate the long-term effects of therapeutic exercise for people living with OA and how this may be affected by their disease progression.

2.6.1 Adherence to Exercise Therapy

The World Health Organization (2003) defined adherence as *"the extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider",* which emphasises that the patient is able to discuss and decide with their health care provider on the preferences of the care they wish to receive. Additionally, research shows patient involvement in the decision-making and individualising exercise therapies to their preferences is a more effective method of managing the symptoms of knee OA (Martin et al., 2005). Thus, it is essential for patients to be active at self-managing their condition to gain the most benefits from their treatment in a clinical setting.

Exercise has positive benefits in improving self-reported pain and disability, and improvements on performance measures of physical function (Ettinger et al., 1997, van Gool et al., 2005). Despite exercise providing immediate and

short-term clinical benefits (Fransen et al., 2015, Juhl et al., 2014, Uthman et al., 2013), adherence to exercise declines significantly over time (van Gool et al., 2005, Ettinger et al., 1997, Pisters et al., 2010). A decrease in the compliance to aerobic and resistance exercise at follow-up was seen in participants in the Fitness Arthritis and Seniors Trial (FAST), which compared aerobic exercise and resistance exercise with health education in older adults with knee OA. Eighty-five per cent of participants complied with the exercises at the 3-month follow-up, but this dropped to 70% at the 9-month and 50% at the 18-month follow-ups (Ettinger et al., 1997). Thus, better strategies need to be developed to enhance long-term compliance with exercise regimens in older adults with OA (World Health Organization, 2016).

Similarly, the results from the Arthritis, Diet, and Activity Promotion Trial (ADAPT) (van Gool et al., 2005), a randomised controlled trial conducted among overweight and obese older adults with knee OA, reported a higher exercise adherence rate during the initiation phase (65.5%), compared to the overall exercise adherence in the 18-month duration (53.7%). The higher adherence rate may be due to the exercise sessions being held at a facility in the first four months in the trial with clinician contact. According to research from the Stages of Change model, the first six months is a crucial period for individuals who have intentions to change to adopt a new behaviour and maintain the new behaviour (Prochaska and Diclemente, 1983). However, most behavioural exercise-based interventions for patients with lower limb OA reported in a systematic review by Williamson et al. (2015) deliver concentrated interventions in less than 6 months with high contact between participant and provider but this contact was reduced after the trial or study period (Williamson et al., 2015). Improvements of translation into clinical

practice is required to investigate the effectiveness of remote versus face-to-face interventions and supervised versus self-directed interventions and the associated costs and benefits of each intervention. Currently, there is a lack of studies that have investigated and explored the changes over time to arthritis self-efficacy and factors associated with arthritis self-efficacy and the management of knee OA during the progression of knee OA.

This decline in exercise adherence is problematic, as adherence has been identified as a predictor of the long-term effectiveness of exercise therapy, both during and after a supervised treatment period (Fransen et al., 2015, Marks, 2012, Pisters et al., 2010). A systematic review of interventions to improve adherence to exercise for chronic musculoskeletal pain in adults reported that incorporating specific adherence-enhancing strategies within an exercise programme, including education and behavioural techniques such as goal setting, use of an exercise contract, and positive reinforcement may increase exercise adherence for people with chronic musculoskeletal pain (Jordan et al., 2010). However, only 18 of the 42 trials showed that supervised or individualised exercise therapy, refresher or follow-up sessions, and self-management strategies based on cognitive behavioural techniques enhanced adherence (Jordan et al., 2010).

A recent systematic review evaluated interventions in randomised controlled trials to increase adherence to therapeutic exercise, compared with contextually equivalent control interventions among older adults with chronic low back pain and/or hip/knee OA highlighted potential interventions that may be effective at increasing exercise adherence (Nicolson et al., 2017). Similar to the findings reported by Jordan et al. (2010) on techniques to enhance

exercise adherence, Nicolson et al. (2017) also reported that positive feedback and reinforcement of patient efforts, advice about posting self-reminders at home to complete exercises, the use of an exercise diary and the use of a 'treatment contract' may improve adherence. However, the findings from both these systematic reviews should be interpreted with caution, as different adherence measures were reported, some studies used objective measures such as accelerometers, some studies used self-reported occurrence of exercise measures, and some studies did not measure adherence as a primary outcome measure. Additionally, individual factors may influence adherence, such as the severity of the disease and personal factors, such as co-morbidities, self-efficacy to exercise, and the patients' interpretation of their preferred method of self-management. Thus, measuring exercise adherence is still challenging, which makes determining the specific component(s) in an intervention that enhances adherence to exercise difficult.

In summary, many factors are known to influence exercise adherence in people with knee OA. However, currently, there is no single measure of exercise adherence that is superior to the other in overcoming all barriers to exercise participation in all people with knee OA (Nicolson et al., 2017). Thus, it was suggested that using two or more methods might allow the strengths of one method to help compensate for the weaknesses of the other (Treuth, 2002). For exercise interventions to effectively facilitate behaviour change and improve long-term adherence to exercise, the use of theoretical rationale is critical when designing interventions (Lippke and Ziegelmann, 2008). Furthermore, the Medical Research Council guidelines recommend including theory within complex intervention study designs (Craig et al., 2013).

2.7 Behaviour Change to Manage Knee Osteoarthritis

Behaviour plays a crucial role in maintaining health, and in the prevention, management, and treatment of disease and disability (Carey et al., 2018). Management of chronic pain depends on how the patient chooses to cope with the pain and the changes they make in their behaviour to manage the pain.

Maintaining behaviour change can be difficult, as seen from previous studies on the barriers to adherence to exercise therapy (Ettinger et al., 1997, Pisters et al., 2010). Chronic pain self-management programmes require patients to change their behaviour and to learn and practice the advice given to them, which can be challenging if they do not have the motivation to change their behaviour (Jensen et al., 2003).

The use of theoretical rationale is crucial when designing intervention components for chronic pain self-management programmes for interventions to effectively facilitate behaviour change in patients (Lippke and Ziegelmann, 2008). The active components of behaviour change interventions are described differently in published literature, for example, “self-monitoring” may be labelled as “daily diaries”) (Ettinger et al., 1997)). The different descriptions used may lead to uncertainty and confusion of active components of behaviour change (Michie et al., 2013). Thus, Abraham and Michie (2008) developed a reliable characterisation of interventions in terms of behaviour change techniques (BCTs). BCTs are theory-based methods for changing one or more psychological determinants of behaviour (Michie et al., 2004). A BCT is defined as a replicable component of an intervention designed to alter or

redirect causal processes that regulate behaviour (i.e., a technique is proposed to be a potentially "active ingredient" in behaviour change) (Michie et al., 2013). BCTs enable behaviour change by enhancing factors that facilitate behaviour change, or by mitigating factors that inhibit behaviour change. For example, the BCT "Graded Tasks" (defined as: "set easy-to-perform tasks, making them increasingly difficult, but achievable, until the desired behaviour is performed" (Michie et al., 2013)) might change behaviour by increasing beliefs about one's capabilities (Carey et al., 2018).

Over the years, the taxonomy first developed by Abraham and Michie (2008) has further evolved into the BCT Taxonomy v1 (Michie et al., 2013). The BCT Taxonomy v1 is an extensive hierarchically organised taxonomy of 93 distinct BCTs, grouped into 16 clusters was developed in a series of consensus exercises involving 54 experts drawn from a variety of disciplines including psychology, behavioural medicine, and health promotion and from seven countries in delivering and/or designing behaviour change interventions (Michie et al., 2013). BCT Taxonomy v1 thus lays the foundation for the reliable and systematic specification of behaviour change interventions, which significantly increases the possibility of identifying the "active ingredients" within intervention components and the conditions under which they are effective, and of replicating and implementing effective interventions (Michie et al., 2013). The advantage in using the BCT Taxonomy v1 is that it is relevant to a wide range of behaviour rather than being restricted to a single behavioural domain. It also provides examples of how the BCTs can be implemented and gives users enough detail to operationalise BCTs in their interventions (Michie et al., 2013). BCTs can be used alone or in combination and are selected based on the theoretical constructs they are proposed to

target. For example, prompting mastery experience through behavioural practice is used to increase self-efficacy, based on Bandura's self-efficacy construct in the Social Cognitive Theory (SCT) (Bandura, 1977).

Guidelines for intervention development and evaluation (The National Institute for Health and Care Excellence, 2014) recommend the need to include a strong and rigorously applied theoretical basis to optimise the effectiveness of intervention effects (Sniehotta et al., 2015). However, the reporting of how interventions have their effects based on theoretical principles is low (Prestwich et al., 2014). An intervention may be described as having been informed by theory, but it does not mean it does if there are no explicit descriptions of how theory has been used to select BCTs and design interventions (Prestwich et al., 2014).

Carey et al. (2018) identified which specific BCTs were described as being linked to specific mechanisms of action reported in behaviour change literature. Mechanisms of action are constructs specified in theories of behaviour and behaviour change that can be seen to "mediate" intervention effects (Carey et al., 2018). Of 974 intervention articles retrieved, 72% were excluded based on full-text screening because the published intervention literature identified in the report did not explicitly describe links between BCTs and mechanisms of actions. These findings are consistent with previous meta-analytic results, which indicated that, although 50% of the interventions reviewed reported a theoretical basis, 90% did not report links between all BCTs and individual theoretical constructs (Prestwich et al., 2014). It is often unclear whether or how theory has been used in the selection of BCTs, and in the targeting and measurement of theoretical constructs that are mediating

variables in the change process. Thus, it can be challenging to draw generalisable theoretical conclusions, and any conclusions from intervention studies without theoretical constructs should be interpreted with caution (Carey et al., 2018).

2.8 Self-Efficacy in Managing Knee Osteoarthritis

Self-efficacy is defined as a person's belief in their capabilities to successfully perform a task or specific behaviour (Bandura, 1977, Bandura, 1997). Self-efficacy a construct of Bandura's Social Cognitive Theory (SCT) and theorises that people's performance was better predicted by their beliefs about their capabilities, rather than by their actual capabilities (Bandura, 1998). According to this construct, behaviour change and maintenance of a new behaviour are a function of outcomes expectations that will result from one's engagement in the behaviour and expectations about one's ability to engage in or execute the behaviour (Bandura, 1977). The SCT predicts that if a patient believed that they could exercise (self-efficacy expectation), but also believed that exercise would be harmful to their arthritis (outcome expectation), the patient would be less likely to exercise than if they expected positive outcomes of exercise (Bandura, 1977). Outcome expectations and efficacy expectations are different, but these constructs are often related (Bandura, 1998). Outcome expectation is described as the individual's *"estimate that a given behaviour will lead to certain outcomes"* (page 193) (Bandura, 1977). In contrast, efficacy expectation is *"the belief that one can successfully execute the behaviour required to produce the outcomes"* (page 193) (Bandura, 1977).

The SCT theorises that efficacy expectations can be altered by four primary sources of information: performance accomplishment/mastery experience, vicarious experience (observation), verbal persuasion, and the physiological state (Bandura, 1977). In performance accomplishments or mastery experience, successes raise mastery expectations, and repeated failures lower them. Strong efficacy expectations developed through repeated success and the effect of failure on personal efficacy depended on the timing and pattern in which the failures occurred (Bandura, 1977).

Many expectations are derived from vicarious experience, therefore seeing others perform activities deemed as threatening without adverse consequences can generate expectations in the observers that they too will not suffer consequences if they were persistent in their efforts towards a task (Bandura, 1977). However, the vicarious experience was a less dependable source of information about one's capabilities compared to one's accomplishments, as the expectation efficacy induced in this manner was more vulnerable to change.

Verbal persuasion is widely used to influence human behaviour, because of its ease and being readily available (Bandura, 1977). People are led to believe they could cope successfully with past overwhelming situations through positive suggestions. But efficacy expectations induced this way were likely to be weaker than those arising from one's accomplishments as they do not provide the experience of personally accomplishing a task (Bandura, 1977).

Emotional arousal and changes in physiological states from stressful situations might affect perceived personal capability (Bandura, 1977). Current

fear can generate fear of future stressful situations. By raising the fear-provoking thoughts about their incompetence, individuals can provoke themselves to elevated levels of anxiety that exceed the fear experienced during the actual threatening situation (Bandura, 1977).

Carey et al. (2018) reported that the definitions Bandura provide on mastery experience, vicarious experience, and verbal persuasion are similar to the BCTs “Behavioural Practice/Rehearsal,” “Demonstration of the Behaviour,” and “Verbal Persuasion about Capability,” respectively, all of which were linked to the mechanism of action called “Beliefs about Capabilities”, which is conceptually identical to the self-efficacy theory. The construct of “Beliefs about Capabilities” was the most frequently identified mechanism of action, which may reflect the relative clarity with which this construct has been linked to BCTs within behavioural theories (Carey et al., 2018).

2.8.1 Self-efficacy and behaviour change

Theories and models of human behaviour view behaviour change as influenced primarily by the perceived importance of behaviour change and the belief that behaviour change is possible (Bandura, 1977).Thus, self-efficacy affects people’s ability to learn, their motivation, and their performance, as people will often attempt to learn and perform only those tasks for which they believe they will be successful (Lunenburg, 2011). Manipulations of self-efficacy have been consistently powerful in initiating and maintaining change, supporting Bandura’s theory that efficacy expectations reflect a person’s perceived, rather than actual, capabilities (Carey et al., 2018). Thus, it is these

perceptions of abilities and not one's actual abilities that often influence behaviour.

Studies measuring the effect of a standard behaviour change programme on self-efficacy found overall increases in efficacy throughout the treatment and efficacy was related to short- and long-term success as a result of the programme (Allegrante and Marks, 2003). Survey studies of self-efficacy suggest strong associations between self-efficacy and progress in health behaviour change and maintenance (Allegrante and Marks, 2003). As self-efficacy can change through efficacy-enhancing interventions, this makes it a rich target of arthritis interventions

One of the strengths of the self-efficacy framework is its direct applicability to the practice of modifying health behaviours (Carey et al., 2018). Self-efficacy is a psychological attribute amenable to intervention. Given the evidence from self-efficacy and intervention literature (Marks, 2012, Marks, 2014, Marks et al., 2005a, McAuley et al., 2003, Nicolson et al., 2017, Nour et al., 2006), and findings from general behaviour change studies (Michie et al., 2004, Michie et al., 2013, Nicolson et al., 2017), suggestions about an overall strategy for enhancing self-efficacy in practice would include breaking the complexities of the target behaviour into components that are relatively easy to manage (Carey et al., 2018).

2.8.2 Arthritis Self-Efficacy

Arthritis self-efficacy is the belief someone has of being able to manage and control the symptoms of their arthritis successfully (Lorig et al., 1989). In the

context of a chronic disease, like OA, where on-going management is required, individuals with higher arthritis self-efficacy for controlling disease-related symptoms, such as pain, were also expected to have significantly higher pain threshold, fewer severe symptoms, fewer mobility limitations, and better quality of life compared to people with lower arthritis self-efficacy scores (Marks et al., 2005b). Individuals with higher arthritis self-efficacy scores had heightened personal perceptions concerning the controllability of their OA and their ability to carry out tasks and were more likely to adopt and maintain favourable health behaviours (Marks et al., 2005b). Furthermore, those with higher arthritis self-efficacy worked harder and persisted longer to achieve superior performance compared to a person who doubted their capabilities (Maly et al., 2007).

Pain and stiffness are the primary causes of restricted activities and disability in people with knee OA, which can negatively impact their quality of life. Individuals with pain-related fear of physical activity due to knee OA were less likely to engage in an active lifestyle and were more likely to experience a decline in physical function, leading to insufficient physical activity levels (Heuts et al., 2004, Shih et al., 2006). Identifying patients with low arthritis self-efficacy might help modify health behaviours among those with arthritis (Marks et al., 2005a). As self-efficacy is potentially modifiable and can impact health status, motivation levels, and adherence to prescribed regimens, intervention approaches that focus on self-efficacy hold much promise for improving chronic disease outcome (Marks et al., 2005a). Therefore, improving the beliefs in one's ability to manage symptoms and function was an essential goal of arthritis self-management education programmes (Brand et al., 2013).

A systematic review by Brand et al. (2013) evaluated studies that used arthritis self-management education alone or with exercise to improve arthritis self-efficacy scores of patients with knee OA. They concluded that exercise interventions currently used in conjunction with arthritis self-management education programmes for patients with knee OA did not improve patient self-efficacy any better than arthritis self-management education alone (small-to-moderate effect sizes observed) (Brand et al., 2013). This result could be due to the exercise interventions not designed with a theoretical component aimed at improving self-efficacy. Therefore, exercise interventions used in combination with arthritis self-management education programmes aimed at improving self-efficacy need to be developed to include components or active ingredients that enhance the self-efficacy of patients with knee OA. These components could include BCTs that have linked with the "Beliefs and Capabilities" mechanisms of action (conceptually identical to the self-efficacy theory), such as "Behavioural Practice/Rehearsal," "Demonstration of the Behaviour," and "Verbal Persuasion about Capability (Carey et al., 2018).

At present, it is unclear about what specific treatment approach is likely to be optimal in enhancing the arthritis self-efficacy level in people with knee OA. There is a gap in knowledge in the literature on what factors or variables influences knee OA patients' arthritis self-efficacy beliefs, which could be useful to consider when developing future interventions to enhance patients' self-beliefs in their ability to manage their OA. Thus, it is essential to investigate the factors associated with predicting increased arthritis self-efficacy beliefs to allow clinicians to focus on treating patients with low arthritis

self-efficacy and the factors that may be attributed to their decreased arthritis self-efficacy.

2.8.3 Exercise Self-Efficacy

Exercise self-efficacy (self-beliefs in their ability to exercise) is a variant of self-efficacy which has been found to predict greater physical activity level and exercise involvement (Marks and Evans, 2005). Exercise self-efficacy may also be an important factor that influences adherence to exercise (Marks, 2012), which may partially explain why a history of exercise participation is often a facilitator of exercise adherence.

Two theories of behaviour change that have been applied to exercise behaviour include the SCT (Bandura, 1998) and the Stages of Change construct in the Transtheoretical Model of behaviour change (Prochaska and Diclemente, 1983). The SCT explains human behaviour in which personal factors, environmental influences, and behavioural factors interact with one another (Bandura, 1998). Whereas, the Stages of Change Model describes a person's intention to adopt a health behaviour and maintain this behaviour develops over time through five Stages of Change (Prochaska and Diclemente, 1983). These stages are: 1) the pre-contemplation stage, when the person is inactive and has no intention to change their behaviour in the next six months. 2) the contemplation stage, when the person is inactive but begins to think about making changes to their behaviour within the next six months. 3) the preparation stage, when the person is planning for a change in their behaviour within the next month. 4) the action stage, when the person begins to adopt new behaviours to be active for at least six months. Lastly, 5)

the maintenance stage, when a person can sustain their new behaviour change for at least six months after the initial behaviour change (i.e. action stage), indicating they have successfully integrated their new behaviour into their lifestyle. Health behaviour change is a dynamic process and people will be at different stages of readiness to adopt new behaviour change and will move back and forth between the different stages before they can successfully settle into the fifth maintenance stage (Patterson, 2005).

Additionally, McAuley et al. (2003) investigated long-term exercise behaviour following a 6-month exercise programme and reported a steep decline in self-efficacy from 4- to 6-month assessment points and self-efficacy dropped by nearly 20% from baseline to the end of the programme. This finding is consistent with the Stages of Change construct (Prochaska and Diclemente, 1983). This decline may be explained by participants being at different stages of readiness to adopting a new behaviour, and those less ready to change may have less self-efficacy to continue with the exercise programme and thus dropped out of a study before entering the maintenance stage of change (>6 months). Therefore, the focus on the first six months is crucial to assessing an individual's readiness to change and whether they were able to maintain this new behaviour change. Furthermore, providing strategies to boost self-efficacy at the end of the programme may help the maintenance of exercise. But, a limitation to the study by McAuley et al. (2003) was the assessments of self-efficacy and exercise frequency were restricted to exercise activity within the exercise programme rather than exercise unrelated to the programme. It would be useful to investigate the people's self-efficacy with exercise that is self-initiated rather than a programme-based exercise regime.

A recent study by Quicke et al. (2016) reported that exercise self-efficacy and positive outcome expectations for exercise were associated with current and future physical activity level in older adults with knee pain due to OA. However, the tools used to measure exercise self-efficacy and outcome expectations for exercise were unable to capture all the condition-specific beliefs, such as people's thoughts on "wear and tear" with exercise. The findings from this study demonstrated that exercise self-efficacy and outcome expectations might be modifiable targets to increasing exercise level in people with knee pain due to OA (Quicke et al., 2016).

People with stronger self-efficacy for exercise tended to approach challenging tasks more confidently, put in more effort, and have longer persistence when faced with challenges or barriers (Bandura, 1977). In addition, Marszalek et al. (2016) reported that participants who reported higher outcome expectancy were significantly more likely to have stronger beliefs in their ability to successfully manage their knee OA symptoms (measured using the arthritis self-efficacy score (Lorig et al., 1989)) and was the first study to confirm this in people with knee OA. If outcome expectancy influences exercise behaviour in this population, assessing individual beliefs in both the benefit of exercise and disease-related symptom management would be beneficial in allowing clinicians and researchers to characterise the individual's degree of willingness to exercise.

Moreover, enhancing exercise self-efficacy was also associated with exercise adherence (McAuley et al., 2003, Oliver and Cronan, 2002), which is important for sustaining the initial programme benefits (Stenstrom, 1994) in people with rheumatoid arthritis. This further supports the importance of

increasing exercise self-efficacy in older adults who are likely to be at higher risk of arthritis. However, these previous studies have focused on exercise self-efficacy and exercise in people with other forms of arthritis and pain syndrome such as rheumatoid arthritis and fibromyalgia. Thus, there is a need to investigate and explore the patients' thoughts and beliefs of their arthritis self-efficacy at managing pain and other symptoms and how this affects their exercise self-efficacy people living with knee OA.

2.9 Interventions and Behaviour Change Techniques for People Living with Osteoarthritis

Interventions designed to improve self-efficacy among arthritis cases and on self-efficacy outcomes following interventions have been reported in the literature (Marks, 2014). The following section will discuss the Arthritis Self-Management Program/The Better Choices, Better Health® for Arthritis Program; the Fit and Strong! Programme; and the Good Life with Osteoarthritis in Denmark Initiative (GLA:D®).

2.9.1 Arthritis Self-Management Program/The Better Choices, Better Health® for Arthritis Program

Lorig et al. (1985) developed the community-based Arthritis Self-Management Program (ASMP), which is an effective self-management education intervention workshop for people with arthritis. The workshop helps people learn and practice the different techniques required to build an individualised self-management programme and gain the confidence to carry it out independently (Lorig et al., 1985). However, the infrastructure and

dissemination support for this programme is limited, so The Better Choices, Better Health® for Arthritis programme was developed, which is an internet-based interactive group workshop using the content from the ASMP (Lorig et al., 2008).

The Better Choices, Better Health® for Arthritis programme is currently being offered through Canary Health in the United States of America (online platform: https://www.canaryhealth.com/bcbh-better-choices-better-health/) and are for people living with OA, fibromyalgia, rheumatoid arthritis and other rheumatic conditions (Lorig et al., 2008). These workshops are facilitated by two trained facilitators, one or both of who live with a rheumatic condition. The workshop lasts for six weeks with about 25 participants in each workshop group. A new topic around arthritis and self-management is discussed each week and participants are asked to log onto the online platform for their session two to three times a week for about two hours each week at their convenience (Lorig et al., 2008). There are no requirements that all participants need to log in to the workshop simultaneously. The sessions are highly interactive through internal messaging and online discussion boards with other users and the facilitators, as mutual support and success build the participants' confidence in their ability to manage their health and maintain active and fulfilling lives (Lorig et al., 2008).

The format of the community-based ASMP and the online Better Choices, Better Health® for Arthritis programmes was designed to be similar and are both based on the SCT and self-efficacy construct and use the processes of skills mastery (action planning and feedback), modelling of action plan and problem-solving supplied by the facilitators, and group persuasion (Bandura,

1997). A difference between the two formats is that unlike the small community-based ASMP, the facilitators on the online version did not deliver the content, as this was already programmed (Lorig et al., 2008).

Multiple behavioural change techniques (BCTs) related to the self-efficacy were thought to have been used in the development of the contents of this programme, which include but not limited to the “Instruction on how to Perform the Behaviour” (through the facilitators, therapists and education content); “Social Support” (from the group-based environment and the discussions on the online platforms from other users and facilitators); “Feedback on Behaviour” and “Verbal Persuasion about Capacity” (from the facilitators) (Carey et al., 2018, Lorig et al., 2008).

Both the community-based ASMP and the Better Choices, Better Health® programmes have demonstrated significant improvements in health status (improved health distress, activity limitation, self-reported global health status, pain, and self-efficacy) (Kruger et al., 1998, Lorig and Holman, 1993, Lorig et al., 1985, Lorig et al., 2005, Lorig et al., 2008). A perceived Arthritis Self-Efficacy, which reflects participants’ confidence to manage their arthritis, designed by (Lorig et al., 1985) was measured in both programmes.

The strengths of the ASMP and the Better Choices, Better Health® for Arthritis programmes were that it can be applied to health conditions beyond arthritis and could be important for people with multi-morbidities. The contents of the programmes were theoretically driven by the Social Cognitive Theory and the self-efficacy construct, which optimised the effectiveness of intervention

effects on behaviour change. However, a limitation to the programme was the repeated failure of uptake of this programme by the patients, perhaps due to the lack of face-to-face contact with the facilitators, as the programme is conducted online. The programme has been copyrighted, which would be problematic for the programme to be adopted in different countries. Also, the mode of delivery of this programme (via an online platform) is different compared to other intervention programmes discussed in this section of the thesis. However, the offer of an online platform may be advantageous for people living in remote areas, or areas which do not have the facilities to hold face-to-face classes.

2.9.2 Fit and Strong! Programme

Fit and Strong! programme was developed in the United States of America and is an evidence-based exercise and behaviour change intervention that has been successfully implemented in multiple community-based settings (Hughes et al., 2004). It is an 8-week intervention, which takes place three times a week, with each session lasting 90 minutes. This programme is targeted at older adults with OA (around 20-25 participants in each group session) and delivered by trained physical therapists and exercise instructors.

The Fit and Strong! programme is a multiple-component exercise programme with group problem solving and education using a curriculum designed to facilitate arthritis symptom management, confidence in the ability to exercise safely with arthritis, and commitment to lifestyle change (Hughes et al., 2004, Hughes et al., 2006). The first 60 minutes of the intervention addressed flexibility exercises, fitness walking, and resistance training. The last 30

minutes included a group discussion around education and behaviour change to enhance self-efficacy for adherence to the intervention. The sessions began and ended with 10-minute warm-up and cool-down periods. Before the end of the 8-week Fit and Strong! programme, participants meet with the instructor to develop individualised exercise plans that foster ongoing maintenance of a balanced physical activity routine.

Like the ASMP and Better Choices, Better Health® for Arthritis programmes, the Fit and Strong! programme was also theoretically strong and developed based on Bandura's SCT and the self-efficacy construct (Bandura, 1997) and uses the Arthritis Self-Efficacy Scale to measure self-efficacy (Lorig et al., 1989). The developers of the programme also adhered to established guidelines for implementing behavioural interventions using many behavioural change techniques related to enhancing self-efficacy (Carey et al., 2018). The developers designed the interventions to address self-efficacy for exercise (defined in this programme as confidence in the ability to conduct the exercises safely and effectively) and self-efficacy for exercise adherence (defined in this programme as confidence in the ability to maintain exercise participation over time and in the presence of barriers). The health education component also addressed self-efficacy to manage pain and other arthritis-related symptoms and adhered to established guidelines for implementing behavioural interventions (Carey et al., 2018). Participants were asked at baseline to specify outcomes that they hoped to achieve through exercise participation (i.e. the 'goal setting' BCT) to boost self-efficacy for exercise. Systematic feedback was provided to participants on progress made toward the achievement of these goals (i.e. the "Feedback on Behaviour" and

“Feedback on Outcomes of Behaviour” BCTs). The BCTs described here reflect the “Beliefs about capabilities” and “Beliefs about Capabilities Skills” mechanisms of action and are linked to the self-efficacy construct described by Carey et al. (2018). Additionally, to increase self-efficacy for adherence to exercise, the trainers followed the Jensen and Lorish (1994) process model for patient-practitioner collaboration.

Previous evaluations of the Fit and Strong! programme within randomised controlled trials (RCTs) compared baseline measures taken before the Fit and Strong! programme to measures taken at the 6-month follow-up, found that participants who completed the programme compared to a no-treatment control group had significant benefits on increased adherence to physical activity; improved arthritis self-efficacy for exercise; reduced lower extremity joint stiffness and joint pain; and improved aerobic capacity (performed on the 6-minute walk) (Hughes et al., 2004). Retention to the programme at eight weeks was 85% for the treatment group and 61% for the control group. But retention decreases for both groups at the 6-month follow-up (75% for the treatment group and 51% for the control group) (Hughes et al., 2004).

Another RCT compared baseline measures taken prior to the Fit and Strong! programme to measures on the complete sample at 6- and 12-month follow-ups found improved self-efficacy for exercise; improved self-efficacy for adhering to exercise over time; reduced joint stiffness and arthritis joint pain (Hughes et al., 2006). Overall retention to the program at 8 weeks for the treatment group was 72% and 55% for the control group. Similar to the previous study (Hughes et al., 2004), retention decreased to 64% treatment

group and 44% at the 6-month follow-up and decreased further at the 12-month follow-up to 50% for the treatment group and 32% for the control group (Hughes et al., 2006). These rates are low in comparison with other similar study retention rates reported in the literature, which range from 61% (Sullivan et al., 1998) to 90.9% (Van Baar et al., 2001) for treatment-group participants.

The low adherence to the Fit and Strong! programme may be due to the multicomponent of the exercises and attendance of 3 times a week, which may be challenging for older adults with OA. Furthermore, the multicomponent Fit and Strong! intervention was based on evidence concerning deficits in older adults with OA and is theoretically driven. But it was impossible to conclude from this trial whether all three components (flexibility, aerobic walking, and strength training) were necessary to attain the reported results. Despite the improvements in arthritis self-efficacy, aerobic capacity and reduction in pain, the retention to the Fit and Strong! programme decreased over time. Future studies with exercise and education programme interventions need to focus on inclusion of component s that can enhance study retention and improve adherence to the programme.

2.9.3 Good Life with osteoArthritis in Denmark (GLA:D®) Initiative

The Good Life with osteoArthritis in Denmark (GLA:D®) initiative is an evidence-based solution toolbox for clinicians managing middle-aged and older adults with hip and/or knee pain. The programme was initiated in Denmark in 2013 with the overarching aim of implementing clinical guidelines

for the treatment of knee and hip OA in clinical practice to facilitate high-quality care of patients with OA in the Danish population (Skou et al., 2014b). The programme is a not-for-profit initiative hosted by the University of Southern Denmark and has a registered trademark to help maintain programme quality. The GLA:D® programme provides an effective, alternative to current standard of care in patients with hip and/or knee in Denmark who does not need a total joint replacement (i.e. those patients who are on prescription pain killers and have been referred for imaging and knee arthroscopy) (Skou and Roos, 2017).

As the GLA:D® programme is an implementation programme in clinical practice (through referrals from patients themselves, from primary care and secondary care), the programme has only been evaluated through feasibility and pilot studies and not RCTs (Skou and Roos, 2017, Skou et al., 2014b), unlike the ASMP, Better Choices, Better Health® for Arthritis and the Fit and Strong! Programmes. Also, as this is an implementation programme, patients were required to pay to participate in the programme. In Denmark, patients with OA are typically referred to a physiotherapist providing the GLA:D® programme by their general practitioner, in which case approximately 40% of the treatment cost is reimbursed from their municipality. Patients can also refer themselves directly to the physiotherapist but must pay the full treatment cost. Finally, patients can be referred by an orthopaedic surgeon, in which case the full treatment cost is reimbursed.

GLA:D® is a standardised, but individualised, treatment consisting of 2 group-based patient education sessions and 12 group-based neuromuscular

exercise therapy sessions (Ageberg et al., 2010, Ageberg and Roos, 2015, Villadsen et al., 2014). The GLA:D® programme consisted of two group-based theoretical educational sessions of about 90 minutes each (Skou and Roos, 2017, Thorstensson et al., 2015). Each exercise session lasts 60 minutes and participants attend these sessions twice a week for six weeks (Skou and Roos, 2017). All sessions are group-based (around 6-8 participants) and supervised by a certified clinician with expertise in OA and exercise therapy. GLA:D® is most commonly provided by a physiotherapist but can be provided by other health practitioners if required by the healthcare system of the specific country or region. Similarly, the Fit and Strong! programme is also lead by a clinician (physical therapist) but, the Better Choices, Better Health® for Arthritis Programme is facilitated by trained peer leaders who also live with a rheumatic condition, and the thus does not have to be a certified clinician.

A multi-modal approach was used to develop the contents for this programme (Grol and Grimshaw, 2003). The theories used to develop the educational content were a 10-step model to induce a change in Professional behaviour, Stages of Change (Transtheoretical Model), Self-Determination Theory, Relapse Prevention Model, Social Learning Theory, and the SCT. The contents of the programme were based on existing evidence, national and international treatment guidelines, as well as patients' views, thoughts and tolerability of treatment and exercise for OA (Thorstensson et al., 2015). The overall aim of the intervention was to increase patients' self-efficacy to manage their OA by explaining the mechanisms behind the possible benefits of specific exercises in reducing joint pain and improving function and to increase the patients' motivation to exercise (Thorstensson et al., 2015).

Similarly to both the ASMP and the Fit and Strong! programmes, the Arthritis Self-Efficacy Scale was used to measure self-efficacy. The first education session contained information about what is OA, its risk factors and symptoms, the currently available treatments and treatment guidelines. The second education session was on exercise for OA (i.e. comprised issues about why exercise is needed, obstacles to exercise, how exercises can be incorporated in daily life), and self-management and coping strategies to reduce pain and symptoms (Skou and Roos, 2017, Thorstensson et al., 2015). The BCTs thought to have been used in this programme were "Information about Health Consequences'; "Information about How to Perform the Behaviour"; "Feedback on Behaviour"; and "Problem Solving", but they are not limited to these (Carey et al., 2018).

An evaluation of the effects of the GLA:D® programme on a nationwide scale has recently been completed in Denmark (Skou and Roos, 2017). Data from 9,825 participants from the GLA:D® registry were used in the analyses. The results indicated that GLA:D® improved pain intensity and quality of life at the 3-month and 12-month follow-ups. Furthermore, physical function improved (only at 3 months), fewer patients took painkillers, and fewer patients were on sick leave at 12 months following GLA:D® compared with the baseline data. However, as GLA:D® is an implementation programme in clinical practice rather than a trial or study, so no control group was used for comparison (Skou and Roos, 2017). The lack of a control group may have produced an overestimation of the specific treatment effects when compared to the effects seen in controlled clinical trials, as the contextual effects contributing to the overall treatment effect cannot be determined (Zou et al., 2016).

The retention rate of participants who underwent the GLA:D® programme was 84% at 3 months but decreased to 68% at 12 months (Skou and Roos, 2017). The high retention rate at 3 months could be due to this time being soon after the patients have finished their 6-week exercise programme. In comparison, the retention rate at 12 months in the GLA:D® programme is higher than the participants in the Fit and Strong! programme (50% retention at 12 months), but the GLA:D® retention rate is not too dissimilar to the 12-month retention rate in the Better Choices, Better Health® for Arthritis online programme (71%). The decrease in retention rate shown in all three programmes could be a result of patients and participants in the programmes not having regular contact with their facilitators or clinician at the time of finishing the programme and the follow-ups.

GLA:D® has shown positive short-term results in improving physical function, quality of life, and reducing pain, sick leave, and painkiller consumption in patients, but long-term follow-up and evaluations are needed to provide a holistic picture of the benefits of the programme and the adherence to the programme.

2.10 Chapter Summary

This chapter presented an overview of knee OA being the most common joint with OA. Knee pain was the primary symptom experienced by people with knee OA, which also contributed to limited physical function and a lower perceived quality of life. Exercise is the recommended form of conservative

treatment for people with knee OA, and recent systematic reviews of exercise-based clinical trials have shown small-to-moderate positive effects of exercise compared to no exercise (Fransen et al., 2015, Uthman et al., 2013).

Behaviour plays a crucial role in maintaining health, and in the prevention, management, and treatment of disease and disability (Carey et al., 2018). Maintaining behaviour change can be difficult, as seen from previous studies on the barriers to adherence to exercise therapy (Ettinger et al., 1997, Pisters et al., 2010). Theories and models of human behaviour view behaviour change as influenced primarily by the perceived importance of behaviour change and the belief that behaviour change is possible (Bandura, 1977). Thus, self-efficacy affects people's ability to learn, their motivation, and their performance, as people will often attempt to learn and perform only those tasks for which they believe they will be successful (Lunenburg, 2011). Self-efficacy can change through efficacy-enhancing interventions, which makes it a rich target of arthritis interventions (Allegrante and Marks, 2003).

There was considerable variability in the delivery, exercise components, and intensity of the interventions in the programmes described in Section 2.9. Thus, it is not possible from the current evidence to reliably distinguish which delivery strategy is most successful and what specific treatment approach is likely to be optimal in enhancing the arthritis self-efficacy level in people with knee OA. Therefore, it is essential to investigate the psychosocial factors associated that predict arthritis self-efficacy beliefs, because it has been linked with pain perception and function (Maly et al., 2005, Maly et al., 2006, Marks, 2014, Sharma et al., 2003).

Furthermore, self-efficacy is modifiable and can predict the different stages of behaviour change, which makes self-efficacy an attractive therapeutic factor, as it can influence health behaviour change effort. According to research from the Stages of Change construct, the first six months is a crucial period for individuals who have intentions to change to adopt new behaviours and maintain the new behaviour (Prochaska and Diclemente, 1983). There are no studies to the author's knowledge to investigate people's self-efficacy with arthritis and everyday physical activity and exercise that is self-initiated rather than programme-based exercise during the progression of knee OA.

Therefore, the main aim of this thesis is to investigate which factors identified in this literature view can predict patients' arthritis self-efficacy perception (see Chapter 1.2 for the aim and objectives of this thesis). The next chapter will describe and justify the mixed methods methodology used in this thesis to meet the aim and objectives.

Chapter 3

Methodology

Chapter 3: Methodology

3.1 Chapter Introduction

This chapter aims to describe the four widely discussed worldviews in the literature, which are post-positivism, constructivism, transformative, and pragmatism worldviews. The pros and cons of each worldview will be described, and justifications will be made for the reasons why the pragmatic worldview was the most appropriate over the other worldviews to meet the mixed methods aim and objectives of this thesis.

Subsequently, the three most common mixed methods designs will be discussed, which are convergent parallel, explanatory sequential, and exploratory sequential mixed methods designs. Justifications will be made for why the explanatory sequential mixed methods design will be followed to answer the aim and objectives of this thesis.

Finally, a brief discussion of the methods used to collect the data for the studies in this thesis will be presented and justifications made for why surveys and semi-structured interviews were the appropriate methods of data collection. A more in-depth description of the methods of data collection, such as a description of the sample and the questionnaire and interview tools used, will be provided within the 'Methods' section in each of the following chapters of this thesis (Chapters 4, 5, and 6).

3.2 Worldviews

The term “worldview” was defined by Guba (1990) as *“a basic set of beliefs that guide action”* (page 17) and a philosophical orientation about the world and the nature of research that a researcher brings to a study (Creswell, 2014). Worldviews have also been referred to as paradigms (Lincoln et al., 2011), epistemologies and ontologies (Crotty, 1998). Worldviews can arise based on one’s discipline, predispositions, and past research experiences (Creswell, 2014); it is these factors that will lead to a researcher following a qualitative, quantitative, or mixed methods approach in their research. The four most common worldviews will be discussed in the following section: post-positivism, constructivism, transformative, and pragmatism.

The post-positivist worldview represents the traditional form of research, and these assumptions hold true more for quantitative research than qualitative research (Creswell, 2014). Post-positivists hold a deterministic viewpoint in which studies are conducted to assess the causes that determine outcomes (Creswell, 2014). The knowledge developed through a post-positivist lens is therefore based on objective observation and measurement of the reality that exists in the world. Thus, post-positivists would develop numeric measures of observations in order to answer their research problems (Liddle et al., 2013).

On the contrary, the constructivism worldview holds true more for qualitative research. The ideas came from works such as Berger and Luckmann (1991) on ‘*The Social Construction of Reality’* and Lincoln and Guba (1985) on the ‘*Naturalistic Inquiry’*. Constructivists see individuals capable of developing subjective meanings of their experiences of the world; these meanings are

varied and complex rather than simple narrowed meanings of the world and their experiences (Lincoln and Guba, 1985). Therefore, constructivists try to make sense of others' meanings of the world by obtaining as much information as possible on people's meaning and perception of their own experiences of the world to answer their research problems (Creswell, 2014).

The transformative worldview (Mertens, 2008) places central importance on the study of lives and experiences of diverse groups that have traditionally been marginalised (such as feminists; racial and ethnic minorities; persons with disabilities; and members of the lesbian, gay, bisexual, transsexual, and queer communities). Researchers following the transformative lens have a special interest in how the lives of people in these diverse groups have been constrained by oppressors and the strategies that they use to resist, challenge, and subvert these constraints (Mertens, 2008).

The pragmatic worldview is concerned with applications, what works, and solution to problems (Patton, 1990). Rather than focusing on one particular method, researchers following the pragmatic worldview use pluralistic approaches available to understand the research problem (Onwuegbuzie and Leech, 2005, Tashakkori and Teddlie, 1998). Pragmatists do not see the world as an absolute unity (Creswell, 2014) and are not committed to using one approach (Cherryholmes, 1992). The pragmatic worldview is similar to how mixed methods researchers conduct their research by using many approaches for collecting and analysing data rather than committing to only one approach. Therefore, mixed methods researchers draw from both quantitative and qualitative assumptions when they find solutions for their research problems (Creswell, 2014). For mixed methods researchers,

pragmatism opens the door to using multiple methods, different worldviews, and different assumptions, as well as different forms of data collection and analysis to answer the research problems (Cherryholmes, 1992, Creswell, 2014). However, it is important to establish a purpose and a rationale for the reasons why quantitative and qualitative data need to be mixed in the first place(Creswell, 2014).

The pragmatic worldview was the most appropriate to follow to meet the aim and objective of this thesis. A quantitative approach was needed to help establish significant psychosocial factors that were predictors of how people living with knee OA perceived their ability to manage their arthritis successfully (arthritis self-efficacy). Subsequently, to have an in-depth understanding of how people living with knee OA felt they were managing their arthritis and why certain factors affected how they perceived their ability to manage their arthritis. Pragmatism was appropriate, because it was considered important to use different approaches to try and understand the research problems (Patton, 1990, Tashakkori and Teddlie, 1998) and this worldview is not committed to just one approach and allowed the use of both quantitative and qualitative assumptions to help answer the research problems (Creswell, 2003).

The pragmatic worldview was considered over the post-positivist worldview because the latter examined the causes that influence the outcomes, based on using numeric measures of observations and measurements from the participants alone (Creswell, 2003). Purely post-positivist worldviews were not entirely appropriate in answering the aim and objectives of this thesis, as it required pure objective measures to provide thorough examinations of the

data and conclusions for bias. Although this may have helped meet Objectives 2, 3, and parts of Objective 6 of this thesis by allowing the use of numeric measures to determine the factors that are predictive of arthritis self-efficacy, it would not have enabled an in-depth exploration of patients' accounts of how they currently managed their arthritis and why they felt certain factors affected their self-beliefs in their ability to successfully manage their knee OA (Objectives 4, 5, and parts of Objective 6).

In contrast, assumptions identified in a purely constructivist worldview emphasised on developing subjective meanings of people's experiences and meaning towards a certain objective or topic (Creswell, 2003). This worldview emphasised how an individual makes sense of their experiences and the world around them. Therefore, this approach explores the complexity, variety, and depth of people's perception of an object rather than narrowing meanings into categories or numbers, such as that of the post-positivist worldview (Creswell, 2003). The constructivist worldview would provide a platform to meet Objectives 4 and 5 by allowing the exploration of people's experiences with living with knee OA and meaning towards the factors that affected how they perceive their ability to manage their knee OA. However, a purely constructivist worldview would not be appropriate to meet Objectives 2 and 3, as a numeric method is required to determine the factors predictive of arthritis self-efficacy.

Therefore, following the pragmatic worldview allowed the author the freedom to draw from the quantitative assumptions to meet Objectives 2 and 3, which would help inform the key factors to explore further using a qualitative approach to gain an in-depth understanding from patients' perspectives of

why they felt certain factors were predictive of their self-beliefs of people living with knee OA and the management of symptoms, to meet Objectives 4 and 5. To meet Objective 6, both quantitative and qualitative approaches were necessary to investigate the factors predicted arthritis self-efficacy and to explore further why and how they felt these factors affected their self-beliefs in OA management in a group of people living with knee OA who have recently experienced an education and exercise programme.

3.3 Mixed Methods Methodology

In recognising the strengths and weaknesses in the purely post-positivist and purely constructivist worldviews, the weaknesses from a single method could offset each other when combined to draw on the strengths of both (Bryman, 2006). Creswell (2003) suggested that the assumptions for a pragmatic worldview are not committed to just one system of data collection and analysis but drawing from many approaches to collecting and analysing data, such as those offered from the mixed methods approach. Therefore, the strategies of inquiries were a mixed methods research design for this thesis to draw from both the quantitative and qualitative assumptions to provide the best understanding of how people living with knee OA perceived their ability to manage their knee OA, what factors predicted arthritis self-efficacy and why. Two phases using two different data collection methods were needed to investigate which factors were predictive of arthritis self-efficacy, and then to explore why.

There are three basic mixed methods designs; the convergent parallel design, explanatory sequential design, and the exploratory sequential design shown in

Figure 4 (Creswell, 2014). The convergent parallel design involves collecting quantitative and qualitative data separately, but in parallel, on the same phenomenon and the two streams of results is converged by comparing and contrasting the results during the interpretation phase. This design is usually used when researchers seek to compare or validate results from the quantitative and qualitative findings (Creswell, 2014).

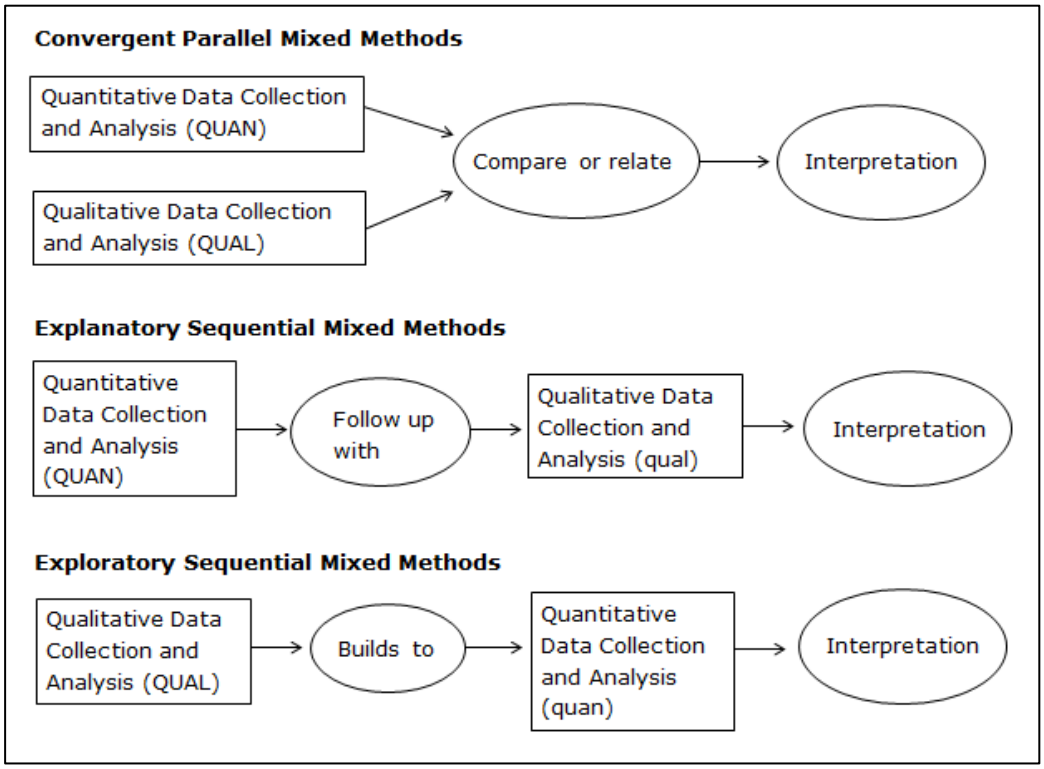


Figure 4 Three Basic Mixed Methods Designs taken from (Creswell, 2014)

The exploratory design is aimed at exploring a phenomenon to test or develop an instrument, because no measures, instruments, or known variables are available for that topic or area (Creswell, 2014). It starts with a qualitative phase, which helps inform the second quantitative phase. This design is more appropriate for when researchers want to generalise results to different groups (Morse, 1991) or to test a theory (Morgan, 1998). Both of these designs were

unable to answer the aim and objectives in this thesis, as the aims were not to collect data in parallel to compare nor to test a theory.

The explanatory sequential design consists of an initial quantitative phase followed by a qualitative phase to help enhance the results obtained from the quantitative phase. This is appealing for individuals with strong quantitative background and who are relatively new to qualitative approaches (Creswell, 2014), like the author who has more quantitative experience and research background and is new to qualitative data analysis. The explanatory sequential design was most suited to answering the aim and objectives of this thesis. The overarching aim of the thesis was to investigate and explore the factors associated with arthritis self-efficacy from the perspectives of people living with knee OA.

Firstly, it was necessary to investigate which factors have been reported in the literature to influence self-efficacy in people with knee OA. Then, to quantitatively investigate the degrees of the associations between these factors specifically with arthritis self-efficacy in people with knee OA. The findings from the first phase will inform the types of participants to be purposefully selected for the qualitative phase and the types of questions that will be asked of the participants. Additionally, the findings from this first phase will inform which significant factors predicted arthritis self-efficacy to explore with people who are living with knee OA to see why they feel certain factors are important in how they perceived their ability to manage their knee OA. In particular, the further discussion and exploration phase with people living with knee OA will provide enhancement and clarification of the questionnaire findings (Bryman, 2006, Greene et al., 1989). Furthermore, combining the

strengths and weaknesses of both the quantitative and qualitative phases could offset the weaknesses of using one phase alone and draws on the strengths of both methods (Bryman, 2006).

3.4 Methods of Data Collection

Having considered the pragmatic worldview and an explanatory sequential mixed methods design, the final element in the research approach was the methods of data collection and analysis. A fundamental assumption in the mixed methods design inquiry is that collecting different types of data provided a better understanding of a research problem (Creswell, 2003). Figure 5 gives the study design outline of how the data was collected for this thesis. A more in-depth description and explanation of the data collection method will be provided in the 'Methods' section of the subsequent chapters, but in brief, the data collection was completed for the first quantitative phase with a survey to investigate perceptions of arthritis self-efficacy in people living with knee OA and the factors that predicted arthritis self-efficacy (Figure 5). A 6-month follow-up questionnaire for Study 1 (Figure 5) was used to investigate the changes over time in arthritis self-efficacy and its associated risk factors in people with knee OA to meet Objective 3 of this thesis. Then, a second qualitative phase was conducted to explain why people living with knee OA felt that these factors affected how they felt about their abilities to manage their knee OA (Figure 5).

To meet Objectives 2, 3, and 6 of this thesis, quantitative statistical analyses were required to investigate which factors were predictive of arthritis self-efficacy score. To collect this data, a quantitative survey method allowed for

questionnaires relating to self-efficacy to be distributed to a relatively large sample. This was a quick method of gathering a large amount of data from a relatively large number of people in a short period of time. Most questions in the questionnaire were closed-ended and responses were mainly on rating scales, which provided a logical way for coding, categorising, and analysing the data. The questionnaire was aimed at collecting data from people who had an opinion about the management of knee OA (Ross, 2012). The questionnaire collected descriptive and inferential data to describe the characteristics of people who completed the questionnaire and also enabled statistical tests to determine the relationships and associations between the variables of interest. A questionnaire method was appropriate to meet the objectives in this thesis, as it provided a platform to investigate the relationships of factors associated with arthritis self-efficacy. Moreover, the aim of this thesis was not to test if an intervention was responsible for a causing an outcome of decreased or increased arthritis self-efficacy; if this was the case, then an experimental design with intervention would have been more appropriate.

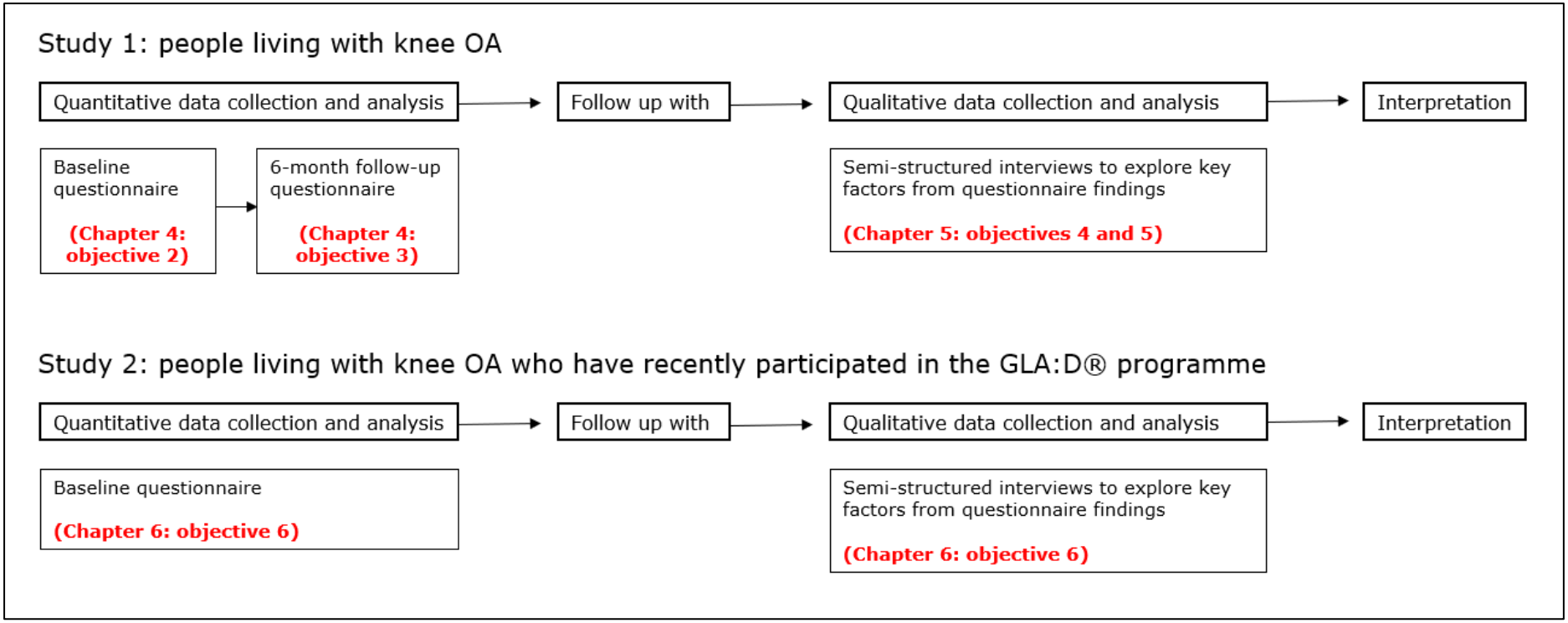


Figure 5 Study design flow diagram

It was also important to consider the disadvantages of using a survey method to collect data. In contrast to close-ended questions, answers to open-ended questions will require more time to code and analyse, and participants may feel the need to explain their circumstances more than space in an open-ended question of a questionnaire allows. To address this potential problem, semi-structured interviews following the questionnaire can provide the author an opportunity to ask some “why” and “how” questions and allows participants to explain what it is like to live with knee OA, how they are currently managing their knee OA, and why they feel certain factors can affect how they perceive in their abilities to manage their knee OA. Thus, this depth of understanding of the participants’ experiences with living with knee OA is limited through the survey method of data collection.

A semi-structured interview was the most appropriate qualitative data collection method to meet Objectives 5, and 6 of this thesis, as it allowed both the researcher and participants have some control over the content (Ross, 2012). In contrast, unstructured interviews does not have a pre-planned set of questions from the interviewer (Creswell, 2014) and resembles a conversation between interviewer and interviewee and questions are generated by the conversations during the interview (Gray, 2013), which could make analysis of the interview data more challenging and complex (Adams and Cox, 2008). On the contrary is a structured interview where interview questions and topics are set in stone and leaves little room for deviation (Creswell, 2014). However, this structured approach may make participants feel less able to fully express themselves and reveal important and in-depth information about the topics discussed (Creswell, 2014). The semi-structured interview approach allows the interviewer to have a set of pre-planned questions and topic to discuss,

which will help ensure the study aims and objectives can be met and also allows the flexibility from both the interviewer and interviewee to explore new key topics that have emerged from discussions during the interview, which were not in the pre-planned questions (Adams and Cox, 2008, Ross, 2012). However, as rich data is required, interviews are often very time-consuming methods of data collection but will provide rich data, which cannot always be captured from questionnaires (Ross, 2012).

Focus group interviews were also considered but were not appropriate in meeting the objectives of this thesis. Human interactions are a key feature in focus group interviews (Parahoo, 2007), but participants in a focus group may want to impress one another and the interviewer and be biased in their responses (Adam and Cox 2008). Therefore, having comparative focus groups to compare responses may help counterbalance this potential bias (Lunt and Livingstone, 1996), but this method will be highly time-consuming. A focus group aims to allow the researcher to access the collective view of groups, how participants interact with each other in a group, and how they would express themselves in the presence of other participants in the group. The aim and objectives of this thesis were focused on exploring people's perspectives on how and why they felt certain factors influence their self-beliefs in their ability to manage their arthritis. Participants are individuals with different severities of arthritis, different symptoms, different ways they have found to manage these symptoms, and have their own ways of coping; exploring the individual experiences was more important than observing how people living with knee OA interacted and discussed their OA management experiences in a group or focus group setting, thus semi-structured individual interviews was the favoured method of data collection.

3.5 Chapter Summary

This chapter describes the different worldviews, strategies of inquiries, and research designs that were considered. The pragmatic worldview was followed because it allowed the researcher to use different approaches to meet the objectives of this thesis. The objectives included elements to investigate the factors associated with arthritis self-efficacy and also to explore from patients' perspectives of how they viewed their arthritis self-efficacy. Therefore, the pragmatic worldview was appropriate for conducting a mixed methods approach to meeting the objectives. In brief, a quantitative survey was used to investigate the factors associated with arthritis self-efficacy, and the results from this survey provided the author with key factors that predicted arthritis self-efficacy to explore further with people living with knee OA in the form on semi-structured interviews, which formed the qualitative element. The mixed methods approach was used, because the findings from the questionnaire helped specific which factors to explore further with patients during the interviews. A more detailed methods section will be discussed in each study in the subsequent chapters (Chapters 4, 5, and 6) to provide an understanding of how each study was conducted.

Chapter 4

The Association between Psychosocial Factors and Arthritis Self-Efficacy

Chapter 4: The Association between Psychosocial Factors and Arthritis Self-Efficacy

4.1 Chapter Introduction

This chapter begins with describing the importance of Patient and Public Involvement (PPI) in the research process and how the PPI Advisory Group has helped with the review of participant facing documents for the studies in this thesis. It then describes and summarises the first part of the explanatory sequential mixed methods design for the study in this thesis, which was a quantitative survey phase to meet Objectives 2 and 3.

Objective 2: *Using factors identified in objective 1, investigate what factors are associated with arthritis self-efficacy in people living with knee OA*

Objective 3: *Investigate the changes over time in arthritis self-efficacy and its associated factors in people living with knee OA*

This chapter then describes in detail the methods of data collection for this study including the sampling procedure; eligibility criteria; sample size; questionnaire measures used to investigate the factors associated arthritis self-efficacy; the questionnaire survey procedure; receiving informed consent from participants; the data analyses conducted; and the ethical approval gained for the study.

The results are then presented in Section 4.3, which describes the responses and the characteristics of the responders to the baseline questionnaire and the findings from the baseline questionnaire.

Subsequently, to meet Objective 3, a 6-month follow-up questionnaire was conducted (Section 4.3.5). The characteristics of the respondents to the follow-up questionnaire are described and compared with the baseline questionnaire and participants who were lost to the follow-up were inspected.

Finally, this chapter ended with a brief discussion (Section 4.4) of the findings from this study and a comparison of other similar studies in the literature.

4.2 Methods

4.2.1 Patient and Public Involvement in Research

A focus group held on 24th November 2014 consisted of four members from the Patient and Participant Involvement (PPI) Advisory Group at the Arthritis Research UK Centre for Sport, Exercise and Osteoarthritis, and the Arthritis Research UK Pain Centre. These members were White British females, aged 65 years old or above, living with joint pain or OA. Thus, they were an appropriate group to comment on the study documents in this thesis. The PPI members were sent the study documents (participant information sheet, consent form, questionnaire, and interview guide) two weeks before the focus group to give them time to review these documents. On the day of the focus group, their opinions of the study documents (from the content to language and layout) were discussed, and their recommendations of how to improve

these participant facing documents were considered and changes were made accordingly. However, the psychometric measures of the wording in the existing questionnaires meant these were unchangeable. All participant facing documents were written in lay-person language, and this was reviewed by the PPI Advisory Group members to ensure that the documents were clear, easy to read, and understandable for the general population.

Furthermore, the 'Gunning Fog Index' readability scoring system (Gunning, 1969) was used to verify that these participant facing documents were not too difficult to understand for a wide audience. The formula for Gunning Fog is 0.4 [(total words/total sentences) + 100 x (complex words/total words)], where complex words were defined as those containing three or more syllables. This formula generates a grade level between 0-20 and the formula estimates the years of formal education required by the reader to understand a piece of text that is presented to them. A Gunning Fog Index Formula software created by Simon Bond (http://gunning-fog-index.com/) was used to compute the Gunning Fog Index for the participant facing documents in this thesis.

Participant facing documents had an index score between 8-12, as it was recommended that texts for broad audiences needed a Gunning Fog Index of less than 12 (which equated to those educated to age 17-18 years old), and texts intended for a near-universal understanding requires a Gunning Fog Index of less than 8 (which equated to those educated to age 13-14 years old). Long sentences and words that were too complex with more than three syllables were highlighted from the software to ensure a simple word replaced the complex word. The PPI advisory group also reviewed the interview guide for the sensitivity in the wording and its content.

Furthermore, members of the PPI advisory group were asked to discuss methods of participant retention. Members recommended that sending participants ‘thank you’ cards, telephone calls, or posting regular updates of the research would be beneficial in keeping participants engaged with this study. Thus, respondents of the questionnaire were sent a personalised, handwritten “thank you” card within two weeks of receiving their baseline questionnaire was added to the study protocol.

Finally, to maximise PPI advisory group input, the PPI members who were unable to attend the focus group were sent study documents via email to provide their comments in the Microsoft Word documents.

The PPI advisory group members provided significant input to the study, but a limitation was that these perspectives were from four volunteers, all of whom female and White British and they were not representative of the general population living with OA or joint pain. The inclusion of PPI advisory group members from more diverse backgrounds and a mix of males and females in the future could help provide broader views and perspectives of the study. These members lived with OA or joint pain who were interested in helping with research and thus showed enthusiasm and support with this study could be a limitation. However, these members were experienced in their roles and have participated in the advisory group for many other studies; thus, their critical opinion of the study was valuable.

4.2.2 Questionnaire Measures

Questionnaire Instrument

This study used a questionnaire booklet as a data collection tool. The contents of the questionnaire were informed by the literature review about psychosocial factors (described in Chapter 2) associated with knee OA outcomes, such as pain and physical function, that were also worth investigating for their associations with arthritis self-efficacy.

The questionnaire booklet comprised of a section about the participants' demographics and clinical characteristics; questions that sought information about their self-beliefs and psychosocial measures; questions that obtained information about their expectations of exercise and physical activity behaviour; and questions regarding their opinion of the problems with their knees. The following sections will describe these questionnaire measures in detail. The total time taken to complete these questionnaires was approximately 20-25 minutes; the participant information sheet and the full version of the participant information sheet and questionnaire booklet are in Appendix 1 and 2, respectively.

4.2.2.1 **Demographics and Clinical Characteristics**

Demographic and clinical characteristics data were collected in the questionnaire to capture the full description of the respondents. The demographic data collected were sex; date of birth; height; weight; ethnicity; smoking status; highest education level; and employment status. From this, the date of birth was used to calculate the participant's age, and body mass

index (BMI) was calculated using the participant's weight (in kilograms) and height (in metres squared) (NHS, 2016).

The clinical characteristics data collected were the year of knee OA diagnosis; the treatments for knee OA; symptoms (such as pain, knees becoming bent, knees giving way, stiffness, loss of movement, cracking/popping, swelling); significant knee injuries; knee surgery or arthroscopy;co-morbidities; general health status; and knee pain perception.

Knee Pain Perception

Adult perception of pain can be measured using different measures likes the Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), and Short-Form McGill Pain Questionnaire (SF-MPQ) (Hawker et al., 2011).

The VAS for Pain was the measure chosen for this study for its acceptability to patients (Huskisson, 1974), as it is easy to understand and can be completed in less than one minute. It has a high test-retest reliability among literate patients ($r = 0.94$, $p<0.001$) and good reliability among illiterate patients ($r = 0.70$, $p<0.001$) (Ferraz et al., 1990). For construct validity, the correlation between vertical and horizontal orientations of the VAS Pain scale is 0.99 (Scott and Huskisson, 1979). However, as there is no gold standard measure for pain, so the criterion validity cannot be evaluated.

The VAS for Pain is a unidimensional measure of pain intensity (McCormack et al., 1988) and has been widely used in diverse adult populations (Arendt-

Nielsen et al., 2010, Crombez et al., 1999). This is a continuous scale comprised of a horizontal or vertical line, usually 100 millimetres (mm) in length, anchored by 2 verbal descriptors at either end of the scale, one with “no pain” (score of zero) and the other with “worst imaginable pain” (score of 100 on the 100mm) (Hawker et al., 2011). The higher score indicates greater perceived pain intensity.

The NRS Pain is also a unidimensional measure of pain intensity (Jensen and McFarland, 1993) and is a segmented version of the VAS Pain in which respondents select a whole number between 0-10 integers to reflect their pain with zero reflecting no pain and 10 reflecting worst pain. There is a high test-retest reliability for both literature and illiterate patients ($r = 0.96$ and $r = 0.95$, respectively). For construct validity, the NRS Pain was shown to be highly correlated (range from 0.86 to 0.95) to the VAS Pain in patients with rheumatic diseases or other chronic pain conditions (i.e. those experiencing pain for more than six months) (Ferraz et al., 1990). Even though this measure is easy to understand and can be completed by patients in less than one minute, the NRS Pain was not chosen over the VAS Pain, as the former is a segmented version of the latter.

The MPQ is a multidimensional pain questionnaire designed to measure the sensory, affective, and evaluative aspects of pain and pain intensity in adults with chronic pain (Burckhardt, 1984). The responses of these sub-scales comprise the Pain Rating Index, which contains 78 pain descriptor items, and a 5-point pain intensity scale (Present Pain Intensity). The test-retest reliability for the 3 MPQ pain items (i.e. nagging, aching, and stabbing) ranged from 0.81 for one-day recall to 0.59 for seven-day recall (Chapman et al., 1985). In

OA patients, higher MPQ scores were associated with greater anxiety and depression (r = 0.30, $p<0.05$ and r = 0.30, $p<0.05$, respectively) (Creamer et al., 1999). The MPQ was not chosen in this study because it takes longer to complete (20 minutes) in comparison to the VAS Pain and the NRS Pain (one minute). Also, some respondents have found difficulty completing the MPQ due to the complex vocabulary used, and through failure to read the instructions of the measure (Chapman et al., 1985).

The SF-MPQ is a shorter version of the MPQ and included the Pain Rating Index which comprised of 15 words instead of 78 words in the original version of the MPQ (Melzack, 1987). The SF-MPQ also includes one item for present pain intensity and one-item for a 100mm VAS for average pain (Melzack, 1987). The SF-MPQ was easier to use and takes less time to complete compared to the original version of the MPQ. However, standardised instructions for patient completion have not been published and some difficulties have been reported with completion due to unfamiliar vocabularies and unclear instructions for the patients (Hawker et al., 2011). Furthermore, new users required supervision in completing this questionnaire, as experience was required to complete this adequately (Hawker et al., 2011). For these reasons, and the design of the study (i.e. postal questionnaire research), it was impractical to supervise participants in completing the questionnaire and thus this measure was not used in this study.

Scoring: VAS pain score was determined by measuring with a ruler, in millimetres, from the left-hand end of the line to the point that the patient has marked. A higher score indicated greater knee pain perceived. The VAS score was reported as a continuous measure in this thesis.

Handling missing data: If participants circled on the horizontal line or marked multiple points on the horizontal line, this was not scored and considered missing data.

4.2.2.2 **Psychosocial Components**

Four psychosocial measures were included in this questionnaire to gain information about participants' self-efficacy beliefs, confidence, and mental health. These included the arthritis self-efficacy scale (beliefs in their ability to successfully manage the symptoms of their arthritis); exercise self-efficacy scale (beliefs about their ability to continue with exercise); knee confidence (confidence with their knee); and depression.

Arthritis Self-Efficacy

Self-efficacy has become an important construct in understanding arthritis management and arthritis interventions. Thus, the main outcome measure used in this thesis was the arthritis self-efficac. The tool used to measure arthritis self-efficacy are the arthritis self-efficacy scale (ASES) full version; the shorter arthritis self-efficacy scale-8 item (ASES-8); and the chronic disease self-efficacy scales (CDSES). The full ASES was chosen over the other two measures, because it is the most widely used arthritis-specific measure (Brady, 2011) and was developed to measure patients' arthritis-specific self-efficacy or patients' beliefs that they could perform specific tasks or behaviours to cope with the consequences of arthritis (Lorig et al., 1989). There was high internal reliability (Cronbach coefficient alpha) for the three

subscales in the arthritis self-efficacy measure (pain, function, and other symptoms) of 0.76, 0.89, and 0.87, respectively. Also, the test-retest reliability for the three subscales was high at 0.87, 0.85, and 0.90, respectively (Lorig et al., 1989).

Even though the ASES-8 questionnaire is a shortened version of the ASES, it was developed in the process of developing a set of Spanish-language health assessment instruments to be used in health promotion research (Gonzalez et al., 1995). The ASES-8 is available in English, but no psychometric studies of the English version have been published beyond the mean and standard deviation, and internal consistency reliability, which are reported on the developer web site (Brady, 2011). Without psychometric evaluation of the English version of the ASES-8, it is difficult to determine its appropriateness for use in research with English-speaking participants and thus this measure was not chosen (Brady, 2011).

The CDSES was also another measure considered but not chosen because it is a non-arthritis-specific measure of perceived ability to manage a chronic disease. Additionally, no psychometric data on the CDSES have been published in peer-reviewed publications (Brady, 2011).

The ASES (full version) has 20 items in three subscales: self-efficacy for managing pain (five items); self-efficacy for physical function (nine items); and self-efficacy for controlling other symptoms (six items). However, in the questionnaires used for this thesis, only self-efficacy for managing pain and self-efficacy for controlling other symptoms were used, as they can be combined as one measure. The items were designed to capture how certain

patient felt they could continue with most of their daily activities and manage their arthritis pain and symptoms. Items were rated on a one (very uncertain) to ten (very certain) rating scale with one-point increments.

Scoring: The score for each item is the number circled, and the score for the scale was the mean of the items (Brady, 2011). If two consecutive numbers were circled, the lower number (less self-efficacy) was coded, and if the numbers were not consecutive, this was not scored. The scores ranged from one to ten; higher scores indicated greater self-efficacy at managing pain and other symptoms of arthritis.

Handling missing data: If more than 25% of the items were missing, this was not scored, and the case was considered as having missing data.

Type of variable: The arthritis self-efficacy score was reported as a continuous measure in this thesis. There is a significant dispute in the ambiguities in classifying Likert-type scales. As the arthritis self-efficacy was reported on a Likert-type scale, ranging from one to ten with one-point increments with two anchor points (very uncertain at one and very certain at ten), Jamieson (2004) suggested that this should be considered as ordered categories and only non-parametric statistics should be used on Likert-scale data. Whereas, other authors have argued that while this is technically ordered, parametric tests are valid in some situations (Sullivan and Artino, 2013). Gaito (1980) and Knapp (1990) stressed that if there was an adequate sample size of at least five to ten observations per group and the data is normally distributed, then parametric can be used with Likert-type scale ordinal data. Furthermore, researchers and educators commonly create survey scales by grouping

together Likert-type items and calculating a total mean score for the grouped items in the survey scale (Rickards et al., 2012). This is often recommended for attempts to measure 'psychological' concepts such motivation, satisfaction, and confidence (Sullivan and Artino, 2013), as it is more useful to ask a series of questions designed to capture the different facets of a particular construct or concept (Rickards et al., 2012).

Furthermore, in psychology, the existence of underlying continuous variables is a common assumption when analysing Likert-type scales like those with seven or more values (Rhemtulla et al., 2012). Supporting this, Knapp (1990) pointed out that a Likert-scale of more than a 5-point scale tends to be considered a continuous variable. Therefore, the justifications for using the ASES as a continuous measure were the scale consisted of ten points; the sample size was greater than ten observations; and the data for ASES met the assumptions of normality, independence, and homogeneity of variance (see Section 4.3.4).

Exercise Self-Efficacy

Two measures have previously been used to measure self-efficacy for exercise: 1) the exercise for self-efficacy (EXSE) scale (McAuley, 1993) and 2) the self-efficacy for exercise (SEE) scale (Resnick and Jenkins, 2000). The latter is a revision of the McAuley's self-efficacy barriers to exercise measure, which is a 13-item instrument that focuses on self-efficacy expectations related to the ability to continue exercising in the face of barriers to exercise (McAuley, 1992).

The EXSE scale assessed a subject's beliefs in their ability to continue exercising at least three times a week at moderate intensity for 40 minutes per session over incremental week periods for eight weeks. For each item, participants indicated the level of their confidence with performing the behaviour on a 0% (not at all confident) to 100% (highly confident) scale comprised of ten-point increments.

The SEE consists of nine situations that might affect participation in exercise. For each one, the participant uses the scale from 0 (Not Confident) to 10 (Very Confident) to describe their current confidence that they could exercise three times a week for 20 minutes each time. The SEE was explicitly designed for older adults and developed from a nursing home population (average age of 85). This measure was developed initially for sedentary adults in the community who participated in an outpatient exercise programme. The SEE shows excellent internal reliability (α=0.92) and validity in comparison to other measures of exercise and mental health.

The EXSE was chosen over the SEE, because the EXSE was constructed by the guidelines provided by Bandura (1997), as this measure followed the self-efficacy theory. The EXSE is predictive of exercise behaviour (McAuley, 1993). According to Bandura (1977), exploring attempts to increase exercise behaviour would be influenced by one's perceived ability to exercise regularly and self-judgment of the expected benefits of regular exercise. The latter is addressed using the Multidimensional Outcomes Expectations for Exercise (MOEES), below.

Concerning exercise and physical activity, even relatively short, acute bouts of physical activity can enhance self-efficacy (McAuley et al., 1991). Although some studies have demonstrated self-efficacy cognitions to be consistent predictors of exercise behaviour (Garcia and King, 1991, McAuley, 1992, Sallis and Hovell, 1990), few studies have gone beyond the static, one-time assessment designs and examined such predictors at multiple stages of the exercise process. The exercise self-efficacy scale was included in this thesis because exercise is a complex and dynamic process in which individuals move through various stages of participation and in which diverse factors play different roles at different stages. Thus it was important to capture this information. The study by McAuley (1992) showed self-efficacy to be predictive of adherence in the early stages of an organised exercise program for older adults, but that previous participation in the programme best predicted later adherence to the programme. Further, once the programme was terminated, self-efficacy again became the most potent predictor of exercise behaviour at four-month follow-up (McAuley, 1993). Exercise self-efficacy measure was used to predict exercise maintenance at follow-up and demonstrated good internal consistency (α=0.95) (McAuley et al., 2003), which was slightly higher than that shown in the SEE scale (α=0.92) (Resnick and Jenkins, 2000).

Scoring: The total strength of self-efficacy was calculated by summing the confidence ratings and dividing by eight (the total number of items in the scale), resulting in a maximum possible self-efficacy score of 100% (highly confident).

Outcomes Expectations for Exercise

The Multidimensional Outcomes Expectations for Exercise Scale (MOEES) was used to assess three related, but conceptually independent domains of outcome expectations for exercise (Physical, social, and self-evaluative outcome expectations). All three outcome expectations scale possessed good internal consistency: Physical (α=0.82), self-evaluative (α=0.84), and social (α=0.81) (Wójcicki et al., 2009).

Another measure of outcome expectations for exercise was the Outcome Expectations for Exercise (OEE) Scale (Resnick et al., 2000). The OEE consists of nine statements about the benefits of exercising (for example, exercise makes my muscles stronger; exercise is an activity I enjoy doing; exercise makes me more alert mentally). The subject is asked to rate his agreement with each statement from 1 (Strongly Disagree) to 5 (Strongly Agree). The total score is the sum of all nine items. The OEE was developed to identify elderly individuals with low expectations for the effects of exercise. Interventions can then be implemented to help these individuals strengthen their outcome expectations, which may subsequently improve exercise behaviour (Resnick et al., 2000). The OEE scale focused on the perceived consequences of exercise for older adults and was designed for older adults and developed from a nursing home population. The OEE was subsequently tested in a community of elderly African- and Latino-Americans and found to have high reliability and validity within these populations. It has good internal reliability of Cronbach (α= 0.89) (Resnick et al., 2000).

The MOEES was chosen over the OEE scale because the MOEES can assess and provide total scores for the three domains of exercise expectations (i.e. physical, social, and self-evaluative) independently. Whereas, the OEE, even though it includes questions regarding the physical, social, and personal benefits of exercise, the total score is a sum of all nine items. Additionally, the underlying rationale for using the MOEES is it has its foundation in Bandura's position that outcome expectations play an essential role in a social cognitive model of behaviour and that such expectations should be assessed along three dimensions (physical, social, and self-evaluative) (Wójcicki et al., 2009).

The MOEES included12 items in total, five in physical outcome expectations, three in social outcome expectations, and four in self-evaluative outcome expectations (Wójcicki et al., 2009). For each item, participants indicated the degree to which they agreed with each statement (e.g., "Exercise will increase my muscle strength") on a scale of 1 (strongly disagree) to 5 (strongly agree).

Scoring: Each dimension was scored by summing the numerical ratings for each response. Higher scores indicated higher levels of outcome expectations for exercise.

Handling missing data: If more than 25% of the items were missing, this was not scored and the case was considered as having missing data.

Knee Confidence

Three previous studies have measured knee confidence. Colbert et al. (2012) were the first to report on knee confidence and its independent association with greater risk of poor function outcomes, by self-reported measures, in persons with or at risk of developing knee OA from the Osteoarthritis Initiative (OAI) cohort. Skou et al. (2014c) also found that higher pain on walking, fear of movement, and poorer general health status were new correlates of worse knee confidence in people with symptomatic knee OA. Hart et al. (2015) found that following anterior cruciate ligament reconstruction, participants with knee OA had significantly worse knee confidence and greater fear of movement compared to those without knee OA.

Knee confidence was measured using the third question of the 'quality of life' component of the Knee injury and Osteoarthritis Outcome Score (KOOS) (Roos and Toksvig-Larsen, 2003). The KOOS is a valid, reliable, and responsive self-administered instrument, developed with an overall goal of evaluating short-term and long-term symptoms and function in persons with knee injury and knee OA (Roos et al., 1998, Roos and Toksvig-Larsen, 2003). The knee confidence measure was chosen because it is likely that confidence is closely related to self-efficacy. However, knee confidence could be a more specific measure than self-efficacy, as it measures the confidence a person has with their knee (Skou et al., 2014c).

The question on knee confidence is: "How much are you troubled with lack of confidence in your knees?" Possible responses were on a 5-point Likert scale ranging from not at all troubled by the lack of confidence; mildly troubled;

moderately troubled; severely troubled; and extremely troubled. The data collected was ordinal and the scores ranged from 0 to 5, respectively. People with a lower score had higher knee confidence and those with a higher score had lower knee confidence.

In previous pilot testing of the knee confidence within the KOOS, participants had difficulty distinguishing “severely” from “extremely” (Colbert et al., 2012). Thus, the authors evaluated these two responses as a single category. To assess reliability, Colbert et al. (2012) interviewed 26 individuals with knee OA on two occasions, one week apart, asking all KOOS quality of life subscale questions (including the knee confidence question). For inter-session reliability, the authors analysed responses on the two occasions using weighted kappa coefficients with quadratic weights (Cohen, 1968). The coefficient specifically for the knee confidence item was 0.84, suggesting excellent agreement (Landis and Koch, 1977).

In the linear regression (simple and multiple) data analyses of this thesis, the ‘severely troubled by the lack of knee confidence’ and ‘extremely troubled by the lack of knee confidence’ variables were combined, as the number of participants who were “extremely troubled by the lack of knee confidence” was low (eight out of 217 participants in Study 2). The collapsing of categories due to low participant numbers in one category had also been previously demonstrated to improve the power of the study (Colbert et al., 2012, Hart et al., 2015).

Depression

Three measures for depression were considered the Patient Health Questionnaire-8 (PHQ-8); Patient Health Questionnaire-9 (PHQ-9); and the Hospital Anxiety and Depression Scale (HADS). The PHQs has been validated for use in primary care (Cameron et al., 2008) and are a diagnostic instrument for common mental disorders and has been used to monitor the severity of depression and patient's response to treatment (Kroenke et al., 2001). The HADS is a measure of both anxiety and depression in the hospital and community settings by giving clinically meaningful results as a psychological screening tool and assess the symptom severity of anxiety and depression (Zigmond and Snaith, 1983).

The PHQ scales were chosen over the HADS because the HADS 7-item questionnaire excluded the focus on physical symptoms such as pain and fatigue, which were an important focus for the studies in this thesis, as pain has been previously reported as the most common symptom in people living with knee OA. Additionally, a meta-analysis of the PHQ-9 showed good operating characteristics across a range of settings (primary care and hospital specialties), countries (the USA and European countries), and medical disorders (Gilbody et al., 2007).

The use of PHQ-8 was chosen over the original PHQ-9 in this thesis. The PHQ-8 has been increasingly used in epidemiological/population-based studies, postal or web-based surveys, and clinical studies in which depression is a secondary outcome(Kroenke and Spitzer, 2002). In such instances, depression prevalence and severity are expected to be low. Therefore, the

ninth item of the PHQ-9 survey inquiring suicidal thoughts is infrequently endorsed, as direct interviews to further explore every positive responder to the ninth item may not be feasible (Kroenke and Spitzer, 2002). The PHQ-9 would be preferred in settings where depression was being diagnosed and treated, because of the importance of recognising the uncommon but serious instances of suicidal thoughts (Kroenke and Spitzer, 2002).

Additionally, the PHQ-8 was comparable to the PHQ-9 in terms of diagnosing depressive disorders when using a Diagnostic and Statistical Manual of Mental Disorders, 4th ed., (DSM-IV) based diagnostic algorithm (Corson et al., 2004, Kroenke and Spitzer, 2002). Hence, for the studies in this thesis, PHQ-8 was used instead of the PHQ-9, as the objective was not to clinically diagnose patients with depression.

Scoring: Each of the eight items in the PHQ-8 was scored from zero, one, two, three, with response categories for each item being not at all, several days, more than half the days, and nearly every day, respectively. The score from each item was added together to give a total score, which ranged from 0-24. Scores of 5, 10, 15, and 20 represented cut points for mild, moderate, moderately severe, and severe depression, respectively. A total of severity score ranged from 0-24. The authors of this questionnaire described that these categories were chosen due to pragmatic reasons, so clinicians can easily remember and apply these cut-points. Another reason was empiric, as using different cut-points did not noticeably change the associations between increasing PHQ-8 severity and measure of construct validity.

Handling missing data: The authors of this questionnaire suggested that if one or two values were missing from the score, then they can be substituted with a mean average score of the non-missing items. But if more than two missing values were present, then the case was not included in the analysis.

Clinical depression was described as a PHQ-8 score of ≥10, which had an 88% sensitivity and 88% specificity for major depression (Kroenke and Spitzer, 2002) and, regardless of diagnostic status, typically represents clinically significant depression (Corson et al., 2004, Kroenke and Spitzer, 2002). Furthermore, the two original validation studies of the PHQ totalling 6,000 patients established that identical scoring thresholds for depression severity could be used for the PHQ-9 and PHQ-8 (Kroenke and Spitzer, 2002).

4.2.2.3 **Physical Activity**

International Physical Activity Questionnaire (Craig et al., 2003)

A recent systematic review of measurement properties to assess physical activity in people with hip OA or knee OA reported there is not enough evidence available for any instrument to conclude that it has adequate measurement properties of physical activity levels in people with hip or knee OA (Terwee et al., 2011).

This International Physical Activity Questionnaire (IPAQ) was chosen, as it is most widely used and practical instrument for measuring physical activity in large groups (van Poppel et al., 2010). The IPAQ is suitable for any mode of administration, and examples can be culturally adapted for local populations

(Craig et al., 2003). The short form was feasible to administer, and there were no differences between the reliability and validity of the short (seven items) and long (31 items) IPAQ forms (Craig et al., 2003). An international study by Craig et al. (2003) had demonstrated that reliable and valid physical activity data can be collected by the IPAQ instruments in many countries. Repeatability of the long IPAQ questionnaire was very good, with an average Spearman correlation coefficient of 0.8 (Craig et al., 2003).

The criterion validity had a median *p* of 0.30, which was comparable with many other self-reported validation studies. The observed concurrent validity coefficients between IPAQ forms suggest that the short and long forms showed reasonable agreement. The pooled *p* for comparisons between long and short forms was 0.67 (95% CI 0.64-0.70). The criterion validity of the self-reported IPAQ data against accelerometer data showed a fair to moderate agreement between the two measures with a pooled *p* of 0.33 (95% CI 0.26-0.39) for the long form IPAQ, and for the short form with the accelerometer, the pooled *p* was 0.30 (95% CI 0.23-0.36). The short form reliability tests showed evidence of a “learning effect” over time, where subjects who were administered the same IPAQ forms over serial visits showed improvements over time in reliability and inter-method agreement (Craig et al., 2003). The content validity of IPAQ was high, because frequency, intensity, and duration of physical activity were assessed, as well as sedentary behaviour (Craig et al., 2003).

The short version of the IPAQ was used for this thesis. This consisted of seven items structured to provide separate scores for vigorous-intensity activities, moderate-intensity activities, and walking. Practical examples of

vigorous and moderate intensities were provided: moderate physical activity was defined as “any activity that gets you mildly sweaty and out of breath, (e.g. brisk walking, carrying loads, digging, climbing ladders)”; vigorous physical activity was defined as “any activity that involves hard physical effort and makes you breathe much harder than normal (e.g. heavy lifting, aerobics, or fast bicycling)”. In each of these domains (i.e. vigorous physical activity, moderate physical activity, and walking), the number of days per week, and time (hours and minutes) per day were recorded. Sitting time on weekdays was included as an indicator of sedentary behaviour.

Scoring: One measure of the volume of activity was computed by weighting each type of activity by its energy requirements defined in the metabolic equivalent of task (MET) to yield a score in MET-minutes. METs are multiples of the resting metabolic rate and a MET-minute is computed by multiplying the MET score of each activity by its time (minutes) and frequency (days). The selected MET values were derived from Craig et al. (2003); the following formulae were used for the computation of MET-minutes/week for IPAQ data analysis and the values reported as a continuous score:

Walking *MET-minutes/week= 3.3 METs x walking minutes x walking days*

Moderate*-intensity MET-minutes/week = 4.0 METs x moderate-intensity activity minutes x moderate days*

Vigorous*-intensity MET-minutes/week = 8.0 METs x vigorous-intensity activity minutes x vigorous days*

Total *physical MET-minutes/week was the sum of walking + moderate + vigorous MET-minutes/week scores.*

The IPAQ Research Committee guidelines for data processing (Patterson, 2005) reported that there were no established thresholds for presenting MET-minutes/week and proposed that data was reported as comparisons of median values and interquartile ranges (IQRs). Also, they recommended that given the non-normal distribution of energy expenditure in many populations, the continuous indicators should be presented as median MET-minutes/week and IQRs rather than means and standard deviations.

Categorical scores were reported as below (Patterson, 2005):

Low physical activity criteria*: those individuals who did not meet criteria for moderate or high physical activity.*

Moderate physical activity criteria*: three or more days of vigorous-intensity activity of at least 20 minutes per day, or five or more days of moderate-intensity activity and/or walking of at least 30 minutes per day, or five or more days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum total physical activity of at least 600 MET-minutes/week.*

High physical activity criteria*: vigorous-intensity activity on at least three days achieving a minimum total physical activity of at least 1500 MET-minutes/week or seven or more days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum of total physical activity of at least 3000 MET-minutes/week.*

Sitting time was an indicator variable of time spent in sedentary activity and was not included as part of any summary scores of the physical activity data.

Data processing rules in accordance to the IPAQ Research Committee guidelines (Salavati et al., 2011): All responses were converted from hours and minutes into minutes and any values of 15, 30, 45, 60, 90 entered into the 'hours' column by mistake were converted to 15, 30, 45, 60, 90 minutes, respectively. If participants had written 'don't know' or did not answer time or days, then the case was removed from the analysis, as both numbers of days and daily time were required for calculating the scores. All cases with a total physical level of greater than 960 minutes (16 hours) were excluded from the analysis on the assumption that an individual on average sleep for 8 hours a night. Also, only values of 10 or more minutes of activity were included in the calculation of physical activity MET-minutes/week scores, as scientific evidence suggest that bouts of at least 10 minutes are required to achieve health benefits (Craig et al., 2003), thus responses of less than 10 minutes were re-coded as zero. Finally, to normalise the distribution of the activity levels, which were usually skewed in national or large population datasets, the IPAQ Research Committee recommended that all walking, moderate, and vigorous time variables exceeding 180 minutes (3 hours) were truncated (re-coded) to equal to 180 minutes in a new variable. This rule permitted a maximum of 21 hours of activity a week to be reported for each category (i.e. three hours * seven days).

4.2.2.4 **Knee functions and Quality of Life**

Knee functions

The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) is the most commonly used outcome instrument to assess the course of disease or response to treatment in patients with knee or hip OA (Bellamy, 1995). The Knee injury and Osteoarthritis Outcome Score (KOOS) is the most commonly used outcome instrument for assessment of the patient's opinion about their knee and its associated problems (Roos et al., 1998). The WOMAC consists of three subscales (pain; stiffness; and physical function) (Bellamy, 1995). The KOOS is an extension of the WOMAC with five subscales (pain; symptoms; function in daily living (ADL); function in sport and recreation; and knee-related quality of life (QOL) (Roos et al., 1998).

The KOOS has undergone a substantial amount of psychometric testing, largely among populations for whom the scale was intended. As well as exhibiting face validity, the direct involvement of patients with knee conditions in the development of the KOOS facilitates content validity (Roos et al., 1998, Roos and Toksvig-Larsen, 2003). The use of individual scores for each subscale, rather than an aggregate score, enhances clinical interpretation and in research acknowledges the impact of different interventions on different dimensionsv(Collins et al., 2011). For example, exercise therapy is likely to have more impact on ADL and sport/recreation, while pharmacology may impact more on pain and symptoms. Unlike the WOMAC, content validity is ensured in the KOOS, and different ages and functional activity levels are taken into consideration. For example, the sport/recreation subscale is more important in patients with a high physical activity level, while the ADL subscale

is more important in subjects with a lower physical activity level (Roos and Toksvig-Larsen, 2003).

The KOOS was chosen over the WOMAC for this thesis because it has adequate internal consistency, adequate test-retest reliability, and face validity and content validity for an audience with knee OA, like those shown in the WOMAC (Collins et al., 2011). The content validity of the WOMAC is not ensured for more physically active patients since the function scale does not include more difficult functional tasks (Collins et al., 2011). Thus, another advantage of using the KOOS is the inclusion of additional subscales (sport and recreation, and quality of life), which can allow for measuring more difficult functional tasks such as kneeling and squatting (Roos and Toksvig-Larsen, 2003). Furthermore, the KOOS's inclusion of the three WOMAC subscale facilitates comparison of findings with studies that have utilised the WOMAC as a primary outcome measure (Collins et al., 2011). Finally, there is a need to obtain permission and pay licensing fees before use of the WOMAC, whereas the KOOS is free to use.

The KOOS assesses a participant's opinion about their knees and the associated problems. The KOOS has two different subscales of physical activity (the ADL, and the sport and recreation) to ensure a wide range of current and expected physical activity levels for a wide variant population with symptomatic knee OA. KOOS consisted of five subscales: 1) pain frequency and severity (nine items); 2) symptoms such as the severity of knee stiffness and the presence of swelling, grinding or clicking, and a range of motion restriction (seven items); 3) difficulty experienced during activities of daily

living (ADL; 17 items); 4) difficulty experienced with sport and recreational activities (five items); and 5) knee-related quality of life (QOL; four items).

Scoring: Five standardised options were given for each question and assigned a score of zero (no problems) to four (extreme problems). A score for each subscale was calculated independently as an aggregate total score has not been validated and was not recommended for use. Scores for each subscale were calculated as the sum of the items and then transformed to a 0-100 scale (using a Microsoft Excel spreadsheet provided by the author of KOOS), where zero represented extreme knee problems and 100 represented no knee problems, as this was common in orthopaedic assessment scales and generic measures (Roos et al., 1998).

Handling missing data: If a mark was placed outside a box, the closest box was chosen. If two boxes were marked, the mark which indicated more severe problem was chosen. The author of the KOOS recommended that as long as at least 50% of the subscale items were answered for each subscale, a mean score can be calculated. So, for KOOS pain, five items must be answered; for KOOS symptoms, four items must be answered; for KOOS ADL, nine items must be answered; for KOOS Sport/Rec, three items must be answered, and for KOOS QOL, two items must be answered. If more than 50% of the subscale items were not answered, then the response was considered invalid and no subscale score was calculated.

The KOOS has also been adapted and translated into 28 languages. Multiple studies reported that the KOOS demonstrate convergent and divergent construct validity, with the KOOS more strongly correlated with subscales of

the Short Form 36 (SF-36) that measure similar constructs (e.g. ADL with physical function, sport/recreation with physical function, pain with bodily pain), and less strongly with SF-36 subscales that measure mental health (Bekkers et al., 2009, Roos et al., 1998, Roos and Toksvig-Larsen, 2003, Salavati et al., 2011). In those with knee OA who have undergone physical therapy treatment, large effect sizes were seen at four weeks on the pain, symptoms, and ADL subscales, while the sport/recreation and QOL subscales showed moderate effects (Collins et al., 2011).

The strengths of using the KOOS were that it has undergone a substantial amount of psychometric testing. The KOOS has been established as a reliable and valid measure across multiple languages, which highlight its usefulness as a patient-reported measure of knee function in people with knee OA.

General Health Status and Quality of Life

The EQ-5D is a standardised instrument for use as a measure of health outcome developed by the EurolQol group, a consortium of investigators in Europe (The EuroQol Group, 1990). It is applicable to a variety of different illness and treatments and provides a simple descriptive profile and a single index value for health status. The five dimensions included in the EQ-5D are mobility; self-care; usual activities; pain/discomfort and anxiety/depression. Each dimension has either three levels (no problems, some problems, major problems) in the EQ-5D-3L or five levels (no problems, slight problems, moderate problems, severe problems, and extreme problems) in the EQ-5D-5L. Additionally, the EQ-VAS portion of the EQ-5D-5L is a measure of participant's overall assessment of their own health on a vertical scale of 0

(the worst health you can imagine) to 100 (the best health you can imagine) (The EuroQol Group, 1990).

Another measure of quality of life is the SF-6D, which is derived from the health-related quality of life questionnaire called the Short Form 36 (Brazier et al., 2002). It has six dimensions: physical functioning; role limitations; social functioning; pain; mental health and vitality. The classification system consists of four to six levels on each of the six dimensions.

Obradovic et al. (2013) compared these two instruments for their performance and validity in patients with chronic pain. They reported that the EQ-5D showed a greater mean change from baseline to endpoint compared with the SF-6D. The Spearman's rank correlation showed a moderate correlation between EQ-5D and SF-6D dimensions. Construct validity showed both instruments could differentiate between patient subgroups with different severities of adverse events and analgesic efficacies, but a more considerable difference was detected with the EQ-5D (Obradovic et al., 2013).

Responsiveness was also higher with the EQ-5D and for the subgroups in which improvements in health status were expected than with SF-6D. At present, the EQ-5D tends to provide a wider scoring range and better completion rates than the SF-6D (Obradovic et al., 2013). Furthermore, the new 5-level version of the EQ-5D is anticipated to have better discriminative capacity and sensitivity to change and smaller ceiling effects than the EQ-5D-3L. Due to these reasons, the EQ-5D was chosen over the SF-6D as the measure for health and quality of life outcome in this thesis.

The EQ-5D-5L was chosen over the EQ-5D-3L, because the 3L measure only had three response categories: no problems, some problems, and extreme problems. Furthermore, reliability and validity tests of the EuroQol in patients with knee OA showed a lack of ability of the 3L to discriminate small-to-moderate differences in health status (Fransen and Edmonds, 1999). The extra levels in the 5L allowed for a greater potential range of responses and the ability to discriminate between the two extreme levels of having no problems to extreme problems (Conner-Spady et al., 2015).

Scoring for EQ-5D-5L: A descriptive system of scoring was used; each dimension was divided into five levels of perceived problems: level one for “I have no problems”, level two for “I have slight problems”, level three for “I have moderate problems”, level four for “I have severe problems”, and level five “I have extreme/I am unable”. Higher scores indicated a higher level of perceived problems. A unique health state was defined by combining one level from each of the five dimensions. A total of 3125 possible health states can be defined in this way; each health state is referred to in terms of a five-digit code (van Reenen and Janssen, 2015). For instance, state 11111 indicated no problems on any of the five dimensions, whereas 12321 indicated no problems with mobility, slight problems with washing or dressing, moderate problems with doing usual activities, slight pain or discomfort and not anxious or depressed.

Handling missing data for EQ-5D-5L: There should be only one response per dimension. If two boxes are ticked for a single dimension, then this was treated as missing data.

Scoring for EQ-VAS: The EQ-5D-5L also included the EQ-VAS to record the participant's self-rated health on a vertical VAS scale with endpoints of 100 being 'best imaginable health' (at the top) to zero being the 'worst imaginable health' (at the bottom).

Handling missing data for EQ-VAS: If there was a discrepancy between where the participant has placed the cross on the vertical VAS scale and the number that is written in the box, then the number written in the box should be considered the correct score. If more than one cross is placed on the vertical scale or more than one number in the box, this was treated as missing data.

4.2.2.5 **Follow-Up Questionnaire Measures**

A 6-month follow-up questionnaire was used to investigate the changes in arthritis self-efficacy and its associated risk factors over time in people with knee OA to meet Objective 3 of this thesis. The content of the follow-up questionnaire was the same as the baseline questionnaire with the same questionnaire measures (Arthritis Self-Efficacy Scale; Visual Analogue Scale (VAS) pain scale; International Physical Activity Questionnaire (IPAQ); Knee injury and Osteoarthritis Outcome Score (KOOS); Exercise Self-Efficacy Scale; EuroQol–5 Dimension–5 Levels (EQ-5D-5L); Patient Health Questionnaire-8 (PHQ-8); Multidimensional Outcomes Expectations for Exercise Scale (MOEES)).

However, questions asking "do you have knee OA?; when were you diagnosed with knee OA?; have you had any treatments for your knee OA?" were replaced with "have you been given exercises by a physiotherapist in the

last 6-12 months? If yes, can you please provide some details: When did you get given the exercises?; Are you currently doing these exercises? What type of exercises have you been given?" in the follow-up questionnaire to investigate if participants have had any physiotherapy exercises in the last 12 months.

OA is a debilitating disease that requires individuals with OA to independently self-manage their arthritis and the symptoms, for example through taking medication or having an exercise routine. Therefore, enhancing an individual's perceived self-efficacy beliefs in successfully managing their arthritis can be highly influential in fostering behaviours critical to an effective self-management process.

According to research from the Stages of Change construct, the first six months is the crucial period for individuals who have intentions to change to adopt new behaviours and maintain the new behaviour (Prochaska and Diclemente, 1983). Thus, a 6-month follow-up period was chosen to investigate and explore if there are changes to arthritis self-efficacy and factors associated with arthritis self-efficacy and the management of knee OA during the natural progression of knee OA in the 6-month period. The natural progression of knee OA is referred to the period where people living with knee OA receiving standard care from the National Health Service, such as in the UK, this would be the conservative and surgical management for knee OA mentioned in Section 2.5 of this thesis. Participants did not receive an intervention during for this study, as the purpose was to observe any natural progression changes that took place during the 6-month period and to ensure the results from this study can be generalised to a wider population of adults

aged 45 or over living with knee OA in the United Kingdom receiving care from the National Health Service. It was hoped that if any significant changes did occur then the reasons for the changes in their self-beliefs could be explored further in the subsequent semi-structured interviews.

4.2.3 Sampling

4.2.3.1 **Sampling Procedure**

Participant Identification Centres (PIC) approach for recruitment was used. This approach involved identifying local general practitioners' (GP) practices and inviting them to act as PICs to help with recruitment for the study. GP practices identified potential participants for the study in line with the inclusion and exclusion criteria (Section 4.2.3.2) and potential participants were sent a study pack in the post. If participants were interested in the study, they were asked to complete and return the questionnaire from their study pack.

Participant recruitment was supported by the East Midlands Division 5 (Primary Care) Clinical Research Network (CRN) to help identify National Health Service (NHS) GP practices in Nottingham City and Nottinghamshire Clinical Commissioning Groups (CCGs) to be the PICs. Thirty-seven practices were approached and ten agreed to be PICs (eight general practices in Nottingham and two general practices in Mansfield).

The PICs were provided with a summary of the protocol, which included the inclusion and exclusion criteria for the study, the questionnaire, participant information sheet, and information about reimbursement for the work they undertake. The PIC was asked to do a patients' database search within their

practice, taking into consideration the inclusion and exclusion criteria of the study, to identify potential participants. The search was done using a specific coding system on the practice's database. As the search only provided a list of patients who met the inclusion and exclusion criteria, there may be other reasons why some patients in the list may not be appropriate for this study and should not be contacted. Therefore, it was the GP's responsibility to review the list of potential participants and remove those who should not be contacted, such as patients who have suffered a recent bereavement; have other serious illness or issues in the family; have another illness where the GP felt taking part would be inappropriate (such as severe mental health illnesses); whether the patient was in a care home; or was already involved in another study.

Once the GP had identified a final list of potential participants, they were contacted via postal mail. The practices were provided with an electronic version of the invitation letter for the participants and they were required to add their logo onto the letterhead and add a signature of the GP or practice manager involved in this study. The author prepared the study packs and the practice needed to print the cover letter for the packs and mail out to the potential participants. This study pack included: an invitation letter to the study; a participant information sheet for the questionnaire; a questionnaire; and a pre-paid return envelope; packed up in individual envelopes.

Funding was secured from the University of Nottingham and The Arthritis Research UK Centre for Sport, Exercise, and Osteoarthritis to provide the support costs for the GP practices that assisted with the recruitment of this study. This covered the time spent undertaking the database search for

potential participants, GP checking the list of potential participants, sending out of packs to potential participants, and stamps or franking of envelopes.

4.2.3.2 **Eligibility Criteria**

The inclusion criteria were adults aged 45 or over; registered with a GP practice in Nottingham City and Nottinghamshire County who have had a diagnosis of knee OA on the practice's database; an ability to communicate in English; and the ability to give informed consent to the study.

Exclusion criteria were those who have had a total knee replacement surgery at baseline recruitment; patients who have suffered a recent bereavement; have other serious illness or issues in the family; have another illness where the GP felt taking part would be inappropriate (such as severe mental health illnesses); whether the patient was in a care home; or was currently involved in another study that their GP was aware of (flagged on the practice's database system).

4.2.3.3 **Sample Size**

The dependent variable for this study was arthritis self-efficacy score, which measured an individual's belief in their ability to perform specific tasks or behaviours to cope with the consequences of arthritis. This score was the sum of the arthritis self-efficacy 'pain' score component plus arthritis self-efficacy 'other symptoms' score component. But, a calculation of sample size was conducted for each component to determine which one required a higher sample size to ensure the study was suitably powered. The sample size

calculations were based on a one-group before-after study design (paired t-test) (Rosner, 2015).

Sample size calculation for arthritis self-efficacy pain score was based on the mean difference of 2.55 points (between baseline and 4-month follow-up group of adults aged >50 years old with knee and/or hip OA diagnosed by their GP who participated in an arthritis self-management programme), a standard deviation of 6.7 (Barlow et al., 1998, Buszewicz et al., 2006) with a 5% significance level and 90% power, which indicated 73 participants were required for the study.

Sample size calculation for arthritis self-efficacy other symptoms score was based on the mean difference of 2.81 points (derived from the same method as above) and a standard deviation of 8.2 (Barlow et al., 1998, Buszewicz et al., 2006) with a 5% significance level and 90% power, which indicated 89 participants were required for the study, and this was used as the number of participants required, as it is higher than 73, to ensure the dependent variable (arthritis self-efficacy score) would be suitably powered.

For the 6-month follow-up questionnaire analyses, a dropout rate was accounted for based on previous studies that used longitudinal questionnaires with a follow-up period of 1 year using the same questionnaire, dropout rates of 7-8% are seen (Dawson et al., 2005, Hoogeboom et al., 2013). To be conservative, a 20% dropout rate was applied for the baseline questionnaire return rate, thus a minimum of 107 participants were required for this study.

Additionally, to run a multiple linear regression, it was important to consider the sample size. Green (1991) recommended that to test the overall fit of the regression model, a minimum acceptable sample size of 50 + 8*k* (*k* is the number of predictors) was required. To test the individual predictors within the model, a minimum sample size of 104 + number of predictors was required. To test both the overall fit of the model and the contributions of the individual predictors to the model, both sample sizes were calculated and the larger sample size was used. Thus, there were eight predictors to include in the multiple linear regression model, thus 50+ (8x8) = 114 and 104+8 = 112, indicated that a minimum sample size of 114 was required for the multiple regression. The number of participants with valid data to run the multiple linear regression in this study was 115.

4.2.4 Questionnaire Survey Procedure

Postal questionnaires were mailed out in batches, as GP practices were recruited as a PIC incrementally. The author prepared the study packs into individual envelopes. Each study pack included a cover letter to invite the participants onto the study; a participant information sheet; a questionnaire booklet and a pre-paid return envelope. The author's contact details were in the letter to the participants should they need to contact her about the study. The participant information sheet also informed participants of the seven-day cooling off period, in which participants had seven days from the day they returned the questionnaire to let the author know if they want to withdraw from the study. After seven days, the author would enter the questionnaire data onto the database. The author hand wrote "Thank You" cards and sent to participants who returned the questionnaire; this was an idea suggested by

the PPI Advisory Group during the design of the study, as they thought this would make the participants feel appreciated for taking their time to complete the questionnaire and could encourage participants to complete the follow-up questionnaire as well.

4.2.5 Informed Consent for a Questionnaire

For consent into the questionnaire survey study, the completion and return of the questionnaire were taken as implied consent to the study. To ensure participants remained anonymous, participants were provided with a unique five-digit Study ID. Personal information about the participants, such as their name(s) and/or addresses was removed from their questionnaire. Their personal details form, their questionnaire, and their consent form were all stored separately.

4.2.6 Data Analyses

To understand which factors were associated with arthritis self-efficacy, descriptive tests were performed to describe participants' demographics; their clinical characteristics; their current perception of their arthritis self-efficacy, exercise self-efficacy, multidimensional outcomes expectations for exercise, general health status, knee pain perception (VAS pain), and depression.

Scatterplots were used to visually assess the linear relationship between each independent variable (exercise self-efficacy; multidimensional outcomes expectations for exercise: physical MOEES, social MOEES, and self-evaluative MOEES); knee confidence; general health status; knee pain

perception; and depression against the dependent variable (arthritis self-efficacy score).

Simple linear regression was run between each independent variable and the dependent variable to investigate a) how much variance in arthritis self-efficacy scores were explained by the independent variables, and b) investigate the change in arthritis self-efficacy score with one unit change in each independent variable.

Multiple linear regression (using the backward step-wise method) was run to further investigate the change in the arthritis self-efficacy scores in the presence of all the independent variables which showed statistical significance ($p<0.05$) from the simple linear regression. The backward step-wise method was preferred over the forward method, as the latter was more likely to exclude predictors that had a significant effect but only when another variable is held constant (i.e. the suppressor effect) (Field, 2009). Thus, the forward method risked missing a predictor that did predict the outcome (i.e. Type II error) (Field, 2009).

All the statistically significant independent variables from the simple linear regression plus age, sex, and BMI (to control for these variables) were put into a multiple regression model (first step). Any variables that did not make a statistically significant contribution to how well the multiple regression model predicted the arthritis self-efficacy outcome variable was removed from this model. These non-significant variables from the simple linear regression and the multiple regression model (at the first step) were subsequently added back into the model one-by-one; variables that became statistically significant were

kept in the model and variables that were not statistically significant were removed from the model. Thus, the final model consisted of all statistically significant independent variables.

For the 6-month follow-up questionnaire, descriptive tests were performed to describe participants' demographics, clinical characteristics, their current perception of their arthritis self-efficacy, exercise self-efficacy, multidimensional outcomes expectations for exercise, general health status, knee pain perception (VAS pain), knee confidence, and depression of participants on respondents to the follow-up questionnaire and those who were lost to follow-up.

To investigate the changes in arthritis self-efficacy and its associated factors, paired t-tests (parametric) and Wilcoxon signed-rank tests (non-parametric) were performed to describe and investigate the differences in participants' perception of their arthritis self-efficacy, exercise self-efficacy, multidimensional outcomes expectations for exercise, general health status, knee pain perception, knee confidence, depression, and physical activity levels at baseline and at 6-month follow-up.

To investigate the participants lost to follow-up (i.e. non-respondents to the second questionnaire), independent-samples t-tests were run to determine if there were statistically significant differences between the demographics, clinical characteristics, and questionnaire measure from responders and non-responders to the follow-up questionnaire. Welch t-tests were performed for variables that violated the assumption of homogeneity of variances for the independent-sample t-test. The Mann-Whitney U test is a non-parametric test

that was used to determine if there was a difference in demographics and questionnaire measures between responders and non-responders. This test was run for variables that violated the assumption of a normal distribution or variables with an ordinal measure. Finally, the test of two proportions, specifically the Chi-Square test of homogeneity, was used to determine if there was a difference between the sex of responders and non-responders.

All statistical analyses were conducted with the IBM SPSS Statistics software, version 24.

4.2.7 Ethics Approval

National Health Service (NHS) Research Ethics approval was obtained on 10th April 2015 for both the quantitative survey (Chapter 4) and qualitative semi-structured interviews study (Chapter 5) from the NHS Oxford South Central Research Ethics Committee (REC reference: 15/SC/0212). Research & Development approvals were obtained on 15th April 2015 from Nottingham City CCGs and Nottinghamshire County CCGs, which provided local site assurance to ensure that the research met nationally agreed research governance criteria for Participant Identification Centres.

4.2.8 Ethical Considerations

A potential risk could be the risk of a breach of confidentiality. Participants are required to write their name and address on the questionnaire. To minimise these risks, any identifiable information (i.e. names and names of places) were removed from the questionnaire once the researcher received it at the

University of Nottingham and the questionnaire will have a unique participant study ID assigned to it.

Additionally, the questionnaires did not leave the School of Medicine, the University of Nottingham, and had restricted access only for researchers directly involved in the study. They were stored in a locked cabinet, in a locked office; the data will be archived for a period of seven years, after which it will be confidentially destroyed. The data analysis of the questionnaire was completed by researchers directly involved in the study to avoid third parties' access to the participants' details. Additionally, the data analysis was only completed at the School of Medicine, the University of Nottingham on a secure computer network within the University of Nottingham.

Another risk was the possibility of misunderstanding (especially for people who have difficulty with the English language) of the study documents or questionnaire materials. Lay-language was used, and all of the research documentation were discussed and reviewed by the Patient and Public Involvement (PPI) Advisory Group members to ensure that our documents were understandable. The 'Gunning Fog Index' readability scoring system was used to ensure that participant facing documents had an index score between 8-12, as it is recommended that texts for wide audiences need a Gunning Fog Index of less than 12, and texts intended for a near-universal understanding requires an index score of less than 8. Additionally, the inclusion criteria state that participants need to be able to communicate in English, as all the research documents are written in English.

4.3 Results

4.3.1 Description of Questionnaire Respondents at Baseline

Eight general practices in Nottingham and two general practices in Mansfield were PICs for this study. The two general practices in Mansfield under the same medical group management with the same practice manager. Practice managers and general practitioners from each practice identified potential participants, as the author did not have access to patients' details. A total of 917 potential participants met the study criteria and were mailed out a study pack (cover letter, participant information sheet, and questionnaire); the response rate to this mail out was 19% (175 responders). As the author did not have access to patients' details, the characteristics of the 81% non-responders were unable to be identified.

A response rate of 19% was low compared to other postal survey studies conducted in primary care patients with knee pain. A questionnaire study by O'Reilly et al. (1996) recruited men and women aged 40-79 years from two general practices in Nottingham and obtained a response rate of 81.9% was achieved following a reminder (n=4057). Another study by Porcheret et al. (2007) mailed out a baseline survey to all adults aged 50 and over registered with three general practices in North Staffordshire (n=8995). They received a response rate of 77% to the baseline questionnaire. A higher number of participants were mailed out postal surveys compared in these previous studies (O'Reilly et al., 1996, Porcheret et al., 2007) compared to the study in this thesis. The study in this thesis focused on mailing out study packs to adults (aged 45 or over) who have had a clinical diagnosis (shown in their medical notes at their GP practice) of knee OA, but the previous two studies

mailed out study packs to all patients in their participating GP practices or mailed out to those who reported ever having knee pain (not a clinical diagnosis of knee OA) (O'Reilly et al., 1996, Porcheret et al., 2007). Additionally, as the author of this thesis did not have access to patient information from the general practices, reminders were not sent out to non-responders to the questionnaire, which could also explain the lower response rate compared to previous studies, as these other studies sent out reminders to non-responders (O'Reilly et al., 1996, Porcheret et al., 2007). If the author of this thesis had mailed out to all patients in the participating general practices with knee pain and had the capacity to send reminders, a higher response rate might have been achieved.

From the 175 responders to the questionnaire, nine were refusals (i.e. sent back a blank questionnaire and/or attached a note to say they did not wish to take part) and 14 were excluded because they had had a total knee replacement. Thus, a final number of 152 responders were appropriate to include in the analyses.

Those who responded were representative of the population of people living in Nottingham. The Census (2011) for Nottingham showed 50.3% male and 49.7% females resided in Nottingham. Similarly, this study consisted of 52.6% male and 47.4% female (Table 3). The Census (2011) data for Nottingham reported that most people were of White ethnicity (71.5%), 3.2% Asian Indian, 5.5% Asian Pakistani, 2% Asian Chinese, 3.1% Black Caribbean, 3.2% Black African, and 11.5% Other (Table 3). As another comparison, the sex and ethnicity of people living in England reported in the Census (2011) revealed that 49.2% were male, 50.8% were female, 86.3% were of White ethnicity,

2.6% Asian Indian, 2.1% Asian Pakistani, 0.7% Asian Chinese, 1.1% Black Caribbean, 1.8% Black African, 5.3% Other (Table 3). For this study in the thesis, 82.9% White-Caucasians, 2% White-Hispanic, 5.9% Black Caribbean, 1.3% Black African, 2% Asian Indian, 2% Asian Pakistani, and data were missing for 3.9% of the participants. Therefore, the ethnicity of this sample was more closely representative of the percentage ethnicity of England than in Nottingham. However, there was a larger percentage from people of Black Caribbean ethnicity completing the survey in this thtesis compared to Census data (Table 3).

Table 3 Demographics of Study 1 participants compared to the population in Nottingham and England

Demographics	Census 2011 Nottingham (%)	Study 1 in this thesis	Census 2011 England (%)
Male	50.3	52.6	49.2
Female	49.7	47.4	50.8
White	71.5	82.9	86.3
Asian Indian	3.2	2	2.6
Asian Pakistani	5.5	2	2.1
Asian Chinese	2	0	0.7
Black Caribbean	3.1	5.9	1.1
Black African	3.2	1.3	1.8
Other	11.5	2	5.3

Furthermore, the author included GP practices from a wide range of areas of deprivation in Nottingham (Table 4) from the areas of affluent to areas that were considered most deprived to ensure a representative sample of participants were recruited for this study.

Table 4 Questionnaire return rate and deprivation rate of general practices in Study 1

GP Practices	Questionnaire return, %	Deprivation rate*, %
GP practice 1	25.8	60.1 – 80
GP practice 2	41.0	40.1 – 60
GP practice 3	26.7	40.1 – 60
GP practice 4	16.8	20.1 – 40
GP practice 5	4.2	20.1 – 40
GP practices 6 & 7	18.8	10.1 – 20
GP practice 8	13.6	10.1 – 20
GP practice 9	20.4	< 10 (worst)
GP practice 10	12.4	< 10 (worst)

*Deprivation rate in accordance with areas was taken from the Nottingham Insight website in 2018 Higher percentage represents least deprived areas in Nottinghamshire and lower percentage represent the most deprived areas in Nottinghamshire. (https://maps.nottinghamcity.gov.uk/insightmapping/?l=0.21,8.89&xmin=442885&xmax=468285&ymin=330842&ymax=349276).

4.3.2 Description of Questionnaire Sample Characteristics at Baseline

Participants' characteristics and scores for the study variables for the baseline and follow-up questionnaires are presented in Tables 5 and 6. In the baseline sample, 47.4% were women, mean age of 67.8 years old (SD 10.59) and an average BMI of 28.65 kg/m^2 (SD 5.86), indicating they were overweight (NHS, 2016) (Table 5). Most participants were of White-Caucasian ethnicity and 5.9% were of black-Caribbean ethnicity (Table 5). Two-thirds of participants were retired and 23.7% were employed (Table 5). Most participants (34.2%) were educated up to secondary school level and 20.4% had a university degree (Table 5).

Table 5 Participants' demographics of baseline questionnaire participants

Demographics	All Baseline (n = 152)
Sex, n (%)	
Male	80 (52.6)
Female	72 (47.4)
Age, mean (SD), y	67.80 (10.59)
45-54, n (%)	18 (11.8)
55-64	35 (23)
65-74	52 (34.2)
75-84	32 (21.1)
85+	5 (3.3)
Missing	10 (6.6)
Body Mass Index, mean (SD), kg/m^2	28.647 (5.86)
Underweight, n (%)	2 (1.3)
Healthy weight	38 (25)
Overweight	53 (34.9)
Obese	47 (30.9)
Missing	12 (7.9)
Smoking status, n (%)	
Non-smoker	77 (50.7)
Ex-smoker	61 (40.1)
Current smoker	11 (7.2)
Missing	3 (2)
Ethnicity, n (%)	
White-Caucasian	126 (82.9)
White-Hispanic	3 (2)
Black-Caribbean	9 (5.9)
Black-African	2 (1.3)
Indian	3 (2)
Pakistani	3 (2)
Missing	6 (3.9)
Employment status, n (%)	
Employed	36 (23.7)
Unemployed	9 (5.9)
Retired	101 (66.4)
Sick leave	2 (1.3)
Part-time employment	1 (0.7)
Other	3 (2)
Highest education level, n (%)	
None	12 (7.9)
Primary school	4 (2.6)
Secondary school	52 (34.2)
UK Higher National Diploma	7 (4.6)
University degree	31 (20.4)
Missing	46 (30.3)

Twenty per cent of participants had been diagnosed with knee OA within the last four years and 8.6% were diagnosed 20+ years ago (Table 6). The average number of symptoms that participants reported at baseline was 3.63 (Standard Deviation (SD) 1.61) with the top 4 most common symptoms (data not shown) being knee pain (77%), stiffness (69.7%), swelling (56.6%), and crepitus (53.9%). Participants had an average of 2 co-morbidities (Table 6); the top two most common (data not shown) were cardiovascular diseases, such as heart disease, high blood pressures, high cholesterol (32.3%); and endocrine disorders, such as Type 2 Diabetes Mellitus (19.8%).

Table 6 Clinical characteristics of baseline questionnaire participants

Clinical characteristics	All baseline (n=152)
Duration of knee OA, n (%)	
0-4 years	31 (20.4)
5-9 years	22 (14.5)
10-14 years	16 (10.5)
15-19 years	14 (9.2)
20+ years	13 (8.6)
Missing	56 (36.8)
Total number of symptoms	
Number of symptoms, mean (SD)	3.63 (1.61)
Comorbidities? n (%)	
No	39 (25.7)
Yes	110 (72.4)
Missing	3 (2)
Total number of comorbidities	
No. of comorbidities, median (IQR)	2 (2)
Painkiller usage for knee OA, n (%)	
No	30 (19.7)
Yes	55 (36.2)
Missing	67 (44.1)

Most people were moderately physically active (34.2%; Table 7), which indicated that they reported being vigorously active for at least 20 minutes at least 3 days a week, or they were moderately active for at least 5 days a week for at least 30 minutes a day, or they had a total physical activity of at least 600 MET-minutes/week and were physically active for at least 5 days a week. Participants reported an average sedentary time of 360 minutes (6 hours) per day (Table 7).

Table 7 illustrates that participants perceived a moderate level of knee pain (mean 46.59mm (SD 26.73)) and moderate arthritis self-efficacy beliefs (mean 5.66 (SD 1.98)). However, their self-belief for being able to keep up with exercises was low (31.25%). Participants had a mean score of 3.50 indicating they were not clinically depressed. Participants also reported a mean score of 70 on the EQ-VAS general health status scale indicating relatively good health status perceived. Lastly, most people were moderately troubled by the lack of knee confidence (31.6%).

Table 7 Study variables from respondents of the baseline questionnaire

Study Variables	**All Baseline (n= 152)**
Knee pain perception[1], mean (SD)	46.59 (26.73)
Missing, n (%)	17 (11.2)
Multidimensional outcomes expectations for exercise (MOEES)[2], mean (SD)	
Physical MOEES	23.71 (4.03)
Social MOEES	12.64 (2.92)
Self-evaluative MOEES	18.57 (3.76)
Arthritis self-efficacy[3], mean (SD)	5.66 (1.98)
Exercise self-efficacy[4] %, median (IQR)	31.25 (70)
Depression[5], median (IQR)	3.50 (6)

Study Variables (Table 7 continued)	All Baseline (n= 152)
General health status[6], median (IQR)	70 (30)
KOOS sub-scales[7], mean (SD)	
KOOS Pain	53.42 (20.39)
KOOS Symptom	45.49 (12.85)
KOOS ADL	58.45 (21.85)
KOOS Sport/Rec	39.53 (30.72)
KOOS QOL	37.66 (22.38)
Knee confidence[8] (KC), n (%)	
Not at all troubled by lack of KC	21 (13.8)
Mildly troubled by lack of KC	25 (16.4)
Moderately troubled by lack of KC	48 (31.6)
Severely troubled by lack of KC	34 (22.4)
Extremely troubled by lack of KC	23 (15.1)
Missing	1 (0.7)
Physical activity[9] (PA) levels, n (%)	
No/low PA level	34 (22.4)
Moderate PA level	52 (34.2)
High PA level	43 (28.3)
Missing	23 (15.1)
METS-mins/week, median and (IQR)	
Vigorous PA METS-mins/week	0.00 (1020)
Moderate PA METS-mins/week	120 (1260)
Walking METS-mins/week	940.5 (1848)
Total sitting time, mins/day	360 (240)

[1]Knee pain perception measured using the VAS for pain = continuous measure (0 = no knee pain to 100 = severe knee pain)

[2]Physical subscale of the multidimensional outcomes expectations for exercise (MOEES) = continuous measure (6 = low expectations in the physical benefits of exercise to 30 = high expectations in the physical benefits of exercise)

[2]Social subscale of the MOEES = continuous measure (4 = low expectations in the social benefits of exercise to 20 = high expectations in the social benefits of exercise)

[2]Self-evaluative subscale of the MOEES = continuous measure (5 = low expectations in the self-evaluative aspect of exercise to 25 = high expectations in the self-evaluative aspect of exercise)

[3]Arthritis self-efficacy = continuous measure (0 = no self-belief in managing arthritis to 10 = high self-belief in managing arthritis)

[4]Exercise self-efficacy = continuous measures (0% =no self-belief inability to exercise to 100% = high self-belief in ability to exercise)

[5]Depression measured using the Patient Health Questionnaire-8 = continuous measure (0 = no depression to 24 = severe depression)

[6]General health status measured using EQVAS (of the EQ-5D-5L)= continuous measure (0 = bad health status to 100 = good health status)

[7]KOOS = Knee injury and Osteoarthritis Outcome Score has five subscales (pain, symptoms, activities of daily living (ADL), sports and recreation, and quality of life (QOL). Each subscale was independent of each other and was continuous measures (0 = good to 100 = bad).

[8]Knee confidence = measured from the KOOS quality of life subscale (question 3) = categorical measure (0 =not troubled; 1 = mildly troubled; 2 = moderately troubled; 3 = severely troubled; 4 = extremely troubled by the lack of knee confidence)

[9]**No/low PA level** was defined as individuals who do not meet criteria for moderate or high PA level; **moderate PA level** was defined as 3+ days of vigorous-intensity activity at least 20 minutes per day, or 5+ days of moderate-intensity activity and/or walking of at least 30 minutes per day, or 5+ days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum of 600 MET-minutes a week of PA; **high PA level** was defined as vigorous-intensity activity at least 3 days a week achieving a

minimum of 1500 MET-minutes/week or 7+ days of any combination of walking, moderate- or vigorous-intensity activity achieving a minimum of 3000 MET-minutes/week.

4.3.3 Missing Data

Attempts were made to reduce the amount of missing data in this study. This questionnaire was presented to a PPI advisory group to check the readability to ease of completion of the questionnaire. However, this would have benefited from a small pilot study to identify any unexpected problems to reduce the amount of missing data. In the baseline data, missing data from the demographics and clinical characteristics sections of the questionnaire ranged from 0-30% (Table 8), with this highest missing percentage (30.26%) being from the question about the highest level of education (Table 8). Some of the participants who did not answer this question wrote that they did not understand the point of this question or how it has any relationship with their knee pain or OA. There were 15% missing data from questions regarding physical activity categories (the IPAQ), as well as a range of 11.84–12.50% missing from vigorous physical activity, moderate physical activity, and walking time (Table 8). But the range of missing data dropped slightly to 9.09-13% at the 6-month follow-up.

Table 8 Missing data from baseline and follow-up questionnaires regarding participants' demographics and clinical characteristics

Demographics and characteristics	Baseline respondents	% of missing data	Follow-up respondents	% of missing data
Sex	152	0	110	0
Age	142	6.58	0	8.33
Height	143	5.92	109	0.91
Weight	143	5.92	105	4.55
Ethnicity	146	3.96	N/A	N/A
Smoking status	149	1.97	N/A	N/A
Employment	152	0	N/A	N/A
Education	106	30.26	N/A	N/A
Vigorous PA	134	11.84	98	10.91
Moderate PA	129	15.13	96	12.73
Walk time	133	12.50	100	9.09
Sit time	137	9.87	103	6.36
PA categories	129	15.13	102	7.27
No. of symptoms	150	1.32	109	0.91
No. of comorbidities	150	1.32	N/A	N/A
Missing data range		**0-30%**		**0-13%**

n=134 was needed for enough power for the study; *total n=152; **total n=110, thus 27.6% of participants lost to follow-up; PA = physical activity; No. = number

From the study variables, the highest percentage of missing data was KOOS Sport/Recreation subscale of the KOOS for both the baseline and follow-up questionnaires (17.11% and 20%, respectively; Table 9). Participants often wrote alongside these questions as "do not squat", "do not run", "can't do these" or left this blank.

Table 9 Missing data of the study variables from baseline and follow-up questionnaires

Study Variables	Baseline respondents	% of missing data	Follow-up respondents	% of missing data
Arthritis self-efficacy	138	9.21	106	3.64
VAS pain 1-100	134	11.84	93	15.45
Physical MOEES	148	2.63	107	2.73
Social MOEES	147	3.29	107	2.73
Self-evaluative MOEES	148	2.63	108	1.82
Exercise self-efficacy	135	11.18	100	9.09
PHQ 8	146	3.95	103	6.36
EQ VAS	148	2.63	107	2.73
KOOS Pain	150	1.32	110	0
KOOS Symptom	150	1.32	110	0
KOOS ADL	150	1.30	109	0.91
KOOS Sport/Rec	126	17.11	88	20.00
KOOS QOL	152	0	110	0
Knee confidence	151	0.66	109	0.91
Missing data range		**0-17.11%**		**0-20%**

n=134 was needed for enough power for the study; *total n=152; **total n=110, thus 27.6% of participants lost to follow-up; font colour key: **Dependent variable**; Independent variables

4.3.4 Factors Associated with Arthritis Self-Efficacy

4.3.4.1 The relationship between the Changes in Arthritis Self-Efficacy and Independent Variables

Simple linear regressions were run to investigate the change in arthritis self-efficacy with a unit change in each of the independent variables and investigate how much of the variances in arthritis self-efficacy was explained by the study variables (Objective 2). The dependent variable was arthritis self-efficacy score and the independent variables measured were exercise self-efficacy, knee confidence, perceived general health status, knee pain perception, depression, and the multidimensional outcomes expectation for

exercise subscales. The assumptions of a simple linear regression were: 1) one dependent variable measured at a continuous level; 2) one independent variable measured at a continuous level; 3) a linear relationship between the dependent variable and the independent variable; 4) independence of observations; 5) no significant outliers; 6) there should be homoscedasticity; and 7) residuals of the regression line are approximately normally distributed

Linear relationships were observed visually on scatterplots between arthritis self-efficacy with exercise self-efficacy, depression, general health status, knee pain perception, and knee confidence, separately. Age, sex, and BMI were added into the models to control for these variables. However, no linear relationships (the slope coefficient was close to zero) were shown between arthritis self-efficacy and the multidimensional outcomes expectation for exercise subscales (physical, social, and self-evaluative), so they were not included in the linear regression analyses.

Simple linear regressions were run to understand the effects the independent variables had on arthritis self-efficacy. To determine how well the linear regression model fit with the data, the adjusted R^2 was used to indicate the variation in one variable that is explained by the other. Table 10 summarises the variances in arthritis self-efficacy score from the simple linear regression for arthritis self-efficacy with each independent variable. Knee confidence explained the highest variance (adjusted R^2=34%) in arthritis self-efficacy score. The next highest were general health status (adjusted R^2=33.7%), exercise self-efficacy (adjusted R^2=30.7%), and depression (adjusted R^2=31.2%). Percentages of the adjusted R^2 were reported here instead of the R^2, as the former informs of how much variance in the arthritis self-efficacy

(dependent variable) would be accounted for if the model had been derived from the population from which the study sample was taken. Whereas R^2 only informs of how much the variance in the arthritis self-efficacy was accounted for by the regression model from the study sample (Field, 2009).

To ensure the independence of observations assumption was met, the Durbin-Watson statistic was used to test for serial correlations between errors, particularly adjacent errors. This test statistic should range from 0 to 4, with the value of 2 indicating that the errors were uncorrelated. The Durbin-Watson test statistics in Table 10 showed that there were the independence of errors (i.e. the errors of prediction were independent of one another) in all the variables, as assessed by the Durbin-Watson statistic being close to 2 (Durbin and Watson, 1951). Any values less than one or greater than three may indicate the lack of independence of the errors (Field, 2009).

Table 10 Variances and *F*-statistics between arthritis self-efficacy and study independent variables for the baseline questionnaire data

Variables	R	Adjusted R^2	Standard error of the estimate	Durbin-Watson	*F*-statistic (degrees of freedom)	*p*-value*
Age	.068	-.003	2.002	1.745	.604 (1, 130)	.439
Sex[1]	.123	.008	1.972	1.740	2.106 (1, 136)	.149
Body mass index	.240	.050	1.903	1.861	7.803 (1, 128)	**.006**
Knee pain perception[2]	.481	.225	1.764	1.616	36.627 (1,122)	**< .001**
Exercise self-efficacy	.559	.307	1.697	1.955	56.928 (1, 125)	**< .001**
Depression[3]	.563	.312	1.645	1.817	62.101 (1, 134)	**< .001**
General Health status[4]	.585	.337	1.620	1.721	69.180 (1, 133)	**< .001**
Not troubled by the lack of knee confidence[5]	.353	.118	1.859	1.818	19.314 (1, 136)	**< .001**
Mildly troubled by the lack of knee confidence[5]	.228	.045	1.934	1.960	7.481 (1, 136)	**.007**
Moderately troubled by the lack of knee confidence[5]	.067	-.003	1.982	1.927	.622 (1, 136)	.432

*$p < .05$; [1]Sex = reference category was female; [2]knee pain perception = visual analogue scale (VAS) for pain (Wewers and Lowe, 1990); [3]depression = Patient Health Questionnaire-8 (Kroenke and Spitzer, 2002); [4]general health status = EQ-VAS section of the EQ-5D-5L questionnaire (EuroQol, 1990); [5]knee confidence = question 3 of the KOOS quality of life subscale (Roos and Lohmander, 2003); reference category for these variables was 'severely extremely troubled by the lack of knee confidence'.

Furthermore, as another measure to determine the goodness of fit of the regression model, the statistical significance of the model was determined from the *F*-test, which test the model against the error in the model (Field, 2009). Table 10 showed that BMI, knee pain perception, exercise self-efficacy, depression, general health status, not troubled by the lack of knee confidence, and mildly troubled by the lack of knee confidence all statistically significantly predicted arthritis self-efficacy score compared to a model with no independent variables (*p*-value of the *F*-statistic < .05).

The outputs from the simple linear regressions were used to investigate the change in arthritis self-efficacy with a unit change in each of the independent variables (i.e. exercise self-efficacy, depression, general health status, not troubled by the lack of knee confidence, mildly troubled by the lack of knee confidence, and moderately troubled by the lack of knee confidence, and knee pain perception). The knee confidence variables were dichotomised and the reference variable was 'severely extremely troubled by the lack of knee confidence' (i.e. not at all troubled vs severely extremely troubled by the lack of knee confidence; mildly troubled vs severely extremely troubled; and moderately troubled vs severely extremely troubled). Additionally, age, sex, and BMI were included to control for these variables in the models.

Outliers were detected from the Casewise Diagnostics output for general health status (3 outliers) and the knee pain perception (1 outlier) variables. Checks were made to ensure these were not due to data entry error, measurement error, and that they were genuine unusual values. Additionally, simple linear regressions were run with and without these outliers. As there were no appreciable differences in the results (i.e. the variables were still

statistically significant), the outliers were kept in the model. There was homoscedasticity across the independent variables with the dependent variables, which was inspected visually using the regression standardised residual/regression standardised predicted value scatterplot. The variances of errors were constant across the values of the independent variables. Finally, there was normality of residuals for the independent variables, which were visually inspected from the histograms and Normal P-P plots.

Table 11 summarises the change in arthritis self-efficacy score with a unit change in the independent variables. A unit increase in exercise self-efficacy (1%) and general health status (1 point) statistically significantly increased arthritis self-efficacy score by .031 and .054 ($p < .001$), respectively. Therefore, the more self-belief in exercise (higher exercise self-efficacy score) and better general health status (higher general health status score) led individuals to have more self-belief in their ability to successfully manage arthritis (higher arthritis self-efficacy score).

Table 11 Simple linear regressions for the baseline questionnaire data

Variable	Unstandardised coefficient (B)	Unstandardised coefficient Standard Error	95% Confidence Interval	Standardized coefficient (Beta)	*p*-value*
Exercise self-efficacy[1]	.031	.004	.023 to .039	.559	**<.001**
Depression[2]	-.194	.025	-.243 to -.145	-.563	**<.001**
General health status[3]	.054	.006	.041 to .066	.585	**<.001**
Knee pain perception[4]	-.036	.006	-.048 to -.024	-.481	**<.001**
Not troubled by the lack of knee confidence[5]	2.12	.482	1.164 to 3.069	.353	**<.001**
Mildly troubled by the lack of knee confidence[5]	1.21	.442	.335 to 2.082	.228	**.007**
Moderately troubled by the lack of knee confidence[5]	.282	.358	-.426 to .990	.067	.432
Age[6]	.014	.018	-.021 to .049	.068	.439
Sex[7]	.488	.337	-.177 to 1.154	.123	.149
Body mass index[8]	-.078	.028	-.134 to -.023	-.240	**.006**

Dependent variable = arthritis self-efficacy *$p < .05$

[1]Exercise self-efficacy = continuous measures (0% =no self-belief in ability to exercise to 100% = high self-belief in ability to exercise)

[2]Depression measured using the Patient Health Questionnaire-8 = continuous measure (0 = no depression to 24 = severe depression)

[3]General health status measured using EQVAS (of the EQ-5D-5L)= continuous measure (0 = bad health status to 100 = good health status)

[4]Knee pain perception measured using the visual analogue scale for pain = continuous measure (0 = no knee pain to 100 = severe knee pain)

[5]Knee confidence = measured from the KOOS quality of life subscale (question 3) = binary measures: not troubled by the lack of knee confidence coded 1 and severely extremely troubled by the lack of knee confidence coded 0; mildly troubled by the lack of knee confidence coded 1 and severely extremely troubled by the lack of knee confidence coded 0; moderately troubled by the lack of knee confidence coded 1 and severely extremely troubled by the lack of knee confidence coded 0; [6]Age = continuous measure; [7]Sex = binary measure, male coded as 0 and female coded as 1

[8]Body mass index = continuous measure

Participants who perceived themselves as not being troubled with the lack of knee confidence reported a statistically significantly higher arthritis self-efficacy score of 2.12 points than those who perceived themselves to be severely extremely troubled by the lack of knee confidence (Table 11). Those who were mildly troubled by the lack of knee confidence reported a statistically significantly higher arthritis self-efficacy score of 1.21 points than those who were severely extremely troubled by the lack of knee confidence (Table 11). Those who were moderately troubled by the lack of knee confidence reported an arthritis self-efficacy score of .282 point higher than those who were severely extremely troubled by the lack of knee confidence, however, this was not statistically significant (Table 11). Thus, those who were less troubled by the lack of knee confidence had statistically significantly higher self-beliefs in their ability to successfully manage their arthritis (higher arthritis self-efficacy).

A unit increase in depression score (1 point), knee pain perception (1mm), and BMI (1kg/m^2) led to a statistically significant decrease in arthritis self-efficacy score by -.194, -.036, -.078 points, respectively (Table 11). Therefore, those who were more depressed (higher PHQ-8 score), perceived worse knee pain (higher VAS pain score), worse knee confidence (higher knee confidence score), and had a higher BMI had a lower self-belief in their abilities to successfully manage their arthritis (lower arthritis self-efficacy).

Age, sex, and moderately troubled by the lack of knee confidence independently did not predict a statistically significant change in the arthritis self-efficacy scores.

4.3.4.2 **Variances in Arthritis Self-Efficacy Explained by the Independent Variables**

To perform a multiple linear regression, all of the variables that were significant (p<.05) from the simple linear regressions (Table 11), except for 'mildly troubled by the lack of knee confidence' variable were put into a multiple linear regression model using the backward stepwise modelling method (as explained in Chapter 4 Section 4.2.6). The 'mildly troubled by the lack of knee confidence' was not included at this stage of the multiple regression modelling, because of the limited number of predictors allowed in the model due to the valid sample size of 115 participants; this variable was chosen because it had the highest p-value out of all the significant variables. This variable will be added back into the regression model at a later stage to see if it is still significant in the presence of other independent variables. Age, sex, and BMI were also included in the multiple linear regression model to control for these variables.

When exercise self-efficacy, depression, general health status, knee pain perception, not troubled by the lack of knee confidence, age, sex, and BMI variables were added into the multiple linear regression model, age and BMI became non-significant (p>.05) and sex was borderline significant (p=.043) (Table 12).

Table 12 Multiple linear regression model with the variables included from the simple linear regressions

Variables	Unstandardized coefficient (B)	Standard error of unstandardized coefficient	95% Confidence interval	Standardized coefficient (Beta)	*p*-value*	Tolerance†	VIF††
Constant	6.524	1.647	3.253 to 9.795		**<.001**		
Exercise self-efficacy[1]	.014	.004	.006 to .022	.252	**.001**	.763	1.310
Depression[2]	-.116	.030	-.177 to -.056	-.331	**<.001**	.522	1.915
General health status[3]	.018	.008	.002 to .035	.191	**.031**	.517	1.934
Knee pain perception[4]	-.014	.006	-.025 to -.002	-.173	**.018**	.763	1.310
Not troubled by lack of knee confidence[5]	1.197	.416	.317 to 2.023	.190	**.005**	.899	1.112
Age[8]	-.010	.015	-.039 to .020	-.045	.517	.811	1.234
Sex[9]	.544	.266	.016 to 1.071	.133	**.043**	.931	1.074
Body mass index[10]	-.035	.025	-.084 to .014	-.099	.159	.806	1.241

Dependent variable = arthritis self-efficacy *$p < .05$

[1]Exercise self-efficacy = continuous measures (0% =no self-belief in ability to exercise to 100% = high self-belief in ability to exercise)

[2]Depression measured using the Patient Health Questionnaire-8 = continuous measure (0 = no depression to 24 = severe depression)

[3]General health status measured using EQVAS (of the EQ-5D-5L)= continuous measure (0 = bad health status to 100 = good health status)

[4]Knee pain perception measured using the visual analogue scale for pain = continuous measure (0 = no knee pain to 100 = severe knee pain)

[5]Not troubled by the lack of knee confidence (coded 1) vs severely and extremely troubled by the lack of knee confidence (coded 0)

[6]Mildly troubled by the lack of knee confidence (coded 1) vs severely and extremely troubled by the lack of knee confidence (coded 0)

[7]Moderately troubled by the lack of knee confidence (coded 1) vs severely and extremely troubled by the lack of knee confidence (coded 0)

[8]Age = continuous measure; [9]Sex = binary measure, male (coded 0) and female (coded 1); [10]Body mass index = continuous measure

†Tolerance = reciprocal of VIF (1/VIF) values below 0.1 indicate serious problems and values below 0.2 are worthy of concern (Menard, 1995)

††variance inflation factor (VIF) – indicates if a predictor has a strong relationship with the other predictor(s). Values of greater than 10 are of concern(Myers, 1990)

Table 13 Final multiple linear regressions model from the baseline questionnaire study

Variables	Unstandardized coefficient (B)	Standard error of unstandardized coefficient	95% Confidence interval	Standardized coefficient (Beta)	*p*-value*	Tolerance†	VIF††
Constant	6.154	.368	5.425 to 6.882		< .001		
Exercise self-efficacy[1]	.019	.004	.012 to .026	.336	< .001	.833	1.200
Depression[2]	-.135	.024	-.183 to -.088	-.389	< .001	.735	1.360
Knee pain perception[3]	-.018	.005	-.028 to -.008	-.229	.001	.787	1.270
Not troubled by lack of knee confidence[4]	1.037	.389	.266 to 1.809	.166	.009	.904	1.106
Sex[5]	.699	.244	.215 to 1.183	.171	.005	.984	1.017

Dependent variable = arthritis self-efficacy *p< .05

[1]Exercise self-efficacy = continuous measures (0% =no self-belief in ability to exercise to 100% = high self-belief in ability to exercise)

[2]Depression measured using the Patient Health Questionnaire-8 = continuous measure (0 = no depression to 24 = severe depression)

[3]Knee pain perception measured using the VAS for pain = continuous measure (0 = no knee pain to 100 = severe knee pain)

[4]Not troubled by the lack of knee confidence (coded 1) vs severely extremely troubled by the lack of knee confidence (coded 0)

[5]Sex = binary measure, male (coded 0) and female (coded 1)

†Tolerance = reciprocal of VIF (1/VIF) values below 0.1 indicate serious problems and values below 0.2 are worthy of concern (Menard, 1995)

††variance inflation factor (VIF) – indicates if a predictor has a strong relationship with the other predictor(s). Values of greater than 10 is of concern (Myers, 1990)

Subsequently, when age and BMI were removed from the model, the general health status variable became non-significant (p=.064 data not shown) and was also removed from the model. The model now consisted of all significant variables (data not shown): exercise self-efficacy (p<.001), depression (p<.001), knee pain perception (p=.001), not troubled by the lack of knee confidence (p=.009), and sex (p=.005). Then, all the non-significant variables from both the previous multiple linear regression model (Table 12) and simple linear regression (Table 11) were added back into the model one at a time to see if they became significant; these variables included age, BMI, general health status, mildly troubled by the lack of knee confidence, and moderately troubled by the lack of knee confidence, in this order. If the variable did not become significant, it was removed from the model and if it became significant, it was kept in the model. This process was repeated for all non-significant variables mentioned above, but no variables became significant. Therefore, the final multiple linear regression is presented in Table 13.

In the final multiple linear regression model (Table 13), exercise self-efficacy, depression, knee pain perception, not being troubled by the lack of knee confidence, and being female statistically significantly predicted the arthritis self-efficacy score, $F(5, 109) = 35.035$, p<.001, R^2 =.785, adjusted R^2 = .599, thus the overall final model together explained 59.9% of the variance in arthritis self-efficacy score. All five variables added statistically significance to the prediction of arthritis self-efficacy score, p<.01 (Table 13).

In the following section, the unstandardised coefficient was reported to ensure the results can be interpreted meaningfully according to the units measured

from the dependent and independent variables. The unstandardised coefficient for exercise self-efficacy was .019; one per cent increase in exercise self-efficacy score statistically significantly increased arthritis self-efficacy score by .019 points (95% Confidence Interval (CI), .012 to .026, $p<.001$) while the other independent variables in the model were held constant (Table 13).

A point increase in depression score decreased arthritis self-efficacy score by .135 points (95% CI, -.183 to -.088, $p<.001$) whilst holding the other independent variables constant (Table 13).

Participants who perceived themselves as having high knee confidence (i.e. not troubled by the lack of knee confidence) had a higher arthritis self-efficacy score by 1.037 points (95% CI, .266 to 1.809, $p=.009$) compared to participants who had low knee confidence (i.e. severely extremely troubled by the lack of knee confidence) (Table 13).

The unstandarised coefficient for sex was .699 (95% CI, .215 to 1.183, $p=.005$), so the predicted arthritis self-efficacy score for females was .699points greater than that predicted score for males (Table 13). Therefore, females had more self-belief in successfully managing their arthritis compared to males.

Therefore, higher self-belief in exercise (exercise self-efficacy score) predicted higher self-belief in successfully managing arthritis. People who had higher knee confidence had more self-belief in their ability to manage their arthritis compared to those who had low knee confidence. Those who had a higher

depression score and worse knee pain perception had less self-belief in their ability to successfully manage their knee OA. Finally, females had more self-belief in their ability to successfully manage their knee OA compared to males.

Additionally, the standardised coefficient values were also used to describe which independent variables had the greatest effect on the dependent variable (arthritis self-efficacy score) in the multiple regression analysis. The standardised coefficients were measured in the standardised unit of standard deviations between the dependent and independent variables, which made the independent variables in the model directly comparable with each other due to the variables being measured in standard deviations(Field, 2009). Depression had the greatest effect on arthritis self-efficacy score in the final multiple regression model for this study (Table 13); for every one standard deviation unit increase in depression, the standard deviation for arthritis self-efficacy score decreased by .389 (standardised coefficient (β)= -.389, p<.001). The next greatest effect was exercise self-efficacy (β= .336, p<.001); then knee pain perception (β= -.229, p= .001); then female (β=.171, p=.005); and finally, not being troubled by the lack of knee confidence (β= .166, p=.009). However, there are limitations in describing the results according to the standardised coefficient.

Multiple Linear Regression Assumptions Met

The assumptions of a multiple linear regression were the same as the simple linear regression except for the presence of two or more independent variables in the model.

There were linear relationships between arthritis self-efficacy score and each of the independent variables as visually assessed by partial regression plots and a scatterplot of the Studentised Residual against the Unstandardised Predicted Value. There were independence of residuals in these data, as assessed by a Durbin-Watson statistic of 2.317 (values close to 2 show independence of errors). The assumption of homoscedasticity was that the residuals were equal for all values of the predicted arthritis self-efficacy score (dependent variable). There was homoscedasticity, as assessed by visual inspection of the scatterplot of Studentised Residuals against the Unstandardized Predicted Value. There was no evidence of multicollinearity in the model, which indicated the independent variables were not highly correlated with each other; this was assessed by a visual inspection of the correlation coefficients matrix (no variables had correlations of greater than 0.7(Field, 2009)), the Tolerance values were greater than 0.1(the lowest value was .735) (Menard, 1995) and VIF values were less than 10 (the highest value was 1.360) (Myers, 1990) (Tables 13).

Checks in the data were made for unusual points such as outliers, high leverage points, and highly influential points, as these can be detrimental to the fit or generalisation of the regression equation. Firstly, there were no Studentised Deleted Residual values greater than ±3 standard deviations (the highest and lowest scores were +2.495 and -2.722, which indicated that it was unlikely there were any outliers in the data. To confirm this, no Casewise Diagnostics table was produced to indicate an obvious outlier was detected when the regression analysis was run.

Secondly, leverage points gauge the influence of the observed value of the outcome variable over the predicted values. Leverage values can lie between 0 and 1, with 0 indicating the case had no influence over the prediction (Field, 2009). There were no high leverage points, the highest value was 0.156; values of less than 0.2 was not of concern (Field, 2009).

Thirdly, further checks using the Cook's Distance value, to measure the effect of a single case on the model as a whole showed there were no highly influential points, as the Cook's Distance values remained below 1 (the highest value was 0.195) (Cook and Weisberg, 1982).

Finally, there were normality of the residuals, as visually assessed by a histogram of the Regression Standardised Residua land the Normal Q-Q plot of the Studentised Residual.

4.3.5 Changes in Arthritis Self-Efficacy and its Associated Factors Overtime

4.3.5.1 **Description of Follow-Up Questionnaire Respondents**

Table 14 summarises the characteristics of respondents at the 6-month follow-up compared to those at baseline. An equal number of female and males responded to the follow-up questionnaire, the mean age was higher at follow-up (68.58 years old), but this was expected due to the 6-month follow-up. The

number of symptoms increased from 3.65 to 3.95 at follow-up and most participants were still moderately physically active (Table 14).

Table 14 Comparison of baseline and follow-up participants' demographics and clinical characteristics

Demographics and clinical characteristics	All Baseline (n= 152)	All follow-up (n =110)
Sex, n (%)		
Male	80 (52.6)	55 (50)
Female	72 (47.4)	55 (50)
Age, mean (SD), y	67.80 (10.59)	68.58 (10.39)
45-54, n (%)	18 (11.8)	13 (11.8)
55-64	35 (23)	22 (20)
65-74	52 (34.2)	40 (36.4)
75-84	32 (21.1)	29 (26.4)
85+	5 (3.3)	6 (5.2)
Missing	10 (6.6)	0 (0)
Body Mass Index, mean (SD), kg/m^2	28.647 (5.86)	28.492 (6.26)
Underweight, n (%)	2 (1.3)	0 (0)
Healthy weight	38 (25)	35 (31.8)
Overweight	53 (34.9)	40 (36.4)
Obese	47 (30.9)	30 (27.3)
Missing	12 (7.9)	5 (4.5)
Number of symptoms, mean (SD)	3.63 (1.61)	3.95 (1.58)
Physical activity[1] (PA) levels, n (%)		
No/low PA level	34 (22.4)	29 (26.4)
Moderate PA level	52 (34.2)	39 (35.5)
High PA level	43 (28.3)	34 (30.9)
Missing	23 (15.1)	8 (7.3)
METS-mins/week, median and (IQR)		
Vigorous PA METS-mins/week	0.00 (1020)	0.00 (1140)
Moderate PA METS-mins/week	120 (1260)	120 (1200)
Walking METS-mins/week	940.5 (1848)	792 (1865)
Total sitting time, mins/day	360 (240)	360 (240)

[1]**No/low PA level** was defined as individuals who do not meet criteria for moderate or high PA level; **moderate PA level** was defined as 3+ days of vigorous-intensity activity at least 20 minutes per day, or 5+ days of moderate-intensity activity and/or walking of at least 30 minutes per day, or 5+ days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum of 600 MET-minutes a week of PA; **high PA level** was defined as vigorous-intensity activity at least 3 days a week achieving a minimum of 1500 MET-minutes/week or 7+ days of any combination of walking, moderate- or vigorous-intensity activity achieving a minimum of 3000 MET-minutes/week.

Participants reported relatively similar knee pain perception, outcomes expectations of exercise (MOEES), arthritis self-efficacy, exercise self-

efficacy, depression, general health status, and the KOOS sub-scale scores (Table 15). Interestingly, the percentage of participants who were not troubled by the lack of knee confidence at dropped from 13.8% at baseline to 4.5% at the 6-month follow-up (Table 15) and there was an increase in participants who felt mildly and moderately troubled by the lack of knee confidence at follow-up (24.5% and 36.4%, respectively) compared to baseline (16.4% mildly troubled and 31.6% moderately troubled; Table 15)

Table 15 Study variables from respondents of baseline questionnaire

Study Variables	All Baseline (n= 152)	All follow-up (n =110)
Knee pain perception[1], mean (SD)	46.59 (26.73)	43.49 (27.48)
Missing, n (%)	17 (11.2)	17 (15.5)
Multidimensional outcomes expectations for exercise (MOEES)[2], mean (SD)		
Physical MOEES	23.71 (4.03)	23.69 (4.16)
Social MOEES	12.64 (2.92)	12.08 (3.14)
Self-evaluative MOEES	18.57 (3.76)	18.36 (3.77)
Arthritis self-efficacy[3], mean (SD)	5.66 (1.98)	5.46 (2.12)
Exercise self-efficacy[4] %, median (IQR)	31.25 (70)	30 (59.10)
Depression[5], median (IQR)	3.50 (6)	4 (9)
General health status[6], median (IQR)	70 (30)	70 (30)
KOOS sub-scales[7], mean (SD)		
KOOS Pain	53.42 (20.39)	53.95 (18.16)
KOOS Symptom	45.49 (12.85)	45.76 (11.37)
KOOS ADL	58.45 (21.85)	59.05 (20.41)
KOOS Sport/Rec	39.53 (30.72)	39.74 (28.79)
KOOS QOL	37.66 (22.38)	37.51 (20.21)
Knee confidence[8] (KC), n (%)		
Not at all troubled by lack of KC	21 (13.8)	5 (4.5)
Mildly troubled by lack of KC	25 (16.4)	27 (24.5)
Moderately troubled by lack of KC	48 (31.6)	40 (36.4)
Severely troubled by lack of KC	34 (22.4)	23 (20.9)
Extremely troubled by lack of KC	23 (15.1)	14 (12.7)
Missing	1 (0.7)	1 (0.9)

[1]Knee pain perception measured using the VAS for pain = continuous measure (0 = no knee pain to 100 = severe knee pain)

[2]Physical subscale of the multidimensional outcomes expectations for exercise (MOEES) = continuous measure (6 = low expectations in the physical benefits of exercise to 30 = high expectations in the physical benefits of exercise)

[2]Social subscale of the MOEES = continuous measure (4 = low expectations in the social benefits of exercise to 20 = high expectations in the social benefits of exercise)
[2]Self-evaluative subscale of the MOEES = continuous measure (5 = low expectations in the self-evaluative aspect of exercise to 25 = high expectations in the self-evaluative aspect of exercise)
[3]Arthritis self-efficacy = continuous measure (0 = no self-belief in managing arthritis to 10 = high self-belief in managing arthritis)
[4]Exercise self-efficacy = continuous measures (0% =no self-belief in ability to exercise to 100% = high self-belief in ability to exercise)
[5]Depression measured using the Patient Health Questionnaire-8 = continuous measure (0 = no depression to 24 = severe depression)
[6]General health status measured using EQVAS (of the EQ-5D-5L)= continuous measure (0 = bad health status to 100 = good health status)
[7]KOOS = Knee injury and Osteoarthritis Outcome Score has five subscales (pain, symptoms, activities of daily living (ADL), sports and recreation, and quality of life (QOL). Each subscale was independent of each other and was continuous measures (0 = good to 100 = bad).
[8]Knee confidence = measured from the KOOS quality of life subscale (question 3) = categorical measure (0 =not troubled; 1 = mildly troubled; 2 = moderately troubled; 3 = severely troubled; 4 = extremely troubled by the lack of knee confidence)

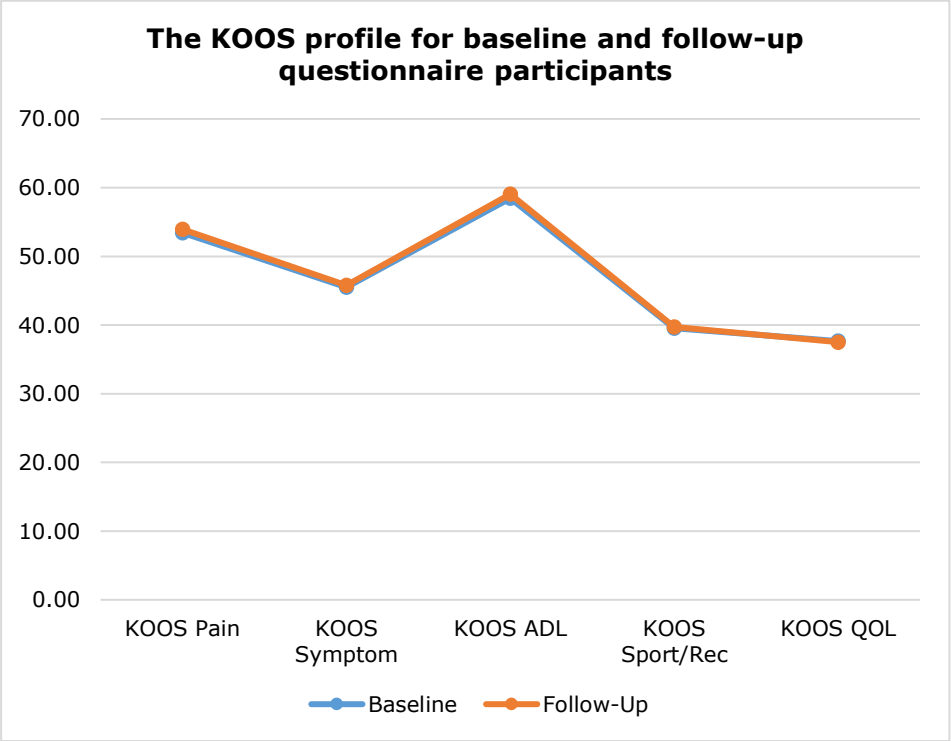


Figure 6 The Knee injury and Osteoarthritis Outcomes Score (KOOS) profile comparing baseline with follow-up questionnaire respondents.

Figure 6 is a graphic representation of the KOOS, which is a patient-reported measure used to assess patients' opinion of their knees and its associated problems; it is a valid and reliable tool suitable for short-term and long-term

use to follow patients and assess the change in symptoms, pain, function, and quality of life over time. Figure 6 demonstrated visually that there was very little change in patients' pain, symptom, activities of daily living functioning, sport, and recreational functioning, and quality of life over the 6-month period, as the baseline and follow-up lines were virtually on top of one another. To provide some statistical evidence of whether there were any statistical differences in the baseline and follow-up variables, paired t-tests and the Wilcoxon signed-rank tests were run, and the outcomes of this test are provided in the following section.

4.3.5.2 **Changes in Arthritis Self-Efficacy and its Factors Overtime**

Paired t-tests were performed on the study variables to determine if there were any statistically significant mean differences in participants' perceptions of their arthritis self-efficacy beliefs and the study independent variables (such as exercise self-efficacy, depression, knee pain perception, general health status, multidimensional outcomes expectations for exercise, the KOOS subscales, and knee confidence) at baseline and at 6 months follow-up.

Normality distributions of the 6-month follow-up subtracted by baseline difference scores of the variables mentioned in the last paragraph were visually assessed using the Normal Q-Q plot. Due to a large sample, the Normal Q-Q plot was assessed instead of the Shapiro-Wilk test (Field, 2009). Assumption of normality was not violated for the following variables: arthritis self-efficacy, knee pain perception, three sub-scales of the multidimensional outcomes expectations for exercise scale (physical, social, and self-evaluative), exercise self-efficacy, depression, general health status, and all

five KOOS sub-scales (pain, symptom, ADL, sport/rec, and QOL). The assumption of normality was violated for the physical activity measures reported from the vigorous physical activity, moderate physical activity, and walking time reported in METS-mins/week, and therefore the Wilcoxon signed rank test was used for these variables.

Table 16 Paired t-test for baseline and follow-up questionnaire data

Variables	Follow-up, mean (SD)	Baseline, mean (SD)	Mean difference (SD)	95% Confidence Interval	*p*-value
Arthritis self-efficacy[1]	5.49 (2.14)	5.68 (1.89)	-.189 (1.62)	-.509 to .132	.245
Knee pain perception[2]	43.21 (26.18)	45.35 (25.22)	-2.15 (27.10)	-7.99 to 3.70	.467
Physical MOEES[3]	23.76 (4.02)	23.92 (3.71)	-.163 (2.62)	-.673 to .346	.526
Social MOEES[4]	12.16 (3.15)	12.37 (2.62)	-.214 (2.78)	-.757 to .330	.438
Self-evaluative MOEES[5]	18.40 (3.76)	18.65 (3.59)	-.250 (3.02)	-.838 to .338	.401
Exercise self-efficacy[6]	37.24 (35.52)	41.97 (37.42)	-4.72 (33.27)	-11.652 to 2.207	.179
Depression[7]	5.88 (6.13)	5.08 (5.31)	.802 (4.05)	.002 to 1.602	**.049**
General health status[8]	64.58 (22.91)	67.28 (20.15)	-2.70 (20.72)	-6.689 to 1.293	.183
KOOS Pain[9]	54.02 (18.23)	53.94 (17.08)	.083 (13.17)	-2.419 to 2.584	.948
KOOS Symptom[9]	45.85 (11.38)	45.50 (11.43)	.349 (11.29)	-1.795 to 2.492	.748
KOOS ADL[9]	59.05 (20.41)	59.44 (19.61)	-.394 (12.66)	-2.798 to 2.009	.746
KOOS Sport/Rec[9]	37.54 (27.44)	40.70 (28.79)	-3.16 (26.63)	-8.557 to 2.241	.248
KOOS QOL[9]	37.51 (20.21)	38.35 (19.97)	-.836 (15.61)	-3.786 to 2.113	.575

[1]Arthritis self-efficacy = continuous measure (0 = no self-belief in managing arthritis to 10 = high self-belief in managing arthritis); [2]Knee pain perception measured using the VAS for pain = continuous measure (0 = no knee pain to 100 = severe knee pain); [3]Physical subscale of the multidimensional outcomes expectations for exercise (MOEES) = continuous measure (6 = low expectations in the physical benefits of exercise to 30 = high expectations in the physical benefits of exercise); [4]Social subscale of the MOEES = continuous measure (4 = low expectations in the social benefits of exercise to 20 = high expectations in the social benefits of exercise); [5]Self-evaluative subscale of the MOEES = continuous measure (5 = low expectations in the self-evaluative aspect of exercise to 25 = high expectations in the self-evaluative aspect of exercise); [6]Exercise self-efficacy = continuous measures (0% =no self-belief in ability to exercise to 100% = high self-belief in ability to exercise); [7]Depression measured using the Patient Health Questionnaire-8 = continuous measure (0 = no depression to 24 = severe depression); [8]General health status measured using EQVAS (of the EQ-5D-5L)= continuous measure (0 = bad health status to 100 = good health status); [9]KOOS = Knee injury and Osteoarthritis Outcome Score has five subscales (pain, symptoms, activities of daily living (ADL), sports and recreation, and quality of life (QOL). Each subscale was independent of each other and was continuous measures (0 = good to 100 = bad).

The paired t-test showed no statistically significant changes in scores between the baseline and follow-up data for the study variables (Table 16), except for depression, which had a borderline statistical significance in the mean difference (p= .049) between baseline and follow-up (Table 16) Thus, there was no statistically significant difference in the means of the study variables at baseline and at follow-up.

Similarly, the Wilcoxon signed-rank test run for non-parametric variables also showed no statistically significant difference in the medians of the study variables at baseline and at 6-month follow-up (Table 17).

Table 17 Wilcoxon signed-rank test for median difference between non-parametric variables at baseline and 6-month follow-up

Non-parametric variables	Median difference	Standardised Test Statistic (z-score)	Asymptotic sig. (2-sided test)
Vigorous physical activity	.000	-1.583	.113
Moderate physical activity	.000	-.239	.811
Walking	.000	.501	.616
Body mass index	.0002	.051	.959

In conclusion, no statistically significant changes scores of the study variables, including arthritis self-efficacy score, were found between participants and baseline and at 6-month follow-up, meeting Objective 3 of this thesis.

4.3.6 Investigation of Participants Lost to Follow-Up

Respondents to the baseline questionnaire were contacted again by post or via e-mail around 6 months to complete a follow-up questionnaire. To maintain a good response rate for the follow-up questionnaire, the PPI members suggested sending “Thank you” cards to participants who completed the first baseline questionnaire. They felt that this would make the participants feel appreciated and involved in the study with some form of personal contact from the author. Therefore, “Thank you” cards were sent to all participants who returned the baseline questionnaire.

A polite reminder letter to complete the questionnaire and a spare questionnaire was sent to those who had not returned their questionnaire after four weeks. Furthermore, for to those who did not return the questionnaire after the reminder letter, the author telephoned or sent them an e-mail to ask them if they had received the questionnaire and if they still wanted to participate in the study. Three attempts were made to telephone participants and one attempt via e-mail. At this stage, the participants who were contactable informed the author that either they will complete the questionnaire and return it, or they no longer wished to participate in the study, and they were thanked for their contribution and their time in completing the first questionnaire. Furthermore, a note was made if a participant decided to withdraw from the study and if they gave a reason.

Forty-two participants were lost to follow-up and six participants provided a reason for not wanting to continue with the story: two participants’ relatives

reported they had deceased since the baseline questionnaire, one participant moved into a nursing home, and three participants reported they were too ill to participate in completing the follow-up questionnaire. Thirty-six participants did not provide a reason or respond to completing the follow-up questionnaire.

Table 18 provides the characteristics of participants who were lost to follow-up compared with participants who completed the follow-up questionnaire. The non-responders were mainly male (59.5%), were slightly more overweight (BMI of 29.29kg/m^2) and perceived less knee pain (36mm out of 100mm) compared to those who responded to the follow-up questionnaire. Both respondents and non-respondents had a similar number of symptoms, multidimensional outcomes expectations for exercise, arthritis self-efficacy score, and exercise self-efficacy (Tables 18 and 19).

Table 18 Demographics and clinical characteristics of questionnaire study participants lost to follow-up compared to those who completed the follow-up questionnaire

Demographics and clinical characteristics	All lost to follow-up (n= 42)*	All follow-up (n =110)
Sex, n (%)		
Male	25 (59.5)	55 (50)
Female	17 (40.5)	55 (50)
Age, mean (SD), y	67.57 (10.90)	68.58 (10.39)
45-54, n (%)	5 (11.9)	13 (11.8)
55-64	10 (23.8)	22 (20)
65-74	13 (31)	40 (36.4)
75-84	6 (14.3)	29 (26.4)
85+	4 (9.5)	6 (5.2)
Missing	4 (9.5)	0 (0)
Body Mass Index, mean (SD) kg/m^2	29.67 (5.84)	28.49 (6.26)
Underweight, n (%)	0 (0)	0 (0)
Healthy weight	8 (19)	35 (31.8)
Overweight	14 (33.3)	40 (36.4)
Obese	16 (38.1)	30 (27.3)
Missing	4 (9.5)	5 (4.5)
Number of symptoms, median (IQR)	4 (3)	4 (2)
Physical activity (PA) levels, n (%)		
Now/low PA level	10 (23.8)	29 (26.4)
Moderate PA level	13 (31)	39 (35.5)
High PA level	12 (28.6)	34 (30.9)
Missing	7 (16.7)	8 (7.3)
Total sitting time, mins/day	330 (240)	360 (240)

*data taken from their baseline questionnaire

Table 19 Study variables of questionnaire study participants lost to follow-up compared to those who completed the follow-up questionnaire

Demographics and clinical characteristics	All lost to follow-up (n= 42)*	All follow-up (n =110)
Knee pain perception[1], median (IQR)	36.00 (52.00)	42.00 (49.00)
MOEES[2], mean (SD)		
Physical MOEES	23.48 (4.48)	23.69 (4.16)
Social MOEES	13.40 (3.47)	12.08 (3.14)
Self-evaluative MOEES	18.62 (4.03)	18.36 (3.77)
Arthritis self-efficacy[3], mean (SD)	5.53 (2.21)	5.462 (2.12)
Exercise self-efficacy[4] %, median (IQR)	40 (77.50)	30.00 (59.10)
Depression[5], median (IQR)	5.00 (6.00)	4.00 (9.00)
General health status[6], median (IQR)	65.00 (40.00)	64.54 (22.80) mean (SD)
Knee confidence[7], n (%)		
Not at all troubled by lack of KC	9 (21.4)	5 (4.5)
Mildly troubled by lack of KC	5 (11.9)	27 (24.5)
Moderately troubled by lack of KC	10 (23.8)	40 (36.4)
Severely troubled by lack of KC	7 (16.7)	23 (20.9)
Extremely troubled by lack of KC	11 (26.2)	14 (12.7)
Missing	0 (0)	1 (0.9)
KOOS sub-scales[8], mean (SD)		
KOOS Pain	52.17 (27.55)	53.95 (18.16)
KOOS Symptom	45.41 (16.23)	45.76 (11.37)
KOOS ADL	55.78 (27.05)	59.05 (20.41)
KOOS Sport/Rec	36.82 (34.55)	39.74 (28.79)
KOOS QOL	36.31 (27.99)	37.51 (20.21)

*data taken from their baseline data

[1]Knee pain perception measured using the VAS for pain = continuous measure (0 = no knee pain to 100 = severe knee pain)

[2]Physical subscale of the multidimensional outcomes expectations for exercise (MOEES) = continuous measure (6 = low expectations in the physical benefits of exercise to 30 = high expectations in the physical benefits of exercise)

[2]Social subscale of the MOEES = continuous measure (4 = low expectations in the social benefits of exercise to 20 = high expectations in the social benefits of exercise)

[2]Self-evaluative subscale of the MOEES = continuous measure (5 = low expectations in the self-evaluative aspect of exercise to 25 = high expectations in the self-evaluative aspect of exercise)

[3]Arthritis self-efficacy = continuous measure (0 = no self-belief in managing arthritis to 10 = high self-belief in managing arthritis)

[4]Exercise self-efficacy = continuous measures (0% =no self-belief in ability to exercise to 100% = high self-belief in ability to exercise)

[5]Depression measured using the Patient Health Questionnaire-8 = continuous measure (0 = no depression to 24 = severe depression)

[6]General health status measured using EQVAS (of the EQ-5D-5L)= continuous measure (0 = bad health status to 100 = good health status)

[7]Knee confidence = measured from the KOOS quality of life subscale (question 3) = categorical measure (0 =not troubled; 1 = mildly troubled; 2 = moderately troubled; 3 = severely troubled; 4 = extremely troubled by the lack of knee confidence)

[8]KOOS = Knee injury and Osteoarthritis Outcome Score has five subscales (pain, symptoms, activities of daily living (ADL), sports and recreation, and quality of life (QOL). Each subscale was independent of each other and was continuous measures (0 = good to 100 = bad).

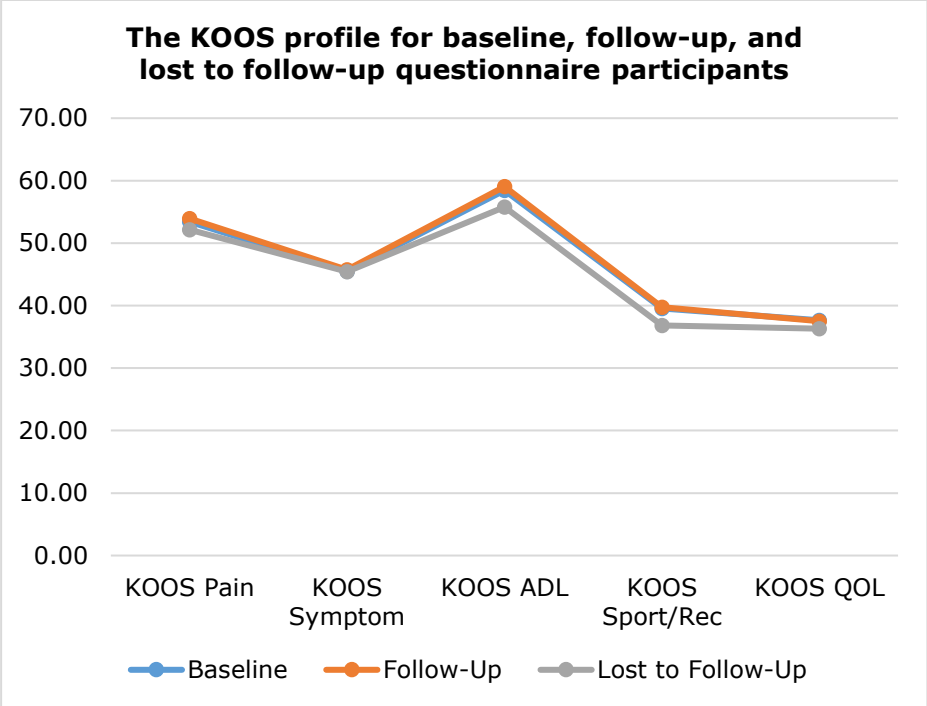


Figure 7 The Knee injury and Osteoarthritis Outcomes Score (KOOS) profile comparing baseline, follow-up questionnaire respondents, and participants lost to follow-up.

Figure 7 represents the KOOS subscales for participants who were lost to follow-up compared to those at baseline and follow-up. Participants lost to follow-up showed a similar profile pattern in the KOOS subscales as those at baseline. Those at follow-up had worse activities of daily living and sport/recreational functioning scores compared to those who completed the follow-up questionnaire and baseline questionnaire.

No statistically significant differences (p>0.05) were observed between responders and non-responders to the follow-up questionnaire with regards to their age, knee pain perception, multidimensional outcomes expectations for exercise (physical and self-evaluative subscales), arthritis self-efficacy score, or the EQ-VAS quality of life score (Table 20). A statistically significant difference was found between the multidimensional outcomes expectations for exercise (social subscale) for responders and non-responders (p =0.026) (Table 20). No statistically significant differences (p >0.05) were observed between responders and non-responders with regards to their KOOS pain, KOOS symptoms, KOOS quality of life scores (Table 20).

No statistically significant differences (p >0.05) were observed between responders and non-responders with regards to their BMI, KOOS activities of daily living, KOOS sports/recreation, exercise self-efficacy, depression, knee confidence level, and physical activity level (Table 21). There was no statistically significant difference between the sex of responders and non-responders (p= .293).

Table 20 Differences between responders and non-responders to the follow-up questionnaire (independent-sample t-test† or the Welch t-test‡)

Variables	Responders, mean (SD)	Non-responders, mean (SD)	Mean difference	95% Confidence Interval	*p*-value
Arthritis self-efficacy[1†]	5.46 (2.12)	5.53 (2.21)	-.070	-.88 to .74	.865
Knee pain perception[2†]	43.49 (27.48)	46.42 (27.90)	-2.93	-13.65 to 7.79	.589
Physical MOEES[3†]	23.69 (4.16)	23.48 (4.48)	.215	-1.32 to 1.75	.781
Social MOEES[4†]	12.08 (3.14)	13.40 (3.47)	-1.321	-2.48 to -.16	**.026**
Self-evaluative MOEES[5†]	18.36 (3.77)	18.62 (4.03)	-.258	-1.64 to 1.12	.713
General health status[6†]	64.54 (22.80)	60.90 (24.47)	3.645	-4.95 to 12.24	.403
KOOS Pain[7‡]	53.95 (18.16)	52.17 (27.55)	1.782	-7.52 to 11.08	.702
KOOS Symptom[7‡]	45.76 (11.37)	45.41 (16.23)	.351	-5.17 to 5.86	.899
KOOS QOL[7‡]	37.51 (20.21)	36.31 (27.99)	1.200	-8.27 to 10.67	.801
Age[8†]	68.58 (10.39)	67.57 (10.90)	1.014	-2.94 to 4.97	.613

[1]Arthritis self-efficacy = continuous measure (0 = no self-belief in managing arthritis to 10 = high self-belief in managing arthritis); [2]Knee pain perception measured using the VAS for pain = continuous measure (0 = no knee pain to 100 = severe knee pain); [3]Physical subscale of the multidimensional outcomes expectations for exercise (MOEES) = continuous measure (6 = low expectations in the physical benefits of exercise to 30 = high expectations in the physical benefits of exercise); [4]Social subscale of the MOEES = continuous measure (4 = low expectations in the social benefits of exercise to 20 = high expectations in the social benefits of exercise); [5]Self-evaluative subscale of the MOEES = continuous measure (5 = low expectations in the self-evaluative aspect of exercise to 25 = high expectations in the self-evaluative aspect of exercise); [6]General health status measured using EQVAS (of the EQ-5D-5L)= continuous measure (0 = bad health status to 100 = good health status); [7]KOOS = Knee injury and Osteoarthritis Outcome Score has five subscales (pain, symptoms, activities of daily living (ADL), sports and recreation, and quality of life (QOL). Each subscale was independent of each other and was continuous measures (0 = good to 100 = bad). ; [8]Age = continuous measure

Table 21 Mann-Whitney U test for median difference or mean rank between non-parametric or ordinal variables for responders and non-responders to the follow-up questionnaire

Non-parametric† or ordinal‡ variables	Responders, median unless specified	Non-responders, median unless specified	Mann-Whitey U test	Standardised Test Statistic (z-score)	Asymptotic sig. (2-sided test)
Body mass index[1]	27.32	29.29	2,315.00	1.462	.144
KOOS ADL[2]	78.07‡	68.67‡	1,954.50	-1.181	.238
KOOS Sport/Rec[2]	30.00	25.00	1,368.50	-.966	.334
Exercise self-efficacy[3]	30.00	40.00	1,828.00	-.108	.914
Depression[4]	4.00	5.00	2,252.50	.869	.385
Knee confidence[5]	2.00	2.00	2,341.50	.225	.822
Physical activity level[6]	1.00	1.00	1,795.50	.055	.956

‡mean rank reported as the distributions of the KOOS ADL scores for responders and non-responders were not similar in shape.

[1]Body mass index = continuous measure; [2]KOOS = Knee injury and Osteoarthritis Outcome Score has five subscales (pain, symptoms, activities of daily living (ADL), sports and recreation, and quality of life (QOL). Each subscale was independent of each other and was continuous measures (0 = good to 100 = bad). ; [3]Exercise self-efficacy = continuous measures (0% =no self-belief in ability to exercise to 100% = high self-belief in ability to exercise); [4]Depression measured using the Patient Health Questionnaire-8 = continuous measure (0 = no depression to 24 = severe depression); [5]Knee confidence = measured from the KOOS quality of life subscale (question 3) = categorical measure (0 =not troubled; 1 = mildly troubled; 2 = moderately troubled; 3 = severely troubled; 4 = extremely troubled by the lack of knee confidence); [6]**No/low PA level** was defined as individuals who do not meet criteria for moderate or high PA level; **moderate PA level** was defined as 3+ days of vigorous-intensity activity at least 20 minutes per day, or 5+ days of moderate-intensity activity and/or walking of at least 30 minutes per day, or 5+ days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum of 600 MET-minutes a week of PA; **high PA level** was defined as vigorous-intensity activity at least 3 days a week achieving a minimum of 1500 MET-minutes/week or 7+ days of any combination of walking, moderate- or vigorous-intensity activity achieving a minimum of 3000 MET-minutes/week.

4.4 Discussion

This study aimed to investigate the factors that were associated with arthritis self-efficacy in people with knee OA. A key finding from this study was that the 'not troubled by the lack of knee confidence' variable was the highest predictor of arthritis self-efficacy in the multiple linear regression model. Skou et al. (2015) suggested that self-efficacy and knee confidence could be two unrelated entities both affecting mobility in people with knee OA. They argued that self-efficacy referred to a person's beliefs in their ability to successfully complete a certain task, whereas knee confidence is referred to a person's sense of confidence in their knee, which makes the latter more specific to knee-specific changes in people living with knee OA. To support this, the multiple linear regression model from this thesis included both knee confidence and exercise self-efficacy and showed no multicollinearity between these variables and other independent variables in the model, which indicate that self-efficacy and knee confidence may be separate entities and should be treated individually.

The multiple linear regression model found that people with less depression, lower knee pain perception, greater self-belief in their ability to exercise, being female, and having a higher sense of confidence with their knee were more likely to have more self-belief in successfully managing their arthritis. This model explained 59.9% of the variance in arthritis self-efficacy, which means that 40% of the variances were due to unknown factors that need to be explored in future studies.

No statistically significant changes scores were observed of the study variables at baseline and 6-month follow-up. At a glance of the 6-month follow-up, participants had perceived less knee pain, had worse arthritis self-efficacy, worse exercise self-efficacy, more depression, and poorer general health status compared to baseline. However, the results were not significant. This could have been due to different reasons; the period of 6-months was a short period and no interventions were given to participants in the studies in this thesis, so a change in arthritis self-efficacy is unlikely to have occurred. In contrast, other researchers have who have included an intervention targeted at self-efficacy have reported changes in self-efficacy at 8-weeks, 6-month, and 12-month follow-up (Hughes et al., 2006, Lorig et al., 2008).

Additionally, OA is a chronic disease and progresses over time, thus 6-months duration may be too short an amount of time to observe changes that may occur in the physical and psychological aspects of OA (such as in disease progression/severity and health behaviour change) (Johnson and Hunter, 2014).

Furthermore, according to the Transtheoretical Model of behaviour change (Prochaska and Diclemente, 1983), it could take people at least six months before they can maintain a changed behaviour. People are usually in their pre-contemplation, contemplation, preparation, and action stages and may go back and forth between these stages before they can successfully maintain their behaviour change (Prochaska and Diclemente, 1983). Thus, observing the changes in arthritis self-efficacy, knee pain, and progression in knee OA

requires more time so it would have been beneficial to include longer follow-up time, such as 1-year, 2-year, 3-year, 4-year, and 5-year follow-ups.

Limitations

A limitation of this study was the sample of respondents to the questionnaire was highly selected, as there were 81% of patients did not return the baseline questionnaire. It was thought that those with more severe knee pain and knee OA may have responded to the questionnaire as they might have felt the study was relevant to them compared to those with less pain. However, the study sample reflected that the sample perceived a good health status (median EQ-VAS score of 70 out of 100, 100 being 'best health imaginable') and moderate level of knee pain (mean 46.59 out of 100, 100 being worse knee pain), which may be due to the fact that participants were recruited from the community. Those who had severe knee OA and severe symptoms may have been non-responders to the questionnaire. However, as the author did not have the authorisation to access patients' medical notes, the characteristics of non-responders could not be determined. A future study could recruit participants from orthopaedic or rheumatology clinics, which would have a sample of more severe knee OA suffers and compare what factors were associated with arthritis self-efficacy for this sample.

Furthermore, the factors that predict arthritis self-efficacy measured in this study only explained 59.9% of the variances in arthritis self-efficacy, so further research needs to be conducted to investigate other factors that were not measured in this study that would explain the other 40% of the variances in arthritis self-efficacy. These may include objective physical function measures

such as the 6-minutes walking test and the chair stand test, and fear of falling, as they have been found to be associated with self-effiacy (Rejeski et al., 2001, Skou et al., 2014c).

Knee confidence was assessed using the third question from the KOOS quality of life subscale question. However, this question has not been validated, as this area of investigation is still relatively new. The first authors to have used this question as a standalone measure from the KOOS was (Colbert et al., 2012, Hart et al., 2015, Skou et al., 2014c), who have also shown this to be a reliable method of assessing knee confidence. Therefore, future studies are needed to evaluate the psychometric properties of this as a standalone measure from the KOOS.

The next chapter will explore and discuss how patients living with knee OA were currently managing their condition, and if/why they felt factors such as knee confidence, exercise self-efficacy, and knee pain perception influenced their beliefs in their ability to successfully manage their knee OA.

Chapter 5

Exploration of Factors Associated with Arthritis Self-Efficacy: Patients' Perspectives

Chapter 5: Exploration of Factors Associated with Arthritis Self-Efficacy: Patients' Perspectives

5.1 Chapter Introduction

The findings from the previous chapter were able to quantify the predictive relationship of exercise self-efficacy, depression, knee pain perception, knee confidence, and sex with arthritis self-efficacy (to meet Objective 4). However, these findings were unable to provide in-depth information on the reasons behind if, how, and why these factors were predictive of arthritis self-efficacy from the perspectives of people living with knee OA. Therefore, this warrants the use of the explanatory sequential mixed methods approach to gain participants' perspectives on how and why they felt certain factors (identified from the previous study) affected the perception of their ability to manage their knee OA (to meet Objective 5).

Objective 4: *Identify the key risk factors of arthritis self-efficacy, which would thus benefit from an in-depth exploration of patients' perspectives*

Objective 5: *Explore patients' perspectives on how and why they feel certain factors influence their self-beliefs in their abilities to successfully manage the symptoms of their knee OA*

The methods of the second part of the mixed methods approach (i.e. one-to-one semi-structured interviews) will be reported in this chapter, including a description of the interview sample and sample size; the interview guide; the

interview procedure; valid informed consent and data confidentiality; data analyses used; inter-rater reliability; ethical considerations; ethical approval; and the author's perspective of the study. Subsequently, the results will be presented, firstly by describing the demographics and characteristics of participants who were willing to be interviewed. Then, the key themes from the interviews will be presented along with a brief discussion.

5.2 Key Risk Factors of Arthritis Self-Efficacy to Explore

Simple and multiple linear regressions (Tables 11 and 13) were run to determine which variables demonstrated the strongest relationship with arthritis self-efficacy. When the simple linear regression was run for each independent variable with arthritis self-efficacy, knee confidence produced the strongest relationship with arthritis self-efficacy (standardised coefficient (β) was -.587 (p<.001)). Therefore, a change in one standard deviation in knee confidence score decreased arthritis self-efficacy by .587 standard deviation. Additionally, knee confidence also produced the highest unstandardised coefficient (B) score of -.953, thus increasing knee confidence by one point decreased arthritis self-efficacy by .953 point.

When the multiple linear regression was run, exercise self-efficacy produced the highest standardised coefficient value of .308 (p< .001) while keeping the other independent variables constant in the model. However, the unstandardised coefficient value was low compared to other independent variables (B = .016). Not being troubled by the lack of knee confidence variable produced the highest unstandardised coefficient value (B = .787, p =

.033), thus not being troubled by the lack of knee confidence would increase arthritis self-efficacy score by .787 point while keeping the other variables in the model constant.

Therefore, the key variables to focus on during the interviews were exercise self-efficacy and knee confidence and how these factors influenced people's beliefs in their abilities to successfully manage their knee OA (arthritis self-efficacy). Furthermore, knee confidence as a topic has not been previously explored in qualitative studies, so exploring how participants perceived their knee confidence affected their arthritis self-efficacy will add valuable new findings to the literature.

5.3 Methods

5.3.1 Semi-Structured Interview Sampling

Two sampling strategies were used for this study. The first stage was self-selecting sampling (volunteer sampling), where participants consented in their baseline questionnaire (Chapter 4) to being contacted again for involvement in an interview study. This technique was quick and easy to set up; but, the participants who consented to being contacted for an interview may not be representative of the study/target population, as these participants may have been more motivated to take part in research studies and those wanting to talk about their knee OA.

After collecting a pool of participants from the self-selecting sample, a maximum variation approach of the purposive sampling strategy was used to

invite participants for a one-to-one semi-structured interview (Patton, 1990). From those who consented to the one-to-one interview, a range of participants were invited for an interview. This method of recruitment was the most appropriate and advantageous, as the principle behind maximum variation sampling was to gain greater insights into arthritis self-efficacy for self-management and to facilitate comparison from different perspectives by allowing the researcher to look at the phenomenon from different angles and perspectives to identify common themes that occur across the varied sample (Palinkas et al., 2015).

The maximum variation, purposive sampling strategy included participants who reported having high and low knee confidence, cross-tabulated with those who reported high and low arthritis self-efficacy (Table 22). The knee confidence variable was chosen for this purposive sample because the ‘not troubled by the lack of knee confidence’ and ‘severely extremely troubled by the lack of knee confidence’ variables demonstrated the highest change in arthritis self-efficacy score in the multiple linear regression model reported in Chapter 4 (Table 13). As the sample of participants were selected based on their knee confidence and arthritis self-efficacy, other variables such as their knee pain perception and depression level were not considered at the initial sampling stage, but the final sample of participants included a range of knee pain perception and level of perceived depression (Table 27 and 28).

Table 22 A blank example to show cross-tabulated table for the sampling of participants interviewed

	High Arthritis Self-Efficacy (value 6 to 10 on the scale)	**Low Arthritis Self-Efficacy** (value 0 to 5 on the scale)
High Knee Confidence (i.e. not at all & mildly troubled by lack of knee confidence)		
Low Knee Confidence (i.e. moderately, severely, extremely troubled by lack of knee confidence)		

5.3.2 Interview Sample size

There was no strict guidance of sample size for qualitative research, as the focus was on collecting detailed and in-depth data from a few participants. Interview transcription and preliminary data analysis were performed for each interview before a new participant was invited for an interview. Therefore, once the themes from the data had reached a saturation point and no new concepts will be discovered in subsequent interviews (Meadows and Morse, 2001), participant recruitment ceased.

5.3.2.1 **Theoretical saturation**

The sampling process was iterative. The author started with the initial interview data collection, analysed the data for themes, and then used the emerging themes to focus on subsequent interview data collection until 'data saturation' (Meadows and Morse, 2001) or when further collection of evidence

provides little in terms of further themes, insights, perspectives or information in a qualitative research synthesis (Harsh, 2011). Therefore, theoretical saturation was when participant recruitment also ceased. The higher likelihood of reaching saturation is when data is collected purposefully (Harsh, 2011).

5.3.3 Interview Guide

To develop the interview guide, the questionnaire data were analysed and significant or unclear results were explored further during the interview (Creswell and Plano Clark, 2011). The interview guide (Appendix 3) began with general questions about the participant's daily life activities to help ease them into the interview. The author then asked participants questions about their thoughts on exercise as a form of treatment for knee OA; if they were troubled by the lack of knee confidence; their knee pain perception; their exercise self-efficacy; what would help them manage their arthritis; and what would help them be physically active in the long-term. Additionally, the participants were informed in the participant information sheet that the main topic of discussion will be about their knee OA, their confidence, and their thoughts on using exercise as a treatment. They were advised that they could skip and not answer any interview questions they felt uncomfortable with or did not wish to answer. Participants did not need to provide a reason for their decision not to answer the question(s). They were also reminded of this during the Informed Consent procedure on the day of the interview.

5.3.4 Interview Procedure

5.3.4.1 **Interview Venue**

The semi-structured interviews were conducted one-to-one (the participant and the author) at the School of Medicine, the University of Nottingham based at the Queen's Medical Centre, Nottingham. Participants were offered reimbursement for their travel costs and offered tea or coffee and biscuits on arrival.

5.3.4.2 **Pilot Interviews**

Two pilot interviews were conducted by the author to test the interview guide to ensure the procedure and interview topics were clear to participants. It was felt that the interview guide had the correct content to explore patients' perspectives on how and why they felt certain factors influenced their arthritis self-efficacy (Objective 5). Therefore, no changes were made to the interview guide for the main interviews.

5.3.4.3 **Interviews**

Potential participants were sent a cover letter, participant information sheet, interview guide, and a consent form. The author's contact details were also on the covering letter, so participants can contact the author if they were interested in participating in the interview study. If the author did not hear from the participant within seven days, then she telephoned the participant to ask if they had received the letter for the interview and whether they would be interested. If the participant declined, then they were thanked for taking part in

the questionnaire. If the participant was interested, then the author explained more about the study, answered any questions they may have, and set a date for the interview at the participant's convenience.

The semi-structured interview was conducted one-to-one between the author and the participant. On the day of the interview, the participant was taken to the interview room and offered a beverage before starting the interview. The author started by going through the informed consent procedure by ensuring the participant has read the study documents posted to them and explained the aims and objectives of the interview and the rough interview topics that would be discussed on the day. The participants had this opportunity to ask any questions. If the participants were still happy to proceed, they were asked to read and initial each statement on the consent form; the author then did the same and photocopied the consent form (the original for the author to keep and the photocopy for the participant).

Participants were asked to think of a pseudonym that they would like to use instead of using their real name to maintain anonymity and confidentiality during the interview, in the transcripts, and for publication. Participants were informed that if they accidentally mention their real name or other personal information, this will not be transcribed onto the transcripts. Participants were asked if they were comfortable with the interview being recorded on an audio recorder (Sony ICPX240 Dictaphone) and they were also informed that they could stop the interview whenever they felt like and shown the stop button on the Dictaphone. Furthermore, they did not need to answer any question(s) they were not comfortable with and they did not need to give a reason.

At the end of the interview, the participant was asked again for their verbal consent to the interview. The participant was debriefed and thanked for their participation and reimbursed their travel costs. They were asked if they would like to have a more in-depth debrief, for example, if what has been discussed had made them feel particularly emotional. Even if the debrief was declined at the time, it was reinforced that another meeting could be arranged if on reflection they feel they would like to talk to someone. The author ensured that participants were not left distressed and were signposted to a Consultant in Sports and Exercise Medicine (also the author's supervisor) with expertise in this topic area if they required extra support or had clinical questions about their knee OA.

5.3.4.4 **Transcribing**

The author recorded and transcribed all the interviews verbatim. Each transcript was then double checked against the recording, and the transcripts were used in the data analysis.

5.3.5 Valid Informed Consent and Data Confidentiality

The author explained the details of the study and provided the participant information sheet, before the date of the interview was agreed to ensure the participant had enough time to consider whether to participate or not. All participants provided written informed consent and verbal consent at the end of their interview. The consent form was signed and dated by the participant

and the author before they began the interview. The author answered any questions that the participant had concerning study participation. The participant also kept a photocopy of the consent form, and the author kept the original consent form.

The signed consent forms and interview recordings were kept in a locked cabinet or on a secure university computer, respectively. The author used pseudonyms of names to ensure the participants were not identifiable. Participants were free to withdraw at any time in the study if they wished.

5.3.6 Data Analysis

To explore patients' perspectives on how and why they feel certain factors influence their arthritis self-efficacy (Objective 5), thematic analysis was the chosen method of analysis, because it was essentially independent of theory and epistemology, but can still be applied across a range of theoretical and epistemological approaches. It is compatible with both postpositivist and constructivist paradigms (Braun and Clarke, 2006), which would suit the pragmatic knowledge claims that included elements of quantitative and qualitative research methods and analysis.

Thematic analysis was chosen over the Interpretative Phenomenological Analysis (IPA) and the grounded theory approaches. Thematic analysis reports experiences, meanings and the reality of participants, and it can be a constructionist method, which examines how events, realities, meanings, experiences are the effects of a range of discourses operating within society

(Braun and Clarke, 2006). Interpretative phenomenological analysis (IPA) is associated with a phenomenological epistemology (Smith, 2004, Smith and Osborn, 2008), which gives experience primacy (Holloway and Todres, 2003), and is about understanding people's everyday experience of reality, in great detail, so as to gain an understanding of the phenomenon in question (McLeod, 2001). Furthermore, the goal of a grounded theory analysis is to generate a plausible and useful theory of the phenomena that is grounded in the data (McLeod, 2001).

In contrast to IPA or grounded theory (and other methods like narrative, discourse or content analysis), thematic analysis is not wed to any pre-existing theoretical framework, and so it can be used within different theoretical frameworks (although not all), and can be used to do different things within them (Braun and Clarke, 2006). As thematic analysis does not require the detailed theoretical and technological knowledge of approaches such as grounded theory and discourse analysis, it can offer a more accessible form of analysis, particularly for those new to qualitative analysis, like the author (Braun and Clarke, 2006).

5.3.6.1 **Thematic Analysis Process**

All qualitative data from the interviews were organised and analysed within the NVivo qualitative data analysis Software; QSR International Pty Ltd. Version 10 (Richards, 2015).

A theme was defined as something that captured the important information about the data in relation to the research question, which does not necessarily depend on the quantifiable measures (Braun and Clarke, 2006). The conduct of thematic analysis followed the six steps guidance provided by Braun and Clarke (2006), which included: being familiar with the data; generate initial codes; search for themes; review themes; define and name themes; and produce a report.

To be familiar with the data, all of the semi-structured interviews were conducted by the author, which was recorded on an audio-recorder (Sony ICPX240 dictaphone). The author also transcribed all the interviews in this thesis using a verbatim account of all verbal and non-verbal (e.g. coughs and laughs) utterances (Appendix 4 for an extract of a transcript). Each interview recording was re-listened to twice to ensure they have been accurately transcribed. The interview transcripts were then read multiple times to ensure familiarity with the depth and content of the data. Reading of the data was done actively to search for meanings and patterns within the data and notes of initial patterns and ideas were made on the right-hand margin.

Even though the interviews were semi-structured in nature, the interview questions were designed to ensure a thorough discussion of how someone currently managed their OA and their symptoms; why they feel certain factors could affect how they manage their OA; and how they feel their management could be improved (whether through themselves or through the National Health Service). Thus, the themes were generated inductively from the data without following a pre-existing framework rather than deductively, as a

theory-based framework was not used to generate themes. Although, it must be acknowledged that some themes were influenced by the author's interest and background knowledge of arthritis management and self-efficacy.

To ensure that the themes were generated inductively, the initial coding (organised in a qualitative software called NVivo qualitative data analysis Software; QSR International Pty Ltd. Version 11 (Richards, 2015); Appendix 5) was extensive and inclusive to allow coding for as many potential themes and patterns as possible. Coded extracts of the data also included the text that surrounded the code of interest to ensure that the context of the story is still present. During the process of searching for themes, analysis of the codes were conducted to search for relationships between the codes and how codes can be combined to form a theme and sub-themes; this step was recursive and the codes and themes were changed on certain occasions to ensure the codes fit into the theme and the definition of the theme. A table was created on Microsoft Excel to help define the themes and sub-themes, with examples to ensure consistency in creating themes (Appendix 6 for a screenshot of an extract of the coding table). No codes or themes were discarded at this stage, as they may become interesting in the latter process of the analysis.

Once a set of themes were developed, the themes were reviewed and refined in two stages. The first stage involved reading and reviewing the coded extracts assigned to each theme to ensure they formed a coherent pattern. If the coded extract did not fit into the theme, it was reviewed to see if it would fit into another existing theme or whether a new theme was needed. The second stage involved re-reading the entire dataset to establish the validity of each

theme in relation to the entire dataset. These two steps were also recursive as re-coding was done to move extracts of codes to other themes or a new theme and to code additional data within a theme.

The themes were then refined and defined, which is presented in Section 5.4.3 of the results. The process involved identifying what each theme was about, what was interesting about the theme and why, and the story that each theme and its sub-theme told and how they were related to other themes. The most vivid extracts which captured the essence of the theme are presented in Section 5.4.3 alongside an analytic narrative of the story of the data in relation to the research question and Objective 5.

5.3.7 Inter-Coder Agreement

There is little guidance in the literature about establishing reliable coding of in-depth semi-structured interview transcripts (Campbell et al., 2013). This is because in-depth semi-structured interviews enable participants to share longer, more open-ended answers compared to structured interviews, which may require several codes simultaneously. Additionally, identifying appropriate blocks of text for a specific code or codes could make establishing inter-coder reliability agreement challenging (Campbell et al., 2013).

Furthermore, it is important to highlight the difference between inter-coder reliability and inter-coder agreement. Inter-coder reliability requires two or more coders of equal knowledge about the topic area of the interview transcripts they are coding, whereas inter-coder agreement requires that two

or more coders are able to reconcile coding discrepancies through discussion, especially if coders have different level of knowledge regarding the topic area of the interview transcripts they are coding (Garrison et al., 2006, Morrissey, 1974). The inter-coder agreement will be reported in this section of the thesis instead of the inter-coder reliability, because of the different areas of interest and knowledge level of the two coders for this study of the thesis. The author is knowledgeable about the area of knee OA, OA management, and arthritis self-efficacy due to prior reviewing of the literature in this area. Whereas, the second coder has experience in coding qualitative transcripts and is a primary school teacher but has an interest in looking at physical activity levels in primary school children and the motivation to exercise. Therefore, the inter-coder negotiated agreement approach was advantageous in this instance, because discrepancies in the coding will occur due to the different level of knowledge and life experiences between the two coders.

Campbell et al. (2013) informed that the coding process of interview transcripts should occur in three stages: stage 1) a coding scheme should be developed to a high inter-coder reliability from sample transcripts (this stage requires at least two coders); stage 2) disagreements in the coding should be discussed and negotiated to establish a high level of inter-coder agreement (this stage requires at least two coders); and stage 3) coding of the full set of transcripts once an acceptable coding scheme has been agreed by between the coders (this stage requires only one knowledgeable coder).

The process of developing a coding scheme started with the author and the second coder separately coding the same interview transcripts. Krippendorff

(2004) suggested that it is acceptable to assess inter-coder reliability on a sample of the texts to be analysed, especially as time restrictions and costs prohibit from multiple coding of every transcript. As 21 interviews were conducted, time constraints meant it was not feasible to code the full transcripts from the 21 interviews. Hodson (1999) recommended that 10% of the transcript document was sufficient to calculate an inter-coder agreement level. Therefore, 10% of the interview transcripts were randomly selected (i.e. two transcripts) and 10% of pages within each of the two transcripts were randomly selected for coding. This equates to 8 pages from Peter's transcript and 13 pages of Billy's transcript.

The author developed a first version of the coding scheme from transcribing and coding the first three interview transcripts in full. The second coder was given the coding scheme with explanations of the definition of each code and examples of what the code included and what it did not include. The author and second coder coded the 10% of the randomly selected transcripts separately and the results were compared.

The overall inter-coder agreement was calculated for all codes by dividing the total number of agreements for all codes by the total number of agreements and disagreements for all codes combined (Campbell et al., 2013). For example, if there were 100 number of agreements and disagreements of all codes and 50 total number of agreements for all codes, then the overall level of inter-coder agreement would be 50% (50/100*100 = 50). On initial coding of Peter's transcript, there were 51 total numbers of agreements and disagreements with 24 agreements for all codes, thus an inter-coder

agreement level of 47%. For Billy's transcript, there were 72 total agreements and disagreements of all codes and 29 total agreements for all codes, thus an inter-coder agreement level of 40%.

There were many discrepancies with the coding, due to the different academic background and experiences of the two coders, but these discrepancies were discussed and most of the discrepancies were resolved to come to an agreement with the codes. The coding scheme was complex and contained many codes and sub-codes, which also contributed to the low-level agreeableness of the codes. Even though Hodson (1999) recommended that inter-coder agreement could be improved by reducing the number of codes by merging the codes to make more general codes, the author felt that it would be difficult to differentiate between the important nuanced meanings in the data if codes were merged too early on in the data analysis.

Another problem was unitisation, which Krippendorff (1995) described as different coders coding different sized units of texts (for example, some may have coded sentences and some may have coded paragraphs to provide the context for the code). Recommendations have been made to overcome the unitisation problem by the more knowledgeable coder putting brackets around the appropriate units of text for coding (Campbell et al., 2013). However, this recommendation was not followed, as this may have biased the second coder to code a unit of text that might not have been coded if the brackets were not used.

A discussion and negotiation of the discrepancies took place (Campbell et al., 2013, Boyatzis, 1998); each discrepancy and whether reconciliation was achieved and the direction of the reconciliation (i.e. whether the knowledgeable coder deferred to the second coder or vice versa) was recorded. After negotiation of the discrepancies, Peter's transcript achieved 88% of inter-coder agreement and Billy's transcript achieved 90% of inter-coder agreement.

5.3.8 Ethical Approval

This qualitative semi-structured interview study was conducted under the same NHS Research Ethics committee and Research & Development approvals as the quantitative survey study discussed in Chapter 4 (please see section 4.2.7 for more detail).

5.3.9 Ethical Considerations

A potential risk was the risk of a breach in confidentiality. Participants were required to write their name and address on the questionnaire. To minimise these risks, the questionnaires did not leave the School of Medicine, University of Nottingham premises, and the questionnaires were stored in a locked cabinet in a locked office. The data analyses of the questionnaires were completed by researchers directly involved in the study to avoid third-party access to participants' details. Additionally, the data analysis was completed at the Queen's Medical Centre on a secure computer network within the University of Nottingham.

Another risk was the possibility of misunderstanding (especially for patients who have difficulty with the English language). The researchers had written all the research documents in layperson terms and presented these documents PPI Advisory Group for feedback to ensure that these documents were understandable. The 'Gunning Fog Index' (http://gunning-fog-index.com/) readability scoring system was used to ensure that our documents had index scores between 8-12, as it was recommended that texts for wide audiences need a Gunning Fog Index of less than 12, and texts intended for a near-universal understanding required an index score of less than 8. The inclusion criteria for the study stated that participants need to be able to communicate in English, as all the research documents were written in English.

A potential risk during the interview was the possibility of upsetting patients during the interview, as some may find talking about their knee osteoarthritis a sensitive topic. The author tried to minimise this by discussing the interview guide with the PPI Advisory Group at Arthritis Research UK, Nottingham Pain Centre and Centre for Sport, Exercise & Osteoarthritis. This PPI group consisted of members who suffer from joint pain and osteoarthritis, so seemed an appropriate group to comment on the research documents. The author who conducted the interviews had the support of other researchers with a psychology background and experiences with qualitative research for guidance. Additionally, the participants had been informed in the patient information sheet that the main topic of discussion will be about their knee osteoarthritis, their confidence, and their thoughts on using exercise as a treatment, prior to the interview. They were advised that they can skip and not

answer any interview questions they feel uncomfortable with or do not wish to answer. Participants did not need to provide a reason for their decision not to answer the question(s). They were also reminded of this during the informed consent procedure on the day of the interview. The participants were informed during the debrief after the interview that a Sports Medicine Consultant was happy to answer their clinical questions about their knee OA, if required.

A potential risk was the risk of a breach in confidentiality during the interview if participants mentioned names and personal, identifiable details on the audio-recorded interview sessions. To minimise these risks, any identifiable information (i.e. names and names of places) were replaced with pseudonyms when the interviews were transcribed.

Another consideration was the travel cost to come to the Queen's Medical Centre for the interview. Funding was sought to reimburse the participants for the transportation to the interview and they could claim up to £9 for the trip for the UK interviews, in accordance with the rates recommended by the NHS.

5.3.10 Author's Perspective

As researchers, research interests, choices in research questions, designs, and methodology are governed by our values and reveal something about who we are (Guillemin and Gillam, 2004, Harding, 1991). These personal interests and choices will have shaped the data collection and interpretation (Mays and Pope, 2000). To improve the quality and credibility of the results from this study, the personal biases and recognition of the limitations of the

knowledge that is produced will be made explicit in this section(Mays and Pope, 2000).

The author has a BSc and MRes in Pharmacology and thus came from a strong positivist background. However, her dissatisfaction with the sole quantitative lab-based approach and the lack of human interaction in this discipline led her to explore Pharmacology from a patient-centred and patient-experience approach by conducting a mixed methods research for her MRes dissertation project. To gain more knowledge about qualitative research, the author attended training courses at the beginning of her PhD on 'Introduction to Qualitative Study'; 'Further qualitative research'; 'Qualitative observational studies'; and a 'Research Interviews' course, which was a theoretical and practical session, provided by the University of Nottingham.

The author developed an interest in patients' management of chronic diseases, such as obesity and cardiovascular diseases, through diet, exercise, surgery during her MRes dissertation project. This interest continued through to her PhD, which influenced her research topic on patients' management of knee OA. The author's background the methodology used in this PhD (i.e. a mixed methods approach).

The author does not have a clinical background, which was explained to the participants when she told them a bit about herself before the interview. The aim of this was to build a rapport with participants before the interview and reduce the chance of social desirability bias, which is where participants respond to questions in a socially acceptable manner and say what they think

a clinician may want to hear (Lewis-Beck et al., 2003). However, there was still been a chance of participants responding to how they think the researcher would want to hear.

The author is in her late twenties and does not have OA or other musculoskeletal conditions, and thus viewed the participants she interviewed as 'experts' about their knee OA and the way they manage the condition. By not having lived experiences of OA herself, this may have limited her full understanding of the physical, psychological, and emotional experienced by people living with OA, and this may have influenced the way that the author coded the interview transcripts and interpretation of the data. In hindsight, the author may have benefited from going back to the participants with the themes and subthemes from the interviews to draw on their insight and interpretation of the findings.

To minimise the potential personal biases from the author, 10% of the interview transcripts were independently coded by another researcher from a different background to the author (part-time researcher and part-time primary school teacher).

5.4 Results

5.4.1 Description of Interview Respondents

Out of 166 people who completed the questionnaire, 95 participants consented to be contacted for further studies (57.2%). These 95 participants' study ID numbers were placed into the appropriate section of the purposive

sampling strategy (knee confidence and arthritis self-efficacy) quadrant shown in Table 23. An interview was conducted and transcribed to explore the initial themes before inviting another participant for an interview; thus, attempts had been made to contact the 45 participants interviewed (47.4%) before saturation of the themes from the interviews was reached. Hence, not all 95 participants who consented for further studies were invited for an interview. The 45 participants were contacted via telephone to verbally ask if they want to re-consent to being involved in the interview and if they were interested in participating in a one-to-one interview.

Of the 45 participants contacted, 22 participants (48.9%) agreed to participate in the interview, however, one participant did not attend the interview even after re-scheduling it twice; 13 participants (28.9%) did not respond; two (4.4%) left no contact details/telephone did not work; two (4.4%) declined without giving a reason; two (4.4%) declined as they lived too far; two (4.4%) declined because they could not travel due to having Parkinson's disease; one (2.2%) declined because they had just had a total knee replacement surgery and could not travel; and one (2.2%) declined as they were a full-time carer for their partner.

One participant included in the interview had recently had total knee replacement surgery. When this participant was recruited into the study to complete the baseline questionnaire, she had not had a total knee replacement surgery. However, during the period of this study, she has had a total knee replacement surgery. It was deemed appropriate to include a participant who has had a total knee replacement surgery during the

interviews for two main reasons: firstly, this had demonstrated the natural progression of her knee OA and the need for a total knee replacement during the period of this study and secondly, it allowed an exploration of the perspective of someone who has had a total knee replacement on how she perceived her arthritis self-efficacy and management of knee OA before and after the surgery.

5.4.2 Description of Interview Sample Characteristics

Twenty-one participants in total participated in the semi-structured interviews. Table 23 shows the final number of participants interviewed concerning the purposive sampling strategy quadrant that they were placed in a particular quadrant based on their questionnaire responses for knee confidence and arthritis self-efficacy.

Table 23 A cross-tabulated table for the sampling of participants interviewed (pseudonyms used)

	High Arthritis Self-Efficacy	**Low Arthritis Self-Efficacy**
High Knee Confidence (KC) (i.e. not at all & mildly troubled by lack of KC)	Jess (mildly troubled KC) Bob (mildly troubled KC) Joanna (mildly troubled KC) Henrietta (mildly troubled KC) Martha (mildly troubled KC) Charles (not at all troubled KC) Lorna (not at all troubled KC – missing ASES but showed high ASES at interview) **Total: 8 participants**	June (mildly troubled KC) Patrick (mildly troubled KC) **Total: 2 participants**
Low Knee Confidence (KC) (i.e. moderately, severely, extremely troubled by lack of KC)	Holly (severely troubled KC) Pearce (severely troubled KC) Billy (moderately troubled KC) Guy (moderately troubled KC) Iris (moderately troubled KC) Fred (moderately troubled KC) **Total: 5 participants**	Ada (extremely troubled KC) Jon (severely troubled KC) George (severely troubled KC) Peter (moderately troubled KC) Polly TKR (moderately troubled KC) John Brown (moderately troubled KC missing EXSE, but during the interview, mentions does a lot of exercises) **Total: 6 participants**

Just over half of the interview participants were female (52.4%), mean age of 68.6 (SD 6.34) years old, with an average BMI of 28.49kg/m^2 (Table 24). Most interview participants (85.7%) were white-Caucasian, retired (90.5%), and educated up to secondary school level (42.9%; Table 24).

Table 24 Demographics for interview participants compared to the questionnaire participants

Demographics	Questionnaire participants (n= 131)	Interview participants (n=21)
Sex, n (%)		
Male	70 (53.4)	10 (47.6)
Female	61 (46.6)	11 (52.4)
Age, mean (SD), y	67.66 (11.17)	68.6 (6.34)
45-54, n (%)	17 (13.0)	1 (4.8)
55-64	34 (26.0)	1 (4.8)
65-74	36 (27.5)	16 (76.2)
75-84	29 (22.1)	3 (14.3)
85+	6 (4.6)	0 (0)
Missing	9 (6.9)	0 (0)
Body Mass Index, mean (SD), kg/m^2	28.67 (5.85)	28.49 (6.07)
Underweight, n (%)	2 (1.5)	0 (0)
Healthy weight	32 (24.4)	6 (28.6)
Overweight	45 (34.4)	8 (38.1)
Obese	42 (32.1)	5 (23.8)
Missing	10 (7.6)	2 (9.5)
Ethnicity, n (%)		
White-Caucasian	108 (82.4)	18 (85.7)
White-Hispanic	3 (2.3)	0 (0)
Black-Caribbean	8 (6.1)	1 (4.8)
Black-African	2 (1.5)	0 (0)
Indian	3 (2.3)	0 (0)
Pakistani	3 (2.3)	0 (0)
Missing	4 (3.1)	2 (9.5)
Employment status, n (%)		
Employed	35 (26.7)	1 (4.8)
Unemployed	9 (6.9)	0 (0)
Retired	82 (62.6)	19 (90.5)
Sick leave	2 (1.5)	0 (0)
Part-time employment	0 (0)	1 (4.8)
Other	3 (2.3)	0 (0)
Highest education level, n (%)		
None	10 (7.6)	2 (9.5)
Primary School	4 (3.1)	0 (0)
Secondary school	43 (32.8)	9 (42.9)
UK Higher National Diploma	6 (4.6)	1 (4.8)
University degree	24 (18.3)	7 (33.3)
Missing	44 (33.6)	2 (9.5)

The sample of interview participants reflected the general sample of the population of this study well (i.e. the questionnaire participants; Table 25). Most interview participants had a longer knee OA diagnosis (5-9 years) compared to the overall sample of the questionnaire respondents, where most participants had been diagnosed for 0-4 years (Table 25).

Table 25 Clinical characteristics for all baseline questionnaire participants and interview participants

Clinical Characteristics	Questionnaire participants (n= 131)	Interview participants (n=21)
Duration of knee OA, n (%)		
0-4 years	30 (22.9)	1 (4.8)
5-9 years	14 (10.7)	8 (38.1)
10-14 years	15 (11.5)	1 (4.8)
15-19 years	10 (7.6)	4 (19)
20+ years	11 (8.4)	2 (9.5)
Missing	51 (38.9)	5 (23.8)
Mean number of symptoms (SD)	3.72 (1.64)	3.05 (1.28)
Comorbidities? n, (%)		
No	37 (28.2)	2 (9.5)
Yes	92 (70.2)	18 (85.7)
Missing	2 (1.5)	1 (4.8)
Total number of comorbidities n (%)		
No. of comorbidities, median (IQR)	2 (2)	2 (1)

The physical activity levels of interview participants were similar to the study sample population (Table 26). Interview participants perceived less knee pain than the overall questionnaire sample participants (mean score of 39.11 (SD 23.38) and 47.75 (SD 27.12), respectively); they reported better multidimensional outcomes expectations for exercise (i.e. perceived more benefits with exercise); higher arthritis self-efficacy; less depressed; higher knee confidence compared to the overall questionnaire sample participants

(Table 26). The exercise self-efficacy and general health status between the two groups were similar (Table 26).

Participants who were interviewed reported slightly higher arthritis self-efficacy and were had a lower depression score compared to the questionnaire participants (Table 26). Interview participants reported worst KOOS scores in the pain, sport/recreation, and quality of life subscales compared to questionnaire participants (Table 26).

Table 26 Study variables for all baseline participants and interview participants

Study variables	**Questionnaire participants (n= 131)**	**Interview participants (n=21)**
Physical activity[1] (PA) levels, n (%)		
Now/low PA level	31 (23.7)	3 (14.3)
Moderate PA level	44 (33.6)	8 (38.1)
High PA level	36 (27.5)	7 (33.3)
Missing	20 (15.3)	3 (14.3)
Total sitting time, mins/day, median, IQR	360 (240)	285 (187.5)
Knee pain perception[2], mean (SD)	47.75 (27.12)	39.11 (23.38)
Physical MOEES[3], mean (SD)	23.37 (3.96)	25.90 (3.86)
Social MOEES[3], mean (SD)	12.69 (2.89)	12.35 (3.18)
Self-evaluative MOEES[3], mean (SD)	18.41 (3.60)	19.55 (4.64)
Arthritis self-efficacy[4], mean (SD)	5.62 (1.94)	5.91 (2.31)
Exercise self-efficacy[5] %, median (IQR)	31.25 (70)	30 (61.25)
Depression[6], median (IQR)	4.0 (7.0)	2 (7)
General health status[7], median (IQR)	70 (30)	70 (30)
KOOS[8], mean (SD)		
KOOS Pain	52.13 (20.05)	61.34 (21.18)
KOOS Symptoms	44.63 (12.77)	50.75 (12.37)
KOOS ADL	57.19 (21.72)	66.14 (21.57)
KOOS Sport/Rec	37.24 (29.90)	51.65 (32.91)
KOOS QOL	36.69 (22.18)	43.75 (23.22)

Study variables (Table 26 continued)	Questionnaire participants (n= 131)	Interview participants (n=21)
Knee confidence[9], n (%)		
Not at all troubled by lack of KC	19 (14.5)	2 (9.5)
Mildly troubled by lack of KC	18 (13.7)	7 (33.3)
Moderately troubled by lack of KC	41 (31.3)	7 (33.3)
Severely troubled by lack of KC	30 (22.9)	4 (19)
Extremely troubled by lack of KC	22 (16.8)	1 (4.8)
Missing	1 (0.8)	0 (0)

[1]**No/low PA level** was defined as individuals who do not meet criteria for moderate or high PA level; **moderate PA level** was defined as 3+ days of vigorous-intensity activity at least 20 minutes per day, or 5+ days of moderate-intensity activity and/or walking of at least 30 minutes per day, or 5+ days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum of 600 MET-minutes a week of PA; **high PA level** was defined as vigorous-intensity activity at least 3 days a week achieving a minimum of 1500 MET-minutes/week or 7+ days of any combination of walking, moderate- or vigorous-intensity activity achieving a minimum of 3000 MET-minutes/week.
[2]Knee pain perception measured using the VAS for pain = continuous measure (0 = no knee pain to 100 = severe knee pain)
[3]Physical subscale of the multidimensional outcomes expectations for exercise (MOEES) = continuous measure (6 = low expectations in the physical benefits of exercise to 30 = high expectations in the physical benefits of exercise)
[3]Social subscale of the MOEES = continuous measure (4 = low expectations in the social benefits of exercise to 20 = high expectations in the social benefits of exercise)
[3]Self-evaluative subscale of the MOEES = continuous measure (5 = low expectations in the self-evaluative aspect of exercise to 25 = high expectations in the self-evaluative aspect of exercise)
[4]Arthritis self-efficacy = continuous measure (0 = no self-belief in managing arthritis to 10 = high self-belief in managing arthritis)
[5]Exercise self-efficacy = continuous measures (0% =no self-belief in ability to exercise to 100% = high self-belief in ability to exercise)
[6]Depression measured using the Patient Health Questionnaire-8 = continuous measure (0 = no depression to 24 = severe depression)
[7]General health status measured using EQVAS (of the EQ-5D-5L)= continuous measure (0 = bad health status to 100 = good health status)
[8]KOOS = Knee injury and Osteoarthritis Outcome Score has five subscales (pain, symptoms, activities of daily living (ADL), sports and recreation, and quality of life (QOL). Each subscale was independent of each other and was continuous measures (0 = good to 100 = bad).
[9]Knee confidence = measured from the KOOS quality of life subscale (question 3) = categorical measure (0 =not troubled; 1 = mildly troubled; 2 = moderately troubled; 3 = severely troubled; 4 = extremely troubled by the lack of knee confidence)

Table 27 Demographics and clinical characteristics of interview study participants

Participant (pseudonym)	Sex	Age	Body mass index	Ethnicity	Employment status	Highest education	Duration of knee OA	No. of symptoms	No. of comorbidities
Guy	Female	67	37.17	White Caucasian	Retired	Secondary	Missing	4	2
Peter	Male	65	26.30	White Caucasian	Retired	University	10-14 years	4	2
Martha	Female	70	28.91	Black Caribbean	Retired	University	5-9 years	1	1
Holly	Female	61	29.62	White Caucasian	Retired	Secondary	5-9 years	5	1
June	Female	78	33.05	White Caucasian	Retired	Secondary	Unknown	2	2
Pearce	Male	69	27.49	White Caucasian	Retired	University	5-9 years	3	1
Patrick	Male	68	22.82	White Caucasian	Retired	Missing	5-9 years	4	1
Ada	Female	68	Missing	White Caucasian	Retired	University	5-9 years	4	2
Henrietta	Female	50	26.37	Black Caribbean	Employed	Missing	5-9 years	4	4
Iris	Female	73	22.21	White Caucasian	Retired	Secondary	20+ years	4	3
Fred	Male	68	27.23	White Caucasian	Retired	Secondary	5-9 years	3	2
Jessie	Female	65	22.73	White Caucasian	Retired	University	15-19 years	3	2
Polly	Female	68	28.16	White Caucasian	Retired	Secondary	5-9 years	4	1
Charles	Male	79	22.70	White Caucasian	Retired	None	0-4 years	1	1
Jon	Male	70	44.03	White Caucasian	Retired	Secondary	Missing	1	2
Bob	Male	67	27.30	White Caucasian	Retired	University	15-19 years	3	1
Joanna	Female	67	Missing	White Caucasian	Retired	Secondary	Missing	1	Missing
Billy	Male	74	36.30	White Caucasian	Part-time	Secondary	Missing	3	3
John Brown	Male	79	22.06	White Caucasian	Retired	Diploma	15-19 years	5	1
Lorna	Female	66	22.47	White Caucasian	Retired	University	15-19 years	2	1
George	Male	68	34.38	White Caucasian	Retired	None	20+ years	3	Missing

Table 28 Study variables of interview study participants

Participant(pseudonym)	Physical activity level	Knee pain perception	Arthritis self-efficacy	Exercise self-efficacy	Depression	General health status	Troubled by lack of Knee confidence
Guy	High	74.0	7.0	61	13	75	Moderately
Peter	Missing	47.0	4.0	21	4	50	Moderately
Martha	None/low	26.0	6.9	50	1	95	Mildly
Holly	Moderate	49.0	6	30	2	70	Severely
June	Missing	48.0	2.5	0	9	50	Mildly
Pearce	Moderate	13.0	6.9	15	2	70	Severely
Patrick	None/low	70.0	1.2	0	9	40	Mildly
Ada	None/low	78.0	3.2	0	4	80	Extremely
Henrietta	Missing	27.0	7.2	21	9	70	Mildly
Iris	High	45.0	6.9	100	4	45	Moderately
Fred	High	4.0	7.5	60	0	80	Moderately
Jessie	High	38.0	9.4	100	2	98	Mildly
Polly	High	62.0	5.4	55	4	80	Moderately
Charles	Moderate	12.0	8.4	0	0	75	Not at all
Jon	Moderate	36.0	3.9	31	15	40	Severely
Bob	Moderate	20.0	7.2	100	2	65	Mildly
Joanna	Moderate	Missing	9.1	80	2	90	Mildly
Billy	High	Missing	6.8	28	2	85	Moderately
John Brown	High	Missing	5.5	Missing	1	70	Moderately
Lorna	Moderate	3.0	Missing	100	1	80	Not at all
George	Moderate	52.0	3	0	2	60	Severely

Table 27 presents the demographics and clinical characteristics of interview participants. Participants were asked to choose their own pseudonym at the beginning of the interview. Two participants chose the name 'John/Jon', despite the difference in their spelling, the second participant who chose the name John was also asked to choose a surname, to be able to differentiate between the two Johns. Table 28 shows the study variables of the interview participants who were purposefully to chosen to have a range of high to low arthritis self-efficacy scores and varying levels of how troubled they were by the lack of knee confidence. This was due to the results from the multiple linear regression of the questionnaire data indicating that knee confidence was the strongest factor to influence a change in people's arthritis self-efficacy scores.

5.4.3 Qualitative Interview Findings

A coding scheme (Figure 8) was developed from the rich descriptions of participants' experiences in managing their knee OA and the symptoms and why they feel certain factors would influence their self-beliefs in their abilities to successfully manage their knee OA (arthritis self-efficacy). A thematic map (Figure 9) was produced to give a visual presentation of the main themes and links between the themes.

Four main themes emerged, which were shared by participants (Figure 8); these were: 1) attitude from self and others towards knee OA with three sub-themes; 2) self-awareness of their knee OA and knee problems with six sub-themes; 3) beliefs and exercise and physical activity for the management of

knee OA with three sub-themes; and 4) what is lacking in the healthcare system with three sub-themes.

The following sections will provide an in-depth account of each theme, including the interesting aspects of about the theme and why, the story that each theme and its sub-themes tells, and how they relate to other themes.

1. **Attitude from self and others towards knee OA**
    a. Acceptance
    b. Managing knee OA is not the priority
    c. Other's attitude towards my knee OA
        i. How others view my knee OA
        ii. Support from friends and family
        iii. Relationships with clinicians

2. **Self-awareness of their knee OA and knee problems**
    a. Ageing
    b. Functional limitations
    c. Knees giving way
    d. Previous negative experiences
    e. Adjusting lifestyle to manage knee OA
    f. Pain management

3. **Beliefs about exercise and physical activity (PA) for the management of knee OA**
    a. Adherence and motivation for regular exercise and PA
        i. High exercise self-efficacy
        ii. Importance of keeping moving
    b. Barriers to exercise or PA
    c. Preferences of the form of exercise or PA

4. **What is lacking in the healthcare system?**
    a. Knowledge about treatments for knee OA
        i. Best efforts to manage knee OA
        ii. Sought different treatments for knee OA
    b. Lack of exercise programme and guidance
        i. Benefits of an exercise programme
        ii. Barriers to continuing with OA specific exercise programme
    c. Lack of follow-ups
        i. Lack of long-term follow-ups with clinicians

Figure 8 Coding scheme from thematic analysis of interviews

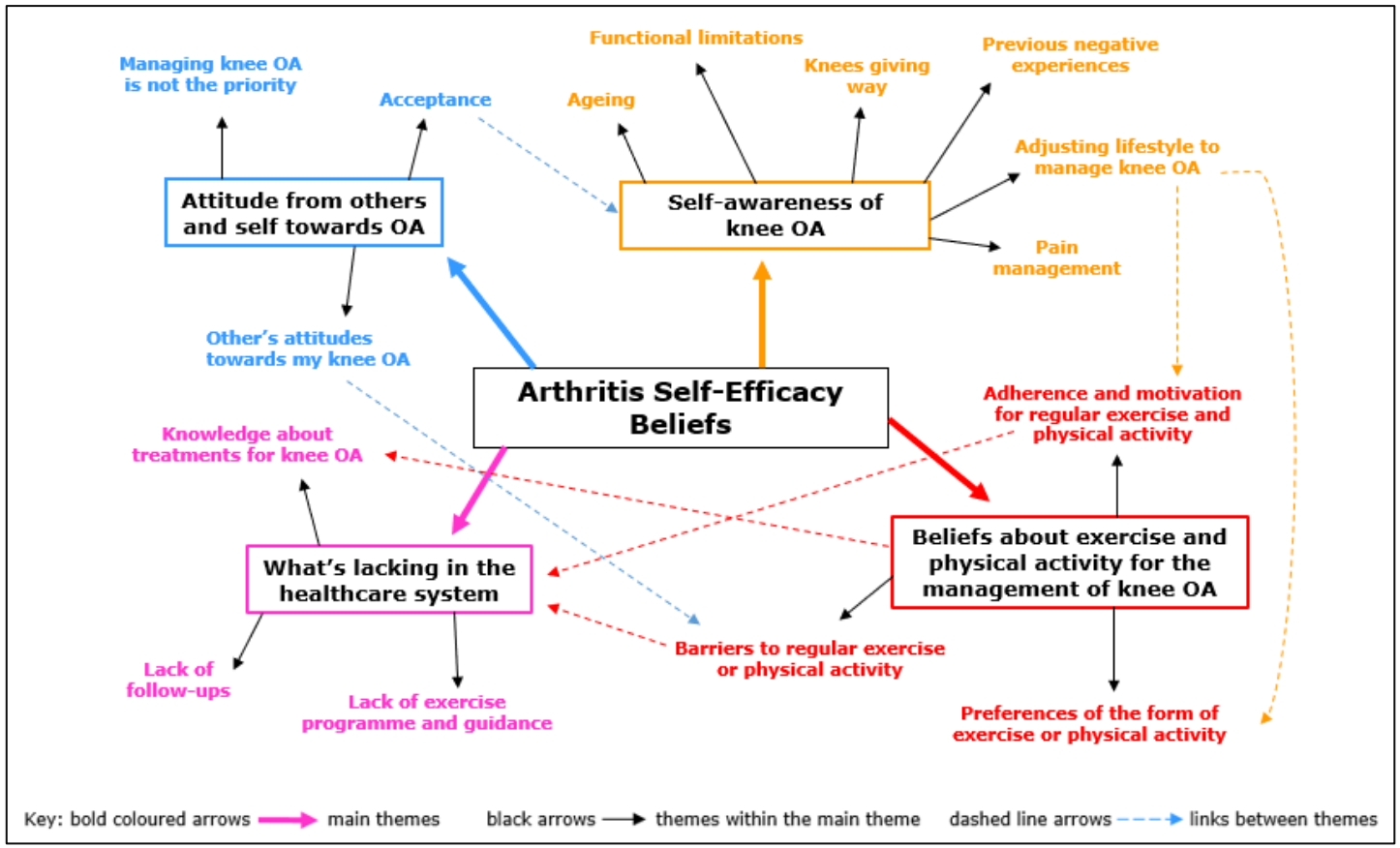


Figure 9 Thematic map of themes from Study 1 interviews

5.4.3.1 **Attitude from self and others towards knee OA**

Participants' attitude and how others view their knee OA influenced their perceived ability to manage their knee OA. Participants reflected on their acceptance of living with knee OA and how they manage it; living with other co-morbidities that they perceive as more serious and difficult to manage than knee OA; and how others other's attitudes towards them affected their perception of their knee OA (Table 29).

Table 29 Themes within the main theme of 'Attitude from self and others towards knee OA'

Theme	Sub-themes
Attitude from self and others towards knee OA	Acceptance My knee OA is not my priority Other's attitude towards my knee OA *i. How others view my knee OA* *ii. Support from friends and family* iii. *Relationship with clinicians*

Acceptance

The feeling of acceptance of having knee OA was expressed by participants, and participants often felt that they were "learning to live with it" or the need to "get on with it". They felt that there was nothing more they could do, as there is no cure for OA. They expressed the need to accept that they have OA and continue living the way they are.

> *"Acceptance and learning to live with it as I mentioned before is sort of part of my personality, I think, you just get on with it, try and make the best of it. But hating it at the same time, loathing it" – Ada*

Some participants compared themselves to other people and felt they should not complain about their condition, as there were people worse off than they are.

"Well, you just think 'well, I know it's not that bad, I know there's a lot of people worse off than me, so I'm probably being a bit, you know, oversensitive and I've just got to go away and get on with it'," – Polly

Others accepted their condition more easily because they felt their knee pain and other symptoms were bearable. Some participants described their way of managing their knee OA was by ignoring it because the symptoms were always there and have become part of what it is like living with knee OA. This reflects people's lack of knowledge and guidance from clinicians about the symptoms and ways to manage knee OA without ignoring it.

"There's a bit of ache in it now. You know, I can feel it aching a bit now, but I just ignore it, if you understand what I mean?" – Charles

"I just don't take any notice. Ignore it" – Lorna

My knee OA is not my priority

Three participants had partners who needed their care and support. Participants expressed that the additional responsibilities of taking care of their partners added a strain to their knee, but they could not focus on their knee problems, as their partners' condition took priority. They felt that they could not let their knee OA restrict their ability to perform daily tasks and activities, as they were the sole carers for their partner. Similarly to what previous

participants have said, they thought they need to get on with it and their partner's condition is worse than their OA and required more care and support from themselves.

> *"I can't really let it restrict me, 'cos me wife's in a wheelchair and I do all the shopping, the cooking, the cleaning and then pushing her about, you know, which does put a lot of strain on this, on the knee. But it's just part and parcel of it" – Patrick*

Five participants explained that they felt they were able to manage their knee OA, because they had other co-morbidities which were more serious than their knee OA. Their attention and efforts were directed to manage these co-morbidities rather than their knee OA.

"It's the eyesight that's knocked me back a hell of a lot. That's come as a, quite a shock, erm, and that's getting on 3 years now... It don't sound right, but you prioritise things that bother you, the eyesight bothers me more than anything." – Jon

> *"It's nowhere near as bad as my brain problems, so that's really been the focus on my problems rather than my arthritis…I think it's more the fact that the other problem I have is more serious" – Jessie*

Other's attitude towards my knee OA

i. How others view my knee OA

Other people's words influenced how participants felt about living with knee OA, especially those that were discouraging to the participant. Some participants felt that other people had made a judgment about their ability to join in with activities when they spoke about their knee OA and thought they

were unable to make their own decisions about their ability to participate, as someone else had already made this decision for them. They expressed wanting the freedom to make their own decisions about their ability to participate in activities. The judgemental attitude from others may have a negative impact on how people living with knee OA perceive their ability to manage their condition and their involvement in trying to keep active and continue with activities they enjoy.

> *"Well, they say you got arthritis, you can't do a Zumba class because 'ooh, you know, it's too high impact', so already, they're crossing you off… And I'm thinking to myself, 'well it's my knee, I should know how much pressure I can hold'…I don't feel good at all…I don't think that anybody should say to you, 'no, you shouldn't do that', you should know within yourself that you can't do that or see if you can modify, so you can still do that and you can still enjoy." – Henrietta*

On the other hand, some participants felt their knee OA is not a visible condition that strangers can spot, and they do not receive the empathy from others that they would like.

> *"The thing I find is people look at you and think 'oh there's nothing wrong with you', and then when you're sitting on a bus and there's an elderly lady wanting a seat and they're looking at you thinking why don't you give me a seat and I think to myself 'well, I can't, if you, if I had to stand up I'd have to get off'" – Holly*

ii. Support from friends and family

Participants described the importance of receiving support from their spouse and friends because they provided them with the encouragement that they needed to be physically active.

"My husband and I have always done an awful lot of walking and he has a similar problem, so between the two of us, we just encourage each other [participant laughs]…To always try a little bit more." – Iris

Polly, who recently received a total knee replacement, reflected that she felt cared for through the extra support that her family and friends showed during the initial post-operative period. As she was also living on her own, some of the daily tasks such as walking her dog would have been impossible straight after her operation.

"I've got brilliant family and friends and they've been really supportive, you know what I mean? Although I live on my own, they were there all the time and helping… I'm fortunate to have had people around me who just stepped in" – Polly

However, some people who lived on their own and did not have family nearby and reflected that they found it harder to find the motivation to keep active.

"Unless you've got some, especially like I live on my own, so there's nobody motivating me, so I don't motivate myself." – Henrietta

Martha lived on her own and was worried about not being able to manage her activities of daily life if her OA became more severe. Unlike other people with family nearby for support, Martha's family is far away, and she was conscious that she needed to be able to manage her OA effectively to maintain her ability to carry out daily activities because she needs to care for herself.

"My family in the main live away. And, [short pause] I just think that if I am in capacitated in a way, how would I manage my day-to-day life?" – Martha

iii. Relationship with clinicians

Primary care clinicians such as general practitioners (GPs) and physiotherapists are usually first points of calls for people living with knee OA and experiences symptoms that limit their ability to carry out daily activities and manage their symptoms.

Half of the participants interviewed discussed that they were sent for further investigation for their knee OA (such as receiving an x-ray for their knee joint) and felt that they were informed about their treatment options by their GP. Participants who felt they were part of the decision-making process were more positive about being able to manage their knee OA.

"They had my sort of scan and stuff like that and said, 'well, you've got a choice at the moment, all right? If it's[the knee] bad enough, we can justify doing it [total knee replacement surgery]'. Or they said, erm, they quite gently pointed out that I was quite a lot overweight at that time, so, the suggestion was why not try and lose some weight" – Bob

However, half of the participants felt that GPs were knowledgeable about many conditions and were not specialists in any one condition. Other than prescribing medication or referring participants to the orthopaedic surgeon for a total knee replacement, they felt nothing more could be done by their GP. They were in a period where their knee OA was not yet severe enough to be considered for a total knee replacement and managing with medication and

wait until they feel it is necessary to have a total knee replacement. So, participants generally felt they needed to manage their knee OA how they thought they should be managing it.

> *"Well, it was nice to speak to a specialist for him to give me different options. I have a lot of faith in the GPs, but they've got to know a little bit about a lot of problems. Whereas a specialist, whether it be knee, hip, elbows, or whatever, then I think is focused on one particular part and for me, it was a benefit to know what my options were." – Fred*

> *"I don't think the NHS could do anything for me now until I decide [to have] the knee replacement. I don't think there is anything else they could do for me…other than they give me stronger pain killers and stronger anti-inflammatories, which I don't want to take anyway. I can't imagine what else they could do really that I'm not doing myself." – Jessie*

Charles and Peter reflected having demotivating discussions with their GPs about their knee OA, both were informed that *"at your age, it's wear and tear"* and *"at your age they will probably never operate anyway*". Charles was 79 years old and Peter was 65 years old at the time of the interviews. The use of negative language during a consultation with people living with knee OA can give people the wrong message about their condition and may not give patients hope or confidence that there were effective ways they could manage their condition.

> *"When I went to the doctor's, when it was swelling up, and he said, 'at your age, it's wear and tear, it's not much we're gonna be able to do'. And, so I've never sort of gone to see him about having a new knee, or anything… what else can they do apart from keep saying, 'well, double up on the painkillers' [participant chuckles], to me, it's just a waste of*

time. I'll just put up with it from now until, he calls me. Ha." – Charles

"When he [GP] actually said to me, 'at your age they will probably never operate anyway. They will just leave it alone.' Er, thanks for assigning me to the rubbish bin! I'm not that old! Anyway so, I just decided I would do what I felt was best really... if a doctor explains to me this is what you've got, this is what will happen or this is what we think will happen, this is how you mitigate it, just explaining exactly what they've seen on the MRI and what the problem is and then that's more likely to motivate me then somebody saying 'oh, just go and take some exercise'. They don't know that much about knees, I don't think. They're generalists, aren't they? – Peter

Peter also described that his physiotherapist was only able to offer a few exercise leaflets that were not effective for him. Henrietta also mirrored Peter's thoughts and felt the lack of understanding from the physiotherapist about which exercises were effective for people living with knee OA.

"If a physio person hasn't got your condition and they're only sitting there just telling you to do this, they don't really know how you feel, you know, it's one thing standing there saying do this, but do you really have that condition?" – Henrietta

However, most participants who had received physiotherapy sessions were pleased with the outcome, particularly if they saw that it had started to make a difference.

"I was quite happy to go through the routine of the physio exercises that they gave me initially on those first two or three appointments, because I suppose my attitude as well, if it's gonna help, and make me feel more confident then, and actually improve, or allow the knee not to get gradually any worse, then I was quite happy to do that" – Pearce

Martha also described that she felt special receiving a one-to-one session with the physiotherapist and that was a motivation to continue with the exercises at home, as someone else has given up their time to look after her.

> *"I think when you get that one-to-one, you feel like it's special to you, you've been given someone else's valuable time… And also, because they're giving you that time, you know, encumbrance you to actually, when you leave to carry on with the exercises you've been given." – Martha*

Participants who had seen an orthopaedic surgeon described better experiences compared to those who saw their GP or a physiotherapist. They felt that orthopaedic surgeons were specialists in OA and felt better informed about their condition and treatment option. Participants were given control and a choice of how they wanted to progress with the management of their knee OA at a time they felt would be beneficial for them. For Bob, he felt that his orthopaedic surgeon took into considerations the activities and lifestyle that he wanted to maintain and discussed some alternatives and special materials that could be used for a new knee to enable Bob to continue with his cycling.

> *"I had some discussion as well, the last time with my orthopaedic consultant about what sort of new knee I should have with wanting to be quite active with it, all right…It was nice to have that discussion and it was nice to know that he was thinking along those lines, that he could do something a little bit different, which might just prolong the [new] knee." – Bob*

5.4.3.2 **Self-awareness of their knee OA**

Participants were all self-aware of their knee OA and discussed details of the different contributions to their self-awareness. This theme contains six sub-themes relating to a different aspect of participants' self-awareness of their knee OA (Table 30).

Table 30 Themes and sub-themes within the main theme of 'Self-awareness of knee OA'

Theme	Sub-themes
Self-awareness of knee OA	Ageing
	Functional limitations
	Knee giving way
	Previous negative experiences
	Adjusting lifestyle to manage knee OA
	Pain management

Ageing

Participants described noticing more knee problems or symptoms in their knee, as they aged. Comparisons were made on their attitudes and the activities they could do when they were younger to what they were able to do at present. They realised that as they have aged, they experienced knee problems and symptoms, which they did not have when they were younger, and this increased their awareness of their knee and they were aware to take more care when carrying out activities.

> *"I think in the past I've been a bit blasé, you can stand at the top saying. 'ah, look at me'. Those days are over…I'm 80 now, when you've had 70 odd years of just doing what you want, it comes a bit hard to have to take care…It makes you feel old and, but it doesn't depress me because I'm getting out and doing what I want to do, I've just got to take more care." – John Brown*

Functional limitations

People living with knee OA described experiencing limitations when they carred out activities of daily life, such as going up and downstairs. Participants were using the handrails as support as going up and downstairs was becoming more challenging than it used to be.

"I do struggle up the stairs, when I get to four steps, five steps from the top, I've got to hang on. I've always worried because I have to take the wife a cup of tea in bed before I go and when I'm coming downstairs with a tray, it's always at the back of my mind all the time, 'if that leg goes away, this tray's going, I'm not going'." – Billy

Functional limitations due to knee OA has affected the choices of activities people living with knee OA can participate in. Walking and hiking were popular activities amongst the participants interviewed, but some reflected that they found walking a challenge and they could not walk the same distance they used to.

"I don't go out for walks anymore, you know. Lovely evening let's go for walks down there and I can't do it. And walking around the corner in the post box, I have to be in the right frame of mind to do it." – Ada

"I mean my whole academic career was based around researching mountain areas and glaciers, that's what I did, all right, and it's so frustrating not to be able to still do that sort of thing and get to places I just love to be. You can look at a mountain from a car, but it's just not the same as being on the mountain." - Bob

Knee giving way

Knee giving way was a difficult sensation for participants who have experienced this to describe; they associated that action with feeling looseness and instability in their knee joint and instances where their knee "collapsed" under them. The feeling of the knee giving way usually took participants by surprise, as they could not predict when it would happen and how to stop it from happening.

> *"I don't know how to describe it [short pause]. Yeah, it, [participant sighs] I don't know, it feels like a looseness in my knee, all right? It's just that looseness is like somehow it's not held together, and I feel like if I take another few steps, it's just going to give" – Bob*

> *"The last year, one of them sort of keep collapsing on me…The first day on that holiday in Borneo, I got out the minibus and collapsed…You don't know it's gonna happen, there's no inkling, just suddenly, it goes…'Cos it's a feeling that you can never, sort of, plant your leg and think it's actually gonna do what it should do. So, it does make you quite cautious about what you do and how you do it." – Peter*

The uncertainty of not knowing when the knee will give way again or why it gave way made it difficult for participants to trust their knee and described the experience as being embarrassing if their knee gave way in front of other people.

> *"I don't like it to happen, I want it to be good, then you think, is it going to be all right? Then you think, if I'm going to do something else is it gonna go again? And things like that. So, just knock, knock a bit of your self-confidence a bit." – Billy*

"Yeah, it is, it can be a bit embarrassing, but depends on the situation, really. Nobody likes to be feeling old, bit unsteady on their feet, do they? There's no warning, you don't know it's going to happen. You can't stop yourself sometimes." – Peter

"I just think, 'oh my God', you know what I mean?'Oh, at least I didn't fall down flat on my face' or anything like that or 'I hope it don't happen again'." – Henrietta

Peter also described that experiencing his knee give way has made him more cautious and aware of how and where he walked and needed to adjust.

"Well it changes your way of thinking, whereas if you've not got a bad knee and you're walking down the slope or whatever, then you'd just walk, you wouldn't think. Now you're looking where you're going, where you're putting your feet all the time, how are you gonna do something" – Peter

For participants who experienced their knee giving way, they made alterations and adaptation to their routine to ensure that they felt safe and stable to minimise the chance of their knee giving way. They felt that their knee gave way due to instability in their knee and this could increase their confidence with being able to manage their knee OA.

"Usually I've got bench or something to hold on when you bend down, so you're in an environment where you feel safer, your legs are not gonna collapse, but you know…but if you've got confidence that your knee weren't going to fall apart…I think that would help." – George

On the contrary, participants who had not experienced their knee giving way (or it has rarely happened to them) reflected not feeling anxious or concerned about it happening, because they did not feel unsafe with their knee.

> *"In fact, I don't remember doing it in the last six to nine months. So, I'm getting a bit more confidence back from that point of view. The giving way did not affect my concerns and my confidence. 'Cos it was much rarer that thing happened."*
> *– Bob*

Previous negative experiences

Over half of the participants spent some time describing negative experiences (such as falls and knees locking up) and how this affected the confidence they have in managing their knee OA. Being in uncomfortable and painful situations after experiencing their knee lock up, give way, or a fall had a negative impact on people's confidence and trust in their knees.

> *"My knee would occasionally lock, and that is excruciatingly painful. If you're coming down at a pace, and then it suddenly locks, then you're in great danger of falling over, and it shakes your confidence after a while or so, particularly if you like doing it on your own." – Bob*

These negative experiences led to participants feeling more cautious and taking more care during their activities to ensure these incidences do not happen again. However, as they did not know what triggered their knee to give way (i.e. the weakness and instability in their knee), and they were unable to increase the confidence they had with their knee.

"I climbed up a bank and I got to the last step and put me weak leg up and then put weight on to it and it would sort of hurt and then I fell back, rolled down the hill… I suppose it made me realise that, I've got to take more care" – John Brown

People who experienced milder knee OA symptoms and those who had not had negative experiences with their knees felt they were better at managing their knee OA and were less likely to be anxious when participating in their daily activities compared to those who described their symptoms as being more severe and having had negative experiences. Experiencing milder symptoms may give people confidence about being able to successfully manage their symptoms.

Lorna was a keen walker and explained that her symptoms were mild enough that she did not notice them and therefore did not feel that she needs to worry about walking down a hill. Lorna also discussed that she had not had a bad experience with her knee when she went out walking and hiking. It was possible that having negative experiences in the past could lead to an individual being more aware and anxious in the situations such as their negative experiences, and not experiencing this in the past could be why Lorna may not feel anxious when she goes walking.

"Erm, well, most days I don't even notice anything at all…I just don't take any notice…I don't think 'oh dear, if I come down that hill, are my knees are going to hurt?' I don't think like that." – Lorna

Adjusting lifestyle to manage knee OA

All the participants who were interviewed described in detail about the different ways they had adjusted their lifestyle and being more prepared before carrying out certain activities to demonstrate how they were coping with their knee OA. Participants took ownership in managing their knee OA and felt that they were successfully managing their condition if they could still do what they wanted or needed to do in their everyday lives with certain adjustments made to make the tasks easier to carry out. For example, Bob and Peter recognised what movements were bad for their knee (such as kneeling or putting too much pressure on their bad knee), so made a conscious effort to adjust the way they carried out certain activities to ensure they could continue doing the activities they wanted to do.

"There are a few precautions. I mean, if I'm gardening, I'm very careful about kneeling down for a long time, 'cos it stiffens up very quickly if I do that. Rather than kneel down, I tend to do it standing with something to lean [on]" - Bob

"I've notice, if I step down off something, if I lead with this leg [touches right leg], then that goes. So, I try to go with the other leg. It's all about knowing your limits, isn't it? Eventually you just alter your life to suit what you can do. [Pauses] I don't see what else I can do, really." – Peter

Participants also explained that being physically active helped them manage their knee OA and find sports or activities they enjoyed. They adjusted their activities to suit their abilities and to continue with the activities they enjoyed. For example, John Brown enjoyed his golf but realised now that he needs to make an adjustment by using a buggy to ensure he can still play golf.

"I play golf on Tuesdays, but now I use a buggy, that's an electric buggy, because I although I could walk around the course, but you've got to be able to concentrate on a little ball. I have a hot bath after golf and after a long walk. I find that that helps, and I might move my leg about a little bit just to free it up and that's about the limit." – John Brown

Participants who perceived themselves as cautious, like Iris, tried to be prepared before carrying out their activities.

"Whenever I do go out distance walking, I always have a small rucksack that's got knee support in it. I never, ever go out without on. Just in case, because if you do go over and you haven't got a knee support, then it weighs heavily on my mind when if I've suddenly realised I haven't taken one." - Iris

Similarly, Martha perceived herself as being more anxious and uncertain of the future, so wanted to be more prepared and was conscious and determined about keeping active to avoid future problems with her ability to manage her knee OA.

"I suppose I'm a bit of a worrier. I'm anxious about the future. I want things to be [participant taps the table] just so. You know, to see whether things can go wrong and try to put steps, things in place before they go wrong. That's, really how I see myself. Yeah, worrier." – Martha

Pain management

Pain was the most common symptom reported by people living with knee OA. Participants demonstrated a high sense of self-awareness of the activities or movements in their knees that increased their pain and what adjustments they are required to make to minimise their knee pain. Their ability to manage their

knee pain was key to feeling that they were capable of successfully managing their knee OA.

"You get pain, it's quite a good teacher, really. You think, well I'm not going to do that again" – John Brown

Jon, who had severe hip and knee OA, found it challenging to minimise his knee and hip pain and carrying out activities of daily life was generally difficult and draining.

"I'm limited to what I can do and how long I can do it for, because of the pain…shopping becomes a chore. Even if you're catching public transport, you've still got to walk certain [distance], and walking around the supermarket, it's so painful." -Jon

As well as feeling physical knee pain, some participants perceived pain as psychological and described different methods that could help overcome this psychological pain, which could help them cope with their physical knee pain.

"I just sit and rub it, and it seems to do the job. It just seems to ease it. Whether that it actually does or whether it's mentally, I think I'm doing the right thing, you know, 'cos I think lot'a, a lot'a pain sometimes is in your mind, you know, you can overcome it if you wanted to." – June

"Because I think sometimes when you've got pain, you can, it's psychological, make it more than what it is. I think if you found some way of de-stressing yourself and learning how to relax your body, it might alleviate that pain" – Henrietta

Bob described his fear of the pain and what it could be like if he experienced pain during a hike up a mountain rather than his actual pain itself. Fear is a psychological factor and may require other methods to manage the fear of pain compared to managing physical feelings of pain.

"I just have to think about what I'm doing, and I think it's more [short pause], it's more the fear of the pain than the actual pain." – Bob

Eight participants believed that the weather and temperature contributed to their knee pain and described the symptoms they felt and how they managed their knee pain depending on the season. When asked why they thought the seasons affected their knee pain, nobody was sure why the cold weather caused them to feel more symptoms in their knee.

"Nobody really knows why, it could be the climate, air pressure, dampness, I don't know? But certainly, it does have periods where it [the knee] misbehaves." – John Brown

As a solution to manage her symptoms in her knees during the winter months, Jessie described spending her time in Spain (to play golf and go to yoga classes) during the autumn and winter months of the year and came back to the UK during the late spring and summer.

"Damp and cold is the problem really, that's why we go to Spain in the winter." – Jessie

Even though participants may not know why they felt less pain in the summer, Guy highlighted that she was aware she was more active during the summer

and keeping the joint moving during activities may contribute to feeling less knee pain.

> *"It seems to come back at winter time, about October time, the pain gets worse…I sometimes can't even get up, I can't move around the house, it's really, really bad…I mean normally during the summertime, I'm probably more active, so it's not quite so painful" – Guy*

5.4.3.3 **Beliefs about exercise and physical activity for the management of knee OA**

This theme describes participants' beliefs about exercise and physical activity as a method to manage the symptoms of their knee OA. Participants described the factors that motivated them to maintain regular exercise and physical activity; barriers to general exercise and physical activity; and the preferences of the type of exercise or physical activity they like to participate in (Table 31).

Table 31 Themes and sub-themes within the main theme of 'Beliefs about exercise and physical activity for the management of knee OA'

Theme	Sub-themes
Beliefs about exercise and physical activity for the management of knee OA	Adherence and motivation for regular exercise and physical activity *i. High exercise self-efficacy* ii. *Importance of keeping moving* Barriers to exercise or physical activity Preferences of the type of exercise or physical activity

Adherence and motivation for regular exercise and physical activity

i. High exercise self-efficacy

Sixteen participants discussed their regular exercise and physical activity behaviour during the interview and perceived themselves to have high self-efficacy for exercise (i.e. they were confident that they were able to maintain their current levels of exercise and/or physical activity for a long period of time).

Some participants like John Brown, Jessie, Bob, and Iris had been able to integrate exercise or physical activity into their everyday lives and routine. These participants chose the activities they enjoyed, which made it easier to maintain regular exercise and be physically active.

> *"I play bowls Monday mornings, indoor bowls. I play 18 holes of golf on Tuesdays, but now I use an electric buggy. Wednesdays I have my walk or ramble in Derbyshire with our little group of anything from 8 to 12 people. We go about 6, maximum of 7 miles in about 4 and a half hours. And Thursday I play golf, but only half a round, but this time I walk around. And Fridays I play bowls again. Saturdays I play golf again and Sunday, perhaps I'll have a little stroll with my wife. And all that period of time, I don't feel I've got any inclination to be doing any specific exercises." – John Brown*

> *"We do have a routine, that's a good way to describe our life, I think. When we go away on holiday, we always look for a hotel that has a gym…When we're away, we don't walk every single day. We walk a day, have a rest day, have a gym day, have a rest day. That's our routine." – Iris*

Bob was involved in a weight loss class and found that he enjoyed cycling and it helped him lose weight. Having a weight loss goal gave him the

determination to keep up with the cycling to reach his goal of reaching the desired weight and improve the symptoms in his knee. This goal setting and enjoyment of cycling helped him maintain his regular cycling and improved his self-efficacy for cycling.

> *"I just feel better as well for the cycling. It's just something I do. I just look forward to going out, so that's sort of good…I was absolutely determined to make it work. And I wasn't making any excuses, all right?" - Bob*

Exercise and keeping physically active did not need to be in an outdoor setting or in a class/group setting. Pearce found the use of technology (the Wii) helpful in keeping him active in his home. The ability to adjust your lifestyle and choose an activity you can do and enjoy can help enhance an individual's sense of exercise self-efficacy because they will be more likely to continue and maintain these exercise or activities in their daily lives and routines.

> *"I was aware as I was a bit more restrictive in the amount of exercise, I wanted i.e. no dogs, I wouldn't do my two-hour walk every day. I thought I need to do a bit more exercise, so that's when I got into thinking 'oh I go and get that Wii game out and see what that's like'. But I find it does keeps your head a bit more active and honestly, gives you exercise at the same time." – Pearce*

ii. Importance of keeping moving

A message that was repeated by participants during the interview was to keep moving. Participants described the importance of being able to keep their knee joint moving because they have seen improvements in their knee OA symptoms. Seeing improvements (mastery experience, according to Bandura)

acted as motivation to ‘keep going’ and maintain their activities and this could give individuals the sense that they were able to manage their knee OA.

> *“I do think it’s the exercise that makes the difference, personally…I can now get on a bike and cycle from here to Leeds and back without thinking about it, whichI wouldn’t have even been able to think about that two years ago. I suppose the thing is to keep it going. Nothing else.”- Bob*

> *“Since I’ve been retired, I’ve end up doing a lot of walking, that’s helped…but I find that just keeping moving is the answer.” – Peter*

Polly persevered with some pain and discomfort experienced during the exercise because she knew it helped build up muscle around her knee. This was the motivator that kept her continuing with her exercise.

> *“I was exercising it, but it felt so much better when I rested it…‘cos the exercise hurts, but you know it’s doing it good, ‘cos it’s building up the muscles around, you can’t repair the knee with exercise, all you can do is sort of build up the muscles round it. So, that’s what I did, you know, just kept on doing it.” – Polly*

Barriers to exercise and physical activity

Participants who had experienced exercise (those given by a physiotherapist and exercise in terms of going to the gymnasium), recognised the benefits of exercise for their joints when they were doing the exercises. But these benefits did not provide the motivation for these individuals to maintain regular exercise. Thus, another source of motivation will be required to help individuals maintain their exercise and physical activity.

"When I done exercises that they gave me, it did give me a bit of leave and you tend to think, 'well that's it', but really, you should keep up with the exercise, you know, which I didn't really, but I should have done…now and again I would do the exercises, but it just tailed off, you know, it's probably my fault." – Patrick

"I know I perhaps could go to the gym and sort of carry out the exercises, which I am certain will maintain that stability, but, I don't know, I seem to have lost the, erm, I veered off the gym…it's motivating myself to go. I haven't taken it up again yet, I just keep thinking about it, it's me, if I stop something I find it really difficult to re-start." – Martha

Some participants tried to exercise but had negative experiences with those specific exercises and believed that some form of exercise was bad for their knee and could worsen their symptoms.

"I've been given certain exercises [from the physiotherapist] to do. In all honesty, I've been struggling with it and that is partially down to the knee anyway, 'cos some of the exercises have made the knee worse." – Jon

Certain exercises may not be appropriate for people living with knee OA, but these uncomfortable experiences with exercise could lead to individuals perceiving any form of exercise to be bad for their knees and act as a barrier preventing them from being physically active.

Furthermore, for individuals who did not have an exercise routine, like Henrietta, found it more difficult to find motivation to start exercising. Thus, being motivated for exercise and stronger self-efficacy in exercise may increase the likelihood of people taking up exercise.

"Just the thought alone of going after work, 'cos I think 'no', after work I want to go home, you know. Can you see 'ow the barriers have already gone up? So, I just think sometimes, some things are good after work, but it depends how straight after. But sometimes it's too far in the evening, I best not go home, because if I go home, I'm not going to come back out, 'cos you get comfortable, 'cos you got a routine. It's a Catch-22." – Henrietta

Preferences of the type of exercise

Being able to choose a type of exercise that was enjoyable was important to participants. They described that the exercises given to them by a physiotherapist were *"boring"* and they had less motivation carrying these out. Whereas other types of exercise and sport such as walking/hiking, golf, and bowls were more enjoyable to participants and they preferred this type of exercise and sport compared to the exercises given to them by their physiotherapist.

"I'm not very good at doing exercises [given by the physiotherapist]. They're utterly boring. [participant sighs] The word exercise to me is doing something like some kind of sport or in my case walking or something rather than [physiotherapy] exercises, which are more, shall I say, artificial. It's not something that your body is really naturally expected to do, because we're designed to be walking around and to be bending and to lifting and sitting as well. Whereas to be lifting your leg up and down, up and down, up and down, whatever, is a bit foreign. Mm, so that way artificial, I think." – Lorna

"Erm, I suppose the other thing I attempt to do, is [short pause], to do exercise, but make it enjoyable exercise rather than sit against the wall or lift my leg up for ten seconds and then put it down again" – Pearce

"I think because if you enjoy what you're doing and you get pain, you put the pain behind you as long as it's not affecting you, what you're attempting to do…But if you get a little bit of extra pain and tiredness and you still enjoy what you're doing, you push, you can push that into the back." – John Brown

The repetitive movements and the lack of enjoyment from physiotherapist exercises could help explain why participants felt less motivated to adhere to them, especially in the long-term. But if the exercises were in the form of a sport or activity they enjoyed doing, participants were more likely to integrate this into their weekly routine and adhere to these activities in the long-term.

5.4.3.4 **What's lacking in the healthcare system**

This theme describes how participants felt about the current guidance and treatments they received about how to manage their knee OA. There were three main sub-themes, which will be described and discussed further: 1) knowledge about treatments for knee OA; 2) lack of exercise programme and guidance; and 3) lack of follow-ups (Table 32).

Table 32 Themes and sub-themes within the main theme of 'What's lacking in the healthcare system'

Theme	Sub-themes
What's lacking in the healthcare system	Knowledge about treatments for knee OA *i. Best efforts to manage knee OA* *ii. Sought different treatments for knee OA* Lack of exercise programme and guidance *i. Benefits of an exercise programme* *ii. Barriers to adherence to an exercise programme* Lack of follow-ups *i.* Lack of long-term follow-ups with clinicians

Knowledge about treatments for knee OA

Eighteen participants from the interview described their lack of knowledge about the treatments or effective management methods for their knee OA. There was a sense of people feeling they had nobody to speak to, as they felt their GP did not have the appropriate information for them.

George and Ada knew that exercise was good for their joint, but when George started walking, his joint became stiff. There was a lack of understanding about the effects of exercise on the knee joint and the types of safe exercises for people living with knee OA. People with knee OA felt that they do not receive feedback from their clinicians, and they were not supported with using exercise as a form of management and treatment for their knee.

> *"I don't even know if it makes any difference, there's no feedback, becausenobody, there's no, pfft, I could be doing all these exercises; I know I'm getting worse…Get more active, lose weight and your blood pressure goes up. It's all very disputed, that's why you need the feedback, the feedback loop to tell you're doing well" - Ada*

i. Best efforts to manage knee OA

Most participants interviewed took ownership to manage their knee OA to the best of their ability and knowledge, such as doing what felt right for them, as they had not received information about managing knee OA from clinicians.

> *"I do believe I should have been given some information, because, I need to know how to manage it and I'm managing it how I feel I should manage it and that's all I can really say, really… Because when you get older, people say it's 'wear and tear', but it might not be just wear and tear, there might*

be some other mitigating factors that's attributing to your condition, you know…I just think that there is no information around arthritis at all really." – Henrietta

Participants felt they were doing the best they could and there was nothing else they could do in addition to manage their condition whilst they were waiting for their knee OA to become severe enough to consider total knee replacement surgery. This period of waiting was frustrating for people living with knee OA, as they felt that they were managing their condition to the best of their ability, but it may not be the most effective method.

"You can't just sit still and go nowhere, can you? But, I don't see what else I can do. I can have an operation; I can't take non-steroidal. So, do I want an operation? Not really. So, I'm not sure what else I can do to manage the condition…you just alter your life to suit what you can do. [Pauses] I don't see what else I can do, really." – Peter

ii. Sought different treatments for knee OA

Participants described a variety of different treatments they had sought to help them manage the symptoms of their knee OA. A few participants found that having a walking stick gave them extra support and felt safer and more confident if they had a walking stick with them.

"There's things you can do with it in your knee, you can keep walking with the aid of a stick and you've got another good leg that helps you along" – June

"I use a stick, and without that stick now I'm not gonna do it; I'll fall over. So, with the stick and take it at my own pace then I'll get there, 'cos I want to get there" – Peter

Participants were conscious of not wanting to become reliant on regular use of painkillers and would use them if they had planned on being physically active that day so they can decrease their knee pain and enjoy their activity.

> *"I played golf yesterday and I've got to play again today, I'll take that before I go out, and if it still hurts whilst I'm still playing, I'll take two more paracetamol. So, basically, I'm managing with analgesics andI have a cream that I rub into my knees if they're very swollen, which is something I got in Spain, you can't get it here. It's quite strong, ketoprofen cream." – Jessie*

Jon recently started using a mobility scooter, which had been helping him become more mobile, but he was also conscious that being reliant on this will decrease the amount of exercise he was getting and could have a negative impact on his mobility if he continued to use it in the long-term.

> *"I've got one of these scooters I use, which might not be a good thing, to be honest…I find it a lot better actually. But, I really think it's something I shouldn't be using because I'm not getting the exercise." – Jon*

Polly was the only participant who took part in the interview to have had a recent total knee replacement surgery. She described her experience as positive and allowed her to have a new lease of life. In her mindset, a total knee replacement was her only option after failed attempts with conservative therapies to manage her knee OA, as she felt so limited in her physical function and knee pain was affecting her quality of life.

"I was thinking, 'oh, I'll be going away, and my knees are going to hurt and I'll slow everybody down when we're walking, and I felt like an old lady', you know what I mean? Now [to] have this done, it's like given a new lease of life, you know, everything's good again, positive… I mean I still would advocate, exercise, because I'm sure that it did help keep me going. I think if I'd given up and not exercised, I think I would have got to rock bottom a lot early." – Polly

Thirteen participants spoke about not wanting a total knee replacement surgery and were determined to do everything they could to manage their knee OA without the need for surgery. The main concerns about the surgery were the success rate of surgery, whether the knee would feel the same post-surgery, not having family to support or care for them post-surgery, and if a second knee replacement would be needed in the same knee in the future.

"Well, it's never the same again, is it? [participant laughs] you know, and X number of years down the road, you gotta have it replaced again isn't it? So, if I can avoid it." – Martha

Ten participants remained undecided about whether a total knee replacement surgery is appropriate for them and were currently weighing up the pros and cons of having the surgery. John Brown reflected that he was still capable of doing the activities he would like to do but knows that he is ageing and that may come with higher risks of the surgery and recovery.

"Well I've got a concern. I managed it reasonably well for 15 years. The doctor's view is, whenever you can walk six or seven miles, whenever you can play your golf, whenever you can play your bowls, you can carry on. But I've got the concerns that someone, a specialist or whoever, may say this is something that should have been dealt with earlier, I don't know." – John Brown

Lack of exercise programme and guidance

Some participants were aware that exercise and physical activity would be beneficial for their joints. However, there were no opportunities for them to join exercise programmes offered by the NHS due to cutbacks or the programme not being offered in the area they live in. Hence, participants felt that they needed to take ownership in their management of knee OA and find other solutions or treatments to manage their condition themselves.

> *"I went to physio, the doctor just send you to physiotherapy and I went to see this gentleman, very nice gentleman, he sat there and talked to me and said 'well you do realise that the exercise course and the group meeting has all ended, we're having cutbacks, so it's not going to start up again'. I felt let down with that, that's why I decided to do something on my own." - Guy*

George truly believed that hydrotherapy would have been beneficial for his knee. Getting rid of his knee pain was important for him and for him to feel able to manage his knee OA, so he was willing to pay for hydrotherapy, as he felt it would help him ease his knee pain.

> *"Now, I asked my GP if I could get referred to that [hydrotherapy], 'no, I don't do it'. But that's something I would like to do. Even if you're paying for it, it don't matter, you know, I would do that, and it would do me good. Well, I would rather pay that and get rid of the pain than have the pain that's basically it." – George*

"It's about having the facility to go and do the exercises" – Martha

Similarly, Ada reflected that she was currently desperate enough to pay to participate in an OA-specific exercise class led by a physiotherapist about how to manage her knee OA more successfully because this option was not available to her from the NHS.

"I'm in a position where I could afford to pay. I wouldn't want to pay 50 quid. I would be prepared to pay a fiver or ten, if I knew I was going to get a trained physiotherapist. What I'm saying is I'm desperate enough to pay and also to pay to support it." – Ada

Martha pointed out that people may be willing to pay for exercise classes because their ability to manage their symptoms and prioritising their health and mobility was worth the payments.

"I mean it depends on what value you put on your health and your mobility, really. I suppose £5 a lesson is not too, you could manage that but if they kept upping it to £10 you wouldn't want to go every week, could you?" – Martha

i. Benefits of an exercise programme

When participants described that they felt there was a lack of exercise programme or guidance, they were asked to elaborate on why they think an exercise programme would be useful. The consensus was that participants would like an exercise programme that was tailored for people living with knee

OA and run by a specialist, such as a physiotherapist, who could take into consideration the appropriate exercises for people with knee OA.

Another benefit of an exercise programme was the face-to-face contact with a physiotherapist who would provide the motivation and support for some people to start exercising and help encourage them to maintain these exercises in their daily routine.

> *"I think a weekly thing at a gym, perhaps with specialist physio running a gym session. I think will be fantastic and it would encourage me to go do the exercises. I want somebody to tell me 'your muscles are getting stronger', you know, but there's nobody to do that, that's why I think it would be nice to have access to a tailored physiotherapist. I'd like to see some progress. It's just seems like an uphill struggle and I don't know whether it's doing any good or not" – Ada*

> *"I'd rather do something, if there is a programme, which would help…I think the result of that would be that, I would walk further. It's possibly is in the mind, but I think if you can get a bit of that encouragement to do these exercises, I think that would get me doing that" – George*

Another concern for some participants was doing the exercises incorrectly and causing more damage to their knee, not knowing how much exercises they should be doing, and what kind of exercise was appropriate. Thus, the benefit of an exercise programme would be receiving guidance and reassurance from a physiotherapist.

"I also have this thing about not doing them absolutely correctly. I can't remember what exercises it was, but I went back to the physio two or three days or a week later, and I was doing it incorrectly, you know, I thought I was doing it right…So are there any detrimental effects? Can I actually be making it worse?" – Lorna

"The one problem I had to start with was how much exercise do you do? For me, I would have pushed myself and even if I was in pain, I'd push it a bit more but is that the right way to do it? The doctor just chuck me this bit of paper, 'oh here's an exercise sheet', that's it. I thought that's not really very helpful. How much exercise do you do? And what sort of exercise?... Are you making it worse?" - Holly

Bob participated in an exercise programme offered by the NHS a couple of years ago to help him lose weight. One of the benefits of this programme was the follow-up, post-exercise classes, as two years on, the nurses on the programme still call him to check on his progress. The feeling that someone was interested in you helped provide motivation to keep going.

"It was a couple of years ago when, when it started…I'm just very grateful that the physiotherapist suggested that I go on these courses, go to this gym and it made a big difference…They ring up about twice a year, just to see how you're getting on and to see whether you've lost weight and how much you've lost and what exercise you're doing. I think it just give you a little push each time…it's nice that they're so interested." – Bob

Ada pointed out that exercise classes could delay the need for a total knee replacement surgery for people living with knee OA, which would be better cost-benefit for the NHS.

"I think it will save money. I think you could put an argument in to say that it will keep people going longer and potentially delay or perhaps even stop them from having surgery and also I don't see why people recovering from knee surgery clinics get physio, and why you can't give physio to people who are at early stages of osteoarthritis at the same time." – *Ada*

Ada also compared the effectiveness of telephone consultation with a physiotherapist with attending an exercise class with a physiotherapist. In her opinion, the group environment of an exercise class can also provide peer support between people living with knee OA along with guidance and reassurance from the physiotherapist would improve the management of her knee OA symptoms. Ada thought that this was more cost-effective than a physiotherapist calling up all their patients for a 20-minute consultation, as she did not think this would help her improve her management of knee OA.

"If somebody phones me up, that would be really nice. And 20 minutes later they'd get off the phone and that's one-to-one. It might be valuable or not, but if a physio turned up for one hour a week at my local gym and I knew that a certain area was carved out for me and others like me and the physio put in one hour's work and we could all talk to the physio and have a chat and people could share their experiences, I think that strikes me as being so much more cost-effective and people can help each other… I like the idea of having a sort of, an osteo-gym session. I would like the NHS to do that and I think it could be really cost-effective!" - Ada

ii. Barriers to continuing with an exercise programme

One barrier of continuing with an exercise programme in the long-term was the motivation to continue with the exercises when they started feeling better and their knee OA symptoms decreased or were under control.

"Once the symptoms wear off, [participant whispers] I stop doing the exercises."– Lorna

"I tried to do them, but again, in your mind you know you got to do them, the motivation to actually execute them gets less and less and less because you're managing" – Martha

"I don't do that now, because I don't feel as though I need to do it… If I thought the pain was coming back and that leg wasn't stretching as far out as it should do then I shall have to revert back to the three exercises." – Fred

Therefore, if the aim of an exercise programme was to provide people living with knee OA the independence to carry out these exercises themselves and integrate them into their lifestyle, then it is important to consider this potential barrier when designing an exercise programme and education for people living with knee OA around exercise.

A suggestion for adhering to an exercise programme was to make a payment for it like going to the gym, if people already paid for the membership, then they might be more likely to go.

"I suppose you're paying money to go to a gym, perhaps that's more motivated to get up to do it." – Peter

Lack of follow-ups

i. Lack of long-term follow-ups with clinicians

Half of the participants interviewed described a lack of follow-up from their clinicians. Participants felt that once they were referred for physiotherapy, they were not followed-up again. As OA is a chronic condition, participants felt strongly about having a continuous follow-up, especially after referrals to specialist care (either from their GP and/or their specialist clinician), to check on their progress and re-assess patients or refer them for another form of treatment for their knee OA.

"The NHS certainly lacks through not following up people who have had the x-rays and been given the osteoarthritis that they've got and then given exercises and they don't seem to have you back in to look at it." – Patrick

"Some follow-up to see how you are at X point along the road would help keep you motivated as well because you know that you're going to have contact with them and therefore, you want to be able to say, 'yeah everything is fine', or otherwise." – Martha

"I think you should be more follow through on there. I would have liked the doctor to have said to me 'what did you think of the physiotherapy?' I never got that…I get no feedback. It was just left that I could order the cream that I could order the tablets, and I got the exercise sheet, what more did I want? Well, I feel the doctor, there isn't a treatment programme. There's no programme." – Guy

Iris described that a benefit of having an open appointment or a follow-up to see her physiotherapist again was useful, particularly to give her reassurance or correct her if she has started doing the exercises wrong.

"He did say to me that if I felt that I needed a bit more or wanted to check that I was doing the right things, I could always make an appointment to go and see them. So, I've always known I've got the back of the physio if I needed it, which was useful…I think with any exercise, you can become a little bit complacent and take the easy way to do something and it might not be quite the correct way to do things and if you're aware that you've slipped into it, then it's useful to just go back and have half an hour and just check am I doing this right." – Iris

Lorna also mimicked Iris' thoughts on the benefit of having follow-up appointments with a physiotherapist.

"I think that would be quite a good idea to have a follow-up and see how you're doing, are you still doing the exercises, what's your movement like, to see if the movement is any worse or the same as it was, that would be quite a good idea." - Lorna

Bob had follow-up sessions with his physiotherapist who referred him to see a surgeon. This regular monitoring of people living with knee OA can help patients feel that they have the support from their clinicians and their knee OA is being managed appropriately.

"I think they've been brilliant. I mean, I've had two meetings now with physiotherapists. One was the follow-up to the first one, which is really then he put me back onto the surgeon at that point." – Bob

This further supports the importance of face-to-face follow-up appointments with the physiotherapist from a patient's point of view and the physiotherapist could provide the continued support, encouragement, reassurance, and refer patients to other treatment options.

5.5 Discussion

The interviews enabled further exploration of how participants perceived their self-beliefs in their ability to manage their knee OA and its symptoms, whether they felt their knee confidence, self-efficacy for exercise, and knee pain perception affected their ability to manage their knee OA, and how they felt the health service could improve their arthritis self-efficacy.

As high knee confidence was the strongest predictor of arthritis self-efficacy, shown in the multiple linear regression model in Chapter 4, the meaning of knee confidence was explored further with interview participants. Participants mainly associated their lack of knee confidence being due to previous negative experiences of their knee giving way, which also leads to them not being able to trust their knees and becoming more cautious during activities of daily living. This information adds new findings to the current literature around knee confidence and arthritis self-efficacy, as the meaning of knee confidence has not been defined in published literature, due to the novelty around this term. The findings from this study provides patients' perspectives of the term knee confidence and what caused them to have a lack of knee confidence. Participants who experienced their knee giving way reflected that it happened during tasks such as going up and downstairs and walking on uneven

surfaces. The sensation of the knee giving way or buckling of the knee has been defined in the literature as a loss of postural support of the knee from mechanical failure during weight-bearing activities, which is due to the instability of the knee (Felson et al., 2007).

However, a study by Skou et al. (2015) found no associations between measures of functional performance (such as the 20-metre walk) and muscle strength with knee confidence. This is likely due to the environment of a research study, where walking surfaces were likely to be flat, and participants were required to walk a short distance, which may not reflect activities carried out by participants in their everyday lives. The finding in this thesis indicated that the lack of knee confidence might be due to psychological factors such as previous negative experiences rather than structural and functional factors.

Participants who had not had not previously experienced their knee giving way reported feeling more confident with their knee, and they were less concerned that their knee could give way. Whereas, participants who have experienced their knees giving way also reflected that their knee would give way without any warning and they do not know when it will happen and makes it difficult to avoid. It is essential to identify this group of participants to explore further the incidences of when their knee gives way and try to build their knee confidence to improve their perception of their ability to manage their knee OA.

Furthermore, a recent study by Nguyen et al. (2014) investigated the psychological and physical consequences of knee instability with and without buckling. They reported that people with or at high risk of developing knee OA

who said sensations of knee instability with and without buckling of the knee were also more likely to report fear of falling, low balance confidence, limited their usual activities, and reduced physical function compared to those without knee instability. Even though fear of falling and low balance confidence were not measured quantitatively in the questionnaire in this thesis, participants made similar reflections during the interview study of the thesis which extended the quantitative work by Nguyen et al. (2014). Participants from the interview study discussed their fears of falling and re-injury due to previous experiences that had made them more aware of how they carry out their daily activities, for example, they would be more aware and careful when walking up and downstairs to avoid falling. Similarly, those who went hiking were more aware of the terrain and surfaces they were walking on to avoid falling over or exacerbating their knee symptoms. Therefore, their previous negative experiences were likely to have increased their fear of falling in the future and low balance confidence.

Participants from the interview study in this thesis took ownership of the management of their knee OA and made adjustments to their lifestyle, adjusted the amount of activities they could cope with, and were more aware and cautious of their knees when they are carrying out their activities. This is consistent with previous findings that arthritis self-efficacy beliefs can affect the adjustment to early knee OA (Wright et al., 2008). However, it could be argued that participant who accepted the invitation to attend the interview study were more likely to perceive better management of their arthritis, but efforts were made to ensure participants selected for the interviews had a different range of arthritis self-efficacy, as seen in Table 28.

Pain reduced participants' activity levels, and some gave up their activities of choice due to pain. This finding was consistent with findings from a study on a younger population (median age 49 years old (range 37-65 years old)) living with knee OA or had knee symptoms such as pain and stiffness (MacKay et al., 2014). The younger population reflected that the consequences of knee symptoms meant they have had to give up high impact physical activities such as running, which also affected their social interactions by not being able to participate in physical activities with their friends(MacKay et al., 2014). This could explain why the questionnaire study in this thesis did not find that age was a predictor in people's self-beliefs in their ability to successfully manage knee OA, as younger people and older people living with knee OA reflected similar consequences associated with their knee symptoms.

Participants from this study in the thesis who had more self-efficacy for exercise were more active when they were younger and found it easier to integrate or maintain exercise into their everyday lives. This finding also mimicked participants with knee OA from another qualitative study, which explored the perception of factors that determined motivation and barriers to exercise (Hendry et al., 2006). In this thesis, participants reflected on discussion points that were linked to Bandura's self-efficacy theory (Bandura, 1997). For example, participants with high exercise self-efficacy reported that they had less severe symptoms and seeing an improvement in their symptoms helped motivate them to continue with exercise in the long-term, which is like the concept of mastery experience. Being able to see a difference in their symptoms have increased their arthritis self-efficacy because they had more

self-beliefs in their ability to manage their arthritis symptoms through regular physical activity.

Many participants in thesis acknowledged the benefits of keeping moving, as they felt it was an important part of how they managed their knee OA. A previous study has classed this as participants actively managing their OA (MacKay et al., 2014). As pain and functional limitations were the main outcomes of knee OA, participants believed that successful management of knee OA was when they could reduce pain and continue to do daily activities and recreational activities they wanted to do. Some participants who were at this stage were more independent and confident with managing their condition. However, other participants who had more severe symptoms felt they needed more guidance to effectively manage their condition.

Participants mentioned that there was a lack of exercise programme and a lack of follow-up from their clinicians regarding their knee OA. Participant described the benefits they thought would come with an exercise programme, which included many BCTs described by Carey et al. (2018). These BCTs include “Instruction on How to Perform the Behaviour” and “Demonstration of Behaviour”, such as having guidance on what exercises were safe for people living with knee OA. It was interesting to hear from participants that they were aware of the benefits of keeping physically, but the barriers and limitations to their physical activity was due to the fear that they could cause more damage to their knees, as they did not have guidance from clinicians who specialised in knee OA on how to look after their knees, the best ways to manage their symptoms, and how to keep active knowing that the exercises were safe for

people with knee OA. Another BCT was “Feedback on Behaviour” and “Feedback on Outcomes of Behaviour”, as participants reflected on the importance of receiving feedback from their clinicians about their condition and progress with exercise. “Verbal Persuasion about Capacity” from the physiotherapists was also another important BCT, as participants want to have support and encourage from clinicians as it will motivate them to continue performing the behaviour (i.e. maintain exercise). These BCTs identified are linked to the “Beliefs about Capabilities” mechanism of action, which is closely linked to the self-efficacy theory ((Bandura, 1997, Carey et al., 2018).

To explore the findings from these interviews further and from a different perspective, another objective was created to investigate how people who have recently participated in an OA-specific exercise and education programme perceived what factors influenced their arthritis self-efficacy. Furthermore, to explore how people who have received a programme felt about participating in a programme and if/how the programme has increased or decreased their self-beliefs in their abilities to manage their arthritis. Exploring this new objective in this thesis was beneficial, as participants from the interviews in the first study expressed a lack of knowledge on how to manage their arthritis, so it was hoped that an insight could be gained from how people who recently participated in an OA-specific programme felt their arthritis self-efficacy has changed since the programme. This could be valuable in making recommendations for future education and exercise trials and implementation programmes by providing important issues to consider for these programmes in people living with knee OA. The study for this new objective (Objective 6) will be discussed in detail in the next chapter.

Chapter 6

Factors Associated with Arthritis Self-Efficacy in People Living with Knee OA who have had an Education and Exercise Programme

Chapter 6: Factors Associated with Arthritis Self-Efficacy in People Living with knee OA who have had an Education and Exercise Programme

6.1 Chapter Introduction

Participants with knee OA from the interview study described in Chapter 5, Section 5.4.3.4, expressed a lack of NHS funding for treatments, lack of knowledge about treatments, lack of exercise programme and guidance for their knee OA. Therefore, this instigated the study in Chapter 6, which to investigate and explore what factors are associated with arthritis self-efficacy in this population, from the perspective of people living with knee OA who have recently been involved in an education and exercise programme, to see if the programme has influenced their arthritis self-efficacy beliefs(to meet Objective 6). The suggestions made from participants who participated in an education and exercise programme from this study will help improve the design of future interventions and implementation programmes for people with knee OA.

Objective 6: *Investigate and explore the relationship between key factors participants identified as being associated with arthritis self-efficacy, which was in people with knee OA who have recently participated in an education and exercise programme*

This chapter begins with explaining why the study population of people with knee OA who have recently participated in the Good Life with osteoArthritis in Denmark (GLA:D®) Initiative was chosen over the and the Enabling Self-

management and Coping of Arthritic knee Pain through Exercise (ESCAPE-pain).

The chapter will then describe in detail the mixed methods design of the method used to collect data for this study; firstly by describing the sampling, procedure, questionnaire measures, and data analyses for the quantitative questionnaire phase of the study and then describe the sampling, procedure, interview guide, and data analyses for the qualitative interview phase of the study.

The results will be presented first from the questionnaire phase by describing the response to the questionnaire and sample characteristics of the responders, the results will be described. Subsequently, the interview sample characteristics will be described and the themes from the interviews will be presented.

The chapter will close with a brief discussion of the findings from this study.

6.2 Methods

6.2.1 Good Life with osteoArthritis in Denmark Initiative (GLA:D®) Initiative

Denmark has a tax-financed healthcare system, which has provided free access to healthcare since 1973 (Everyday Culture., 2017). Like the UK National Health Service (NHS), people in the Danish tax-financed healthcare system are registered with a specific primary care physician, who acts as a gatekeeper to secondary health care. For both primary and secondary

healthcare, most services are free of charge. However, there are some differences in the Danish tax-financed healthcare system compared to the UK. Every contact made to the healthcare system (i.e. primary health care specialists and non-hospital-based specialists like physiotherapists) is registered using a unique personal identification number, which is linked to national patient registries. Denmark has fee-for-service healthcare, which is a fee if patients seek private hospital appointments or alternative medicines, such as acupuncture, reflexology, homeopathy, and massages (Everyday Culture., 2017). Psychological pain treatment is also self-funded and not generally available in Denmark (Mehlsen et al., 2017)

For this study, a sample of participants were chosen from the Good Life with osteoArthritis in Denmark (GLA:D®) Initiative. Information about the components of the GLA:D® intervention and the theories used to design the content of the programme has been discussed in detail in Chapter 2 (Background), Section 2.9.3.

Participants were chosen from the GLA:D® cohort for several reasons. The GLA:D® Initiative was started by Skou and Roos (2017) in Denmark in 2013. The Initiative incorporates training physiotherapists to deliver care in accordance with the clinical guidelines, like that in the UK, by educating patients on their OA and to teach patients the safe neuromuscular exercises they can perform, so they will be confident and independent in carrying out these exercises at home after they have completed the programme. Initial findings revealed a reduction in knee pain by 34% on the VAS pain scale and a reduction in usage of painkillers (for knee/hip pain) by a third of the GLA:D®

intervention patients between baseline and the 3-month follow-up (Skou et al., 2014a).

In the UK, the ESCAPE-pain programme started in 2007 exists which is similar to the GLA:D programme with a similar concept to provide people with knee OA education and exercises led by health professionals (Hurley et al., 2012). GLA:D® is offered in 286 active GLA:D® units across the five regions of Denmark. The ESCAPE-pain programme has fewer sites, currently, around 30 active sites are running and mainly located in the south of England, across London, Kent, and Brighton areas.

The GLA:D® programme was chosen over the ESCAPE-pain programme for several reasons. Firstly, the GLA:D® programme was in its implementation phase whereas the ESCAPE-pain programme was an intervention from a randomised controlled trial. Research conducted within a randomised controlled trial are precise, controlled, and may contain extra elements or benefits (more follow-up with a physiotherapist for example) than patients living with knee OA might receive in a real-world clinical practice environment.

Secondly, the aim of this thesis was to investigate factors that are associated with arthritis self-efficacy in people with knee OA in people who have not received an OA-specific education and exercise programme (Study 1) and people who have received such a programme (Study 2). In this vain, the GLA:D® programme measures the arthritis self-efficacy pain and other symptoms subscales as outcome measures (Lorig et al., 1985), whereas the ESCAPE-pain programme does not measure these outcomes (Hurley et al.,

2007). Additionally, the GLA:D® programme measured perceived knee problems using the KOOS (as in Study 1 of this thesis), whereas the ESCAPE-pain programme used the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). The WOMAC consists of three subscales (pain; stiffness; and physical function), whereas the KOOS has two extra subscales in addition to the subscales used in the WOMAC, which are "sport and recreation" and "quality of life". These extra subscales provide more information about participants' knee function (Roos et al., 1998), which is why the study in this thesis used the KOOS over the WOMAC.

Furthermore, participants interviewed in the study in Chapter 5 reflected that they had a lack of knowledge on how to self-manage their knee OA and they had not received any guidance on the safe exercises or exercise classes they could attend that were specific for people with knee OA. Therefore, exploring patients' experiences of living with knee OA and their experiences of the GLA:D® programme was attractive, because the programme had been implemented into the Danish Healthcare system and the perspectives from patients who had participated in this programme would be more reflective of the real-world clinical practice environment than if it was part of a clinical trial. It was hoped that valuable information would be gained from patients about how the programme impacted their self-beliefs in their ability to manage their arthritis and their life after the programme would help inform important elements to include in an education and exercise programme if one were to be introduced in Nottinghamshire. To further support this, a recent systematic review by Fransen et al. (2015) reported high-quality evidence for the effectiveness and benefits of exercise for people with knee OA, so further

clinical trials would not change the results from their review. More effort should be focussed on implementing results from clinical trials to the real-world clinical practice settings to ensure the most effective long-term care for patients living with knee OA.

6.2.2 Questionnaire Sampling

6.2.2.1 **Questionnaire Sampling Procedure**

Currently, not all patients with OA in Denmark undertake the GLA:D® programme, as not all OA patients are referred to the programme. The different referral methods are: 1) patients with OA are typically referred to the physiotherapist by their GP, in which case approximately 40% of the treatment cost is reimbursed to the patient; 2) patients can self-refer directly to the physiotherapist who can provide the GLA:D® programme, but then must pay the full treatment cost; and 3) patients can be referred by an orthopaedic surgeon to the GLA:D® programme, in which case the full treatment cost is reimbursed to the patient.

Participants on the GLA:D® registry, who entered the programme at least six months prior to this study and met the other eligibility criteria (Section 6.2.2.2) were recruited. Six or more months was the cut-off point because research from the transtheoretical model of health behaviour change (Prochaska and DiClemente, 1982) reported that the maintenance stage occurred when changes in the exercise behaviour continued for six or more consecutive months. Therefore, to explore whether participants had been able to maintain

their exercise regime post-programme, it was important to recruit participants who were first given the programme at least six months ago.

The manager of the GLA:D® registry provided the author with a list of potential participants who met the study's eligibility criteria (Section 6.2.2.2). Potential participants were sent a link to the online questionnaire and a participant information sheet was sent through an e-mail invitation (all in Danish). See Appendices 7 and 8 for the English version of the participant information sheet and the questionnaire, respectively. The documents were in Danish following recommendations from our Danish colleagues as they felt this would minimise the chance of participant bias on who responded to the questionnaire if the study documents were in Danish rather than English.

6.2.2.2 **Questionnaire Eligibility Criteria**

The inclusion criteria for the Denmark study included adults aged 45 or over; participants on the GLA:D® registry with knee OA (diagnosed by Danish healthcare professionals, i.e. GP or physiotherapist); participants who were registered onto the GLA:D® programme and had attended at least two education classes and one exercise class at least six months prior to entering this study; and those who have provided an e-mail address as a form of contact, as this was an online questionnaire study. Those who had total knee replacement surgery were excluded from this study.

6.2.2.3 **Questionnaire Sample size**

The arthritis self-efficacy score (made up of arthritis self-efficacy pain score plus arthritis self-efficacy other symptoms score) was the dependent variable in this study, thus a calculation of sample size was conducted for each measure to determine the one that required higher sample size to ensure the study was suitably powered.

Sample size calculation for arthritis self-efficacy pain score was based on the mean difference of 2.55 points (between baseline and 4-month follow-up group of adults aged >50 years old with knee and/or hip OA diagnosed by their GP who participated in an arthritis self-management programme), a standard deviation of 6.7 (Barlow et al., 1998, Buszewicz et al., 2006) with a 5% significance level and 80% power, which indicated 109 participants were required for the study.

Sample size calculation for arthritis self-efficacy other symptoms score was based on the mean difference of 2.81 (derived from the same method as above) and a standard deviation of 8.2 (Barlow et al., 1998, Buszewicz et al., 2006) with a 5% significance level and 80% power, which indicated 134 participants were required for the study, and this was used as the number of participants required to ensure the dependent variable (arthritis self-efficacy score) would be suitably powered.

Thus, the sample size for this study was 134 participants to ensure the statistical tests including the dependent variable (arthritis self-efficacy score) was suitably powered.

To run a multiple linear regression, it was important to consider the sample size. Green (1991) recommended that to test the overall fit of the regression model, a minimum acceptable sample size of 50 + 8*k* (*k* is the number of predictors) was required. To test the individual predictors within the model, a minimum sample size of 104 + number of predictors was required. To test both the overall fit of the model and the contributions of the individual predictors to the model, both sample sizes were calculated, and the larger sample size was used. Thus, there were eight predictors to include in the multiple linear regression model, thus 50+ (8x10) = 130 and 104+10 = 114, indicated that a minimum sample size of 130 was required for the multiple regression. The number of participants with valid data to run the multiple linear regression in this study was 171.

No follow-up measure was taken from the participants in this dataset, as this was a cross-sectional study.

6.2.3 Questionnaire Measures

Similarly to the previous questionnaire study described in Chapter 4, the current questionnaire study also included questions regarding participants' demographics and clinical characteristics. These included sex, date of birth, height, weight, smoking status, highest education level, and employment status. From this, their date of birth was used to calculate participant's age and BMI was calculated using participant's weight (in kilograms) and height (in metres squared). Clinical characteristics data included the year they were diagnosed with knee OA, the treatments they have received for knee OA, symptoms (such as pain, knees becoming bent, knees giving way, stiffness,

loss of movement, cracking/popping, swelling), significant knee injuries, knee surgery or arthroscopy, and co-morbidities.

The questionnaire components that were the same as the survey instrument used in the questionnaire study described in Chapter 4, Section 4.2.2 and included the International Physical Activity Questionnaire; the Knee injury and Osteoarthritis Outcome Score; Arthritis Self-Efficacy Score; Exercise Self-Efficacy Scale; EuroQol-5 Dimensions-5 Levels, Patient Health Questionnaire-8, and the Multidimensional Outcomes Expectations for Exercise Scale. The new components for this questionnaire were:

Numeric Rating Scale (NRS) for Pain (Hawker et al., 2011)

Like the VAS for pain, the NRS for pain is a measure for pain intensity in adults. The NRS was a segmented numeric version of the VAS in which a participant selects a whole number (0-10 integers; 11-point scale) that best reflects their pain intensity. 0 represented “no pain” and 10 represented “worst pain imaginable”. Higher scores indicated greater pain intensity.

As this questionnaire was online, it was more practical to create an NRS for pain with 0-10 integers rather than use the 100mm VAS for pain, as the VAS for pain was to be administered as a paper and pen measure using a ruler to measure the 100mm line for the VAS score. Therefore, the NRS measure was more flexibility to administer compared to the VAS for pain in this study. The NRS measure showed a high test-retest reliability in both literate and illiterate patients with rheumatic diseases (r=0.96 and 0.95, respectively) before and after rheumatic clinic (Ferraz et al., 1990). The reliability for this measure was

a little higher than those found in VAS (Ferraz et al., 1990), showing that this was a straight forward questionnaire to complete with little burden on the participant as it takes less than 1 minute to complete. For construct validity, this measure also showed to be highly correlated to VAS in patients with rheumatic and other chronic pain conditions (pain > six months); correlation ranged from 0.86 – 0.95 (Ferraz et al., 1990). The NRS was chosen because it highly correlates to VAS, i.e. was able to measure the same construct (pain) using different measures (Cronbach and Meehl, 1955).

Satisfaction with the GLA:D® education and exercise programme

One of the themes from Chapter 5 was that participants living with knee OA in the UK would like access to an OA-specific exercise programme. But these participants had not had access to such a programme before, so it may or may not work for them. The reason for including questions regarding how satisfied participants in Denmark were with the GLA:D® programme was to find out if they were satisfied with the programme (i.e. ask people who have experienced the programme and see what they think), in order to be able to link back to the UK participants' requests in Study 1 of this thesis.

These participants' satisfaction questions were created by the author and creators of the GLA:D® programme. The participants' satisfaction questions were split into three domains: 1) satisfaction with education from GLA:D® (seven items); 2) satisfaction with the physiotherapist (three items); and 3) satisfaction with the GLA:D® exercises (eight items). Participants scored on a 5-point Likert scale ranging from very dissatisfied (score of one) to very

satisfied (score of five). A sum of each domain was calculated separately. The higher the score, the more satisfied they were.

6.2.4 Questionnaire Procedure

The author spent three months at the University of Southern Denmark, Odense, Denmark, to collect data for Objective 6 of this thesis. The author created an online questionnaire hosted on the Bristol Online Survey platform (http://www.survey.bris.ac.uk/support/survey-design), which was the platform approved by the University of Nottingham for use as a data collection tool; this reduced the cost of the study significantly and was easier and quicker to distribute to the participants located nationwide in Denmark. The author emailed participants who were eligible for the study a personalised invitation to the study that briefly explained why they were sent an invitation to participate, the participant information sheet, and a link to the questionnaire for those who wanted to be in the study. Participants were asked to complete one questionnaire for the study, which took around 20 minutes to complete.

Due to the limited time the author had in Denmark and the fact that participants needed to complete the online questionnaire prior to starting the interview phase of the study, only one round of reminder e-mail was sent two weeks after the first mail out date to optimise the response rate. Additionally, the author personalised each email with the participant's first name and surname, so manually sent out each email to participants, which was a time-consuming task and there was not enough time to send out more reminders to avoid cutting into the time left to conduct the interviews.

6.2.5 Informed Consent for the Questionnaire

For consent into the questionnaire study, the completion and return of the questionnaire were taken as implied consent to the studies in this thesis. To ensure participants remained anonymous, participants were provided with a unique 5-digit Study ID. Personal information about the participants, such as their name(s) and/or addresses was removed from their questionnaire. Their personal detail form, their questionnaire, and their consent form were stored separately.

6.2.6 Questionnaire Data Analyses

To investigate the factors were associated with arthritis self-efficacy in people who have participated in the GLA:D® programme (Objective 6), descriptive tests were performed to describe the personal characteristics of Denmark study participants, their arthritis self-efficacy, exercise self-efficacy, multidimensional outcomes expectations for exercise, general health status, knee pain perception, knee confidence and depression in those who have been given an education and exercise programme.

Scatterplots were used to assess the linearity of each independent variable (exercise self-efficacy, multidimensional outcomes expectations for exercise subscales (physical, social, and self-evaluative), knee confidence, general health status, knee pain perception, and depression) against the dependent variable (arthritis self-efficacy). Then, simple linear regressions and multiple linear regressions (backward step-wise method) were run between each of these independent variable and the dependent variable (arthritis self-efficacy)

to investigate if there was any relationship between these variables, specifically to determine how much arthritis self-efficacy score changes for a one unit change in the independent variables, and to determine how much variation in the arthritis self-efficacy score is explained by the independent variable. The backward method of multiple linear regression involved putting all of the statistically significant (p<.05) independent variables first and then removing any independent variables that were not significant from the model, and subsequently adding them back into the model one-by-one to see if they became significant. Those that were not significant were removed, and those that were significant were kept in the model. The final model consisted of all statistically significant independent variables.

All statistical analyses were conducted with the IBM SPSS Statistics software, version 24.

6.2.7 Interview Sampling

Two sampling strategies were used. The first stage was self-selecting sampling (volunteer sampling), where participants granted in their questionnaire to being contacted again for involvement in an interview. This technique was quick and easy to set up, however, the participants who consented to be contacted for an interview may not be representative of the study/target population, as these participants were probably more motivated to take part in research studies and those wanting to talk about the research topic (Morse, 1991). After collecting a pool of participants from the self-selecting sampling, purposive sampling was used based on participants' perception of how troubled they were by the lack of knee confidence i.e. not

troubled, mildly troubled, moderately troubled, severely and extremely troubled by the lack of knee confidence and their arthritis self-efficacy. A disadvantage of the interview sample is that all the participants were based in Odense, Denmark, due to the logistics and practicality of participants having to travel to the University of Southern Denmark for their interview. The results will only be representative of these few participants who received treatment from Odense, Denmark.

6.2.8 Interview Sample Size

There was no strict guidance of sample size for qualitative research, as the focus was on collecting detailed and in-depth data from a few participants. Interview transcription and preliminary data analysis were performed for each interview before a new participant was invited for an interview.

6.2.9 Interview Guide

The interview guide started off with general questions about how participants found out about the GLA:D® programme and what they did on the programme. This was to help participants settle into the interview and allowed them to talk about something they had experienced. Then the author asked questions about the positive and negative aspects of GLA:D®; whether it has changed the participants' activities have changed in any way to further explore their knee pain perception, arthritis self-efficacy, exercise self-efficacy, and knee confidence after being on the GLA:D® programme. The interview guide can be found in Appendix 9.

6.2.10 Interview Procedure

6.2.10.1 **Interview Venue**

The interviews took place in the Department of Sports Science and Clinical Biomechanics, Musculoskeletal Function and Physiotherapy Research Unit, University of Southern Denmark. Participants were offered a reimbursed for their travel costs and offered tea or coffee on arrival.

6.2.10.2 **Interviews**

Participants were asked at the end of the questionnaire whether they would like to consent to participate in the interview study. They were also informed that the interview will be conducted in English, so if they felt that they would like an interpreter present, they should tick ‘yes’ in the box when asked, and an interpreter will be present at their interview.

Procedures for the interviews conducted in Demark were the same as the interviews conducted in the UK. The author emailed potential participants with a cover letter, participant information sheet, interview guide, and a consent form. The author’s contact details were also on the cover letter so participants can contact the author if they were interested in the interview. If the author did not hear from the participant within seven days, then she telephoned the participant to ask if they had received the letter for the interview and whether they would be interested. If the participant declined, then they were thanked for taking part in the questionnaire. If the participant was interested in the interview, then a date was set at the participant’s convenience.

On the day of the interview, the participant was taken to the interview room and offered a beverage before starting the interview. The author started by going through the informed consent procedure by ensuring the participant has read the study documents posted to them and explained the aims and objectives of the interview and the rough interview topics that would be discussed on the day. The participants had this opportunity to ask any questions they had. If the participants were still happy to proceed, they were asked to read and initial each statement on the consent form; the author then did the same and photocopied the consent form (the original for the author to keep and the photocopy for the participant). The participants were asked if they were comfortable with the interview being recorded on an audio recorder (Sony ICPX240 Dictaphone) and they were also informed that they could stop the interview whenever they felt like and shown the stop button on the Dictaphone and they did not need to answer any question(s) they were not comfortable with and they did not need to give a reason.

At the end of the interview, the participant was asked again for their verbal consent to the interview. The participant was debriefed and thanked for their participation and reimbursed their travel costs.

6.2.10.3 **Transcribing**

For the interviews with Danish participants, the author recorded and transcribed all of the interviews verbatim. Each transcript was then double checked against the recording. The interviews were conducted in English, but two interviews were conducted in the presence of a professional interpreter (more about interpreter in research is discussed in Section 6.2.10.6).

6.2.10.4 **Cross-Language in Qualitative Research**

For the study conducted in Denmark, a professional translator and interpreter was requested to provide their language translation services. These two roles are distinct; a translator translates written documents from one language to another, whereas an interpreter provides oral translation services during an interaction between at least two people who do not speak the same language (Squires, 2009). As there was a presence of cross-language research in English and Danish, this section will address the methodological issues of language barriers and the presence of an interpreter in the research process to increase the trustworthiness of the data. Four key strategy areas for addressing translation issues include maintaining conceptual equivalence, translator credentials, translator or interpreter's role in the research process, and specific recommendations for different types of qualitative approaches (Squires, 2009).

6.2.10.5 **Conceptual Equivalence and Translator Credentials**

As the study was being undertaken in a Danish population with the author who is fluent in English and was not fluent in Danish, participants in the study had a choice of whether they would like a Danish-English interpreter present in the interview. Thus, the interpreter was present for some, but not all, interviews.

The process of interpretation involves interpreting the literal meaning of the word and how the word relates conceptually in the context. Conceptual equivalence is when the translator provides a technically and conceptually

accurate translated communication of a concept spoken by the study's participant (Jandt, 2004). Therefore, poor interpretation could lead to a loss of conceptual equivalence. Time was taken to select a reputable and an experienced interpreter, as the ability to maintain the conceptual equivalence of what a participant said during the interview was a key part of mediating the methodological issues that arose from using interpreters and translators (Larkin et al., 2007). Additionally, other interpreter credentials were considered, such as their language competency and ability to describe concepts or words when they do not know the actual word or phrase in the interpreted language, as this could reduce errors related to interpretation and provide more accurate concepts and phrases to reflect what the participant meant during the interview, which would affect the qualitative coding and data analysis process (Jandt, 2004).

The interpreter was selected from the Danish State Authorised Translators and Interpreters database; this authorisation board ensures that their language competency has been verified and all members must have obtained a master's degree in translation and interpretation in Danish and one or more other languages. One interpreter was employed for this study to maintain consistency and quality of interpretations. She was born to a Danish mother and American father and was raised in America but moved back to Denmark 41 years ago. She works both as a translator and an interpreter. Her translating and interpreting career involved various projects for mid-Atlantic and inter-Scandinavian events (Danish/English UK/USA). She also had experience translating and interpreting for medical related projects. Taking all of these into consideration, the author felt she was skillful, competent, and had

bi-cultural experience and can make cultural and linguistic interpretations for Danish into English (UK) to ensure the study documents were both technically and conceptually accurate for a Danish audience.

6.2.10.6 **Role of an Interpreter in the Interviews**

In Wallin and Ahlstrom (2006) systematic review of cross-culture research, they stressed the importance of describing the interpreter's role in the research process and their competence, style, and seating arrangements at the interview.

The interpreter for this study helped translate the participant information sheet and the interview guide from English to Danish, so had a good understanding of the study. On the day of the interview, the interpreter arrived 30 minutes before the participant to allow time for the author to brief the interpreter and for the interpreter to ask the author any questions regarding the interview guide and the study. The same interpreter was present for both interviews.

The presence of an interpreter in a one-to-one interview with the author and the participant could change the dynamic and the flow of the interview and may influence what the participant says or does not say during the interview. The role of the interpreter was to try to be as 'invisible' as possible during the interviews, so the flow of conversation between the author and the participant could remain as natural as possible.

Before the interview, the author, the interpreter and the participant discussed the role of the interpreter and informed the participant of the seating

arrangement. The participant was given a chance to ask questions and to clarify the process of the interpretation before the interview started. The author and participant sat opposite each other, while the interpreter sat behind the participant. The interpreter also used first person language, just as how the participants would have spoken, to give the participants a feeling that they had their own voice. The interpreter was asked to translate directly, verbatim, and to be transparent where they were making a cultural interpretation, so the interpreter was not just translating word-for-word (Tribe, 2007), but also considered the conceptual equivalence of the phrases from the participant. The interpreter also had opportunities to clarify words and phrases with the participant to ensure the interpretation was as accurate as possible. The participant was informed to speak in shorter sentences to ensure that the interpreter was able to capture a rich interpretation from the participant's language, although this may break the flow of conversation or speech from the participant and seem rather unnatural, it was decided that this was important to maintain conceptual equivalence of the words being interpreted, which would benefit the process of data analysis and themes emerging from the phrases.

The interpreter and the author debriefed after the interview to reflect on the interview and any cultural differences that needed to be considered.

6.2.11 Considerations for a Different Qualitative Approach

Jandt (2004) reported that most qualitative research approaches are amenable to cross-language designs, except for phenomenological studies that involve translating participant data. This is because phenomenological

studies require an intense, exact focus on how participants use language to describe their experiences and language is part of the identity of the person experiencing the phenomenon, the translation would disrupt the fluid process from inception through the dissemination of studying the participants' use of language to describe their experience of the phenomenon. The process of translation alters the original use and, sometimes, the structure of the participant's use of language. The text may change enough during the translation process that the investigator will not adequately capture the essence of the phenomenon in the translated language. Therefore, phenomenological studies can only take place in the first language of the participant and cannot involve the use of interpreters or translators during the data collection of analysis (Jandt, 2004). With this consideration, the method of thematic analysis was used in the Denmark interview study to enable the use of translators and interpreters.

6.2.12 Valid Informed Consent and Data Confidentiality

As for the interview phase of the study, the interviews were conducted in English, the author gave participants the details of the study and provided a Participant Information Sheet and a copy of the consent form, ensuring that the participant has sufficient time to consider participating or not prior to the interview. The author answered any questions that the participant had concerning study participation. An interpreter was available on the request from the participants.

The interpreter was required to sign a confidentiality agreement between her and the University of Nottingham before interpreting any interviews. Written informed consent was granted by each participant before they undertook any interviews. A photocopy of the consent form was kept by the participant and the original was kept by the author.

For the interview part of the study, any personal information mentioned on the recorded at the interview on the tape recorder (such as name(s) and names of places) were removed during transcription and replaced with an 'X' or with pseudonyms.

6.2.13 Interview Data Analyses

All qualitative data from the interviews were organised and analysed within the NVivo qualitative data analysis Software; QSR International Pty Ltd. Version 11 (Richards, 2015). The data analysis process was the same as the thematic analysis process described in Chapter 5, Section 5.3.6.1.

6.2.14 Inter-Coder Agreement

Similarly to the inter-coder agreement described in Chapter 5, Section 5.3.7, two transcripts from this study (40%) were chosen at random and were coded independently by the author and a second coder.

The author is knowledgeable about the area of knee OA, OA management, and arthritis self-efficacy due to prior reviewing of the literature in this area. Whereas, the second coder has experience in coding qualitative transcripts

and is a primary school teacher but has an interest in looking at physical activity levels in primary school children and the motivation to exercise. Therefore, the inter-coder negotiated agreement approach is advantageous in this instance, because discrepancies in the coding will occur due to the different level of knowledge and life experiences between the two coders.

The process of developing a coding scheme started with the author and the second coder separately coding the same interview transcripts. (Hodson, 1999) recommended that 10% of the transcript document was sufficient to calculate an inter-coder agreement level. Therefore, 10% of the interview transcripts were randomly selected (i.e. two transcripts) and 10% of pages within each of the two transcripts were randomly selected for coding. This equates to 8 pages from Anne's transcript and 12 pages of Caroline's transcript.

The overall inter-coder agreement was calculated for all codes by dividing the total number of agreements for all codes by the total number of agreements and disagreements for all codes combined (Campbell et al., 2013). For example, if there were 100 number of agreements and disagreements of all codes and 50 total number of agreements for all codes, then the overall level of inter-coder agreement would be 50% (50/100*100 = 50). On initial coding of Anne's transcript, there was 56 total number of agreements and disagreements with 16 agreements for all codes, thus an inter-coder agreement level of 29%. For Caroline's transcript, there were 53 total agreements and disagreements of all codes and 28 total agreements for all codes, thus an inter-coder agreement level of 53%. However, after negotiation

of the discrepancies, Anne's transcript achieved 91% of inter-coder agreement and Billy's transcript achieved 98% of inter-coder agreement.

A discussion and negotiation of the discrepancies took place (Campbell et al., 2013, Boyatzis, 1998); each discrepancy and whether reconciliation was achieved and the direction of the reconciliation (i.e. whether the knowledgeable coder deferred to the second coder or vice versa) was recorded. It is possible that discrepancies in coding and therefore suboptimal levels of intercoder reliability occur because some coders are significantly more knowledgeable than others rather than because there are inherent problems with the coding scheme per se. The coded transcripts were reviewed and discussed using the negotiated agreement method and then calculated the intercoder agreement. In each discrepant case, the author kept track of whether reconciliation was achieved and if so, which way it went (i.e. whether the author deferred to the second coder or vice versa). Occasionally, there were irreconcilable differences.

There was also a problem with unitization, which Krippendorff (1995)described as different coders coding different sized units of texts (for example, some may have coded sentences and some may have coded paragraphs to provide the context for the code). Recommendations have been made to overcome the unitisation problem by the more knowledgeable coder putting brackets around the appropriate units of text for coding (Campbell et al., 2013). However, this recommendation was not followed, as this may have biased the second coder to code a unit of text that might not have been coded if the brackets were not used.

6.2.15 Ethical Approval

For the study based in Denmark, the University of Nottingham, School of Medicine Research Ethics Committee approval was granted (Ethics Reference Number: E14072015 SoM ROD Ph.D.). An e-mail letter from The Head of Secretariat of the Regional Committees on Health Research Ethics for Southern Denmark, Legal Advisor, Claus Kvist Hansen, confirmed that the study based in Denmark was not notifiable to the Danish Research Ethics Committee and "can be implemented without the permission of the Regional Committee on Health Research Ethics for Southern Denmark" due to the questionnaire and interviewing nature and design of the study. Notification to the Danish Research Ethics Committee was only required for study designs that wished to obtain biological samples from study participants.

6.2.16 Ethical Considerations

A potential risk was the risk of a breach in confidentiality and Laws in Denmark; participants' personal details such as names and address were prohibited from leaving the country (i.e. these details could not be taken back the UK). To keep with these regulations, participants were not required to write their names and other contact details on the online questionnaire platform. Instead, they were given an individual five-digit ID to enter online questionnaire page before they start the questionnaire. Also, if participants revealed personal details such as names or location during the interview, this was replaced with a pseudonym or an 'X'.

A potential risk during the interview was the possibility of upsetting patients during the interview, as some may find talking about their knee osteoarthritis a sensitive topic. The participants had been informed in the patient information sheet that the main topic of discussion would be about their knee osteoarthritis, their confidence, and their thoughts on using exercise as a treatment, prior to the interview. They were advised that they could skip and not answer any interview questions they feel uncomfortable with or do not wish to answer. Participants did not need to provide a reason for their decision not to answer the question(s). They were also reminded of this during the informed consent procedure on the day of the interview.

Another consideration was the travel cost to come to the University of Southern Denmark, Odense campus, for the interview. Funding was sought to reimburse the participants for the transportation to the interview and they were able to claim up to an equivalent of £0.21 per kilometre, in accordance with the guidelines at the University of Southern Denmark. Participants were also offered with tea/coffee and biscuits on arrival.

6.3 Results

6.3.1 Description of Questionnaire Respondents

The initial search for participants in the Good Life with Osteoarthritis in Denmark Initiative (GLA:D®) database found participants who were registered into the Initiative during January-March 2015 found 568 participants nationwide across Denmark. After looking through the database, those who have had at least one exercise training session were included (n=541),

duplicates were removed (n=509), and those whose email addresses did not work were removed (n=484) (Figure 10). Email invitations were sent out to 484 participants and a round of reminder emails was sent out 2 weeks later to those who did not respond. A total of 217 responded, which gave a response rate of 44.8%. There were no data on the characteristics of those who did not respond to the questionnaire.

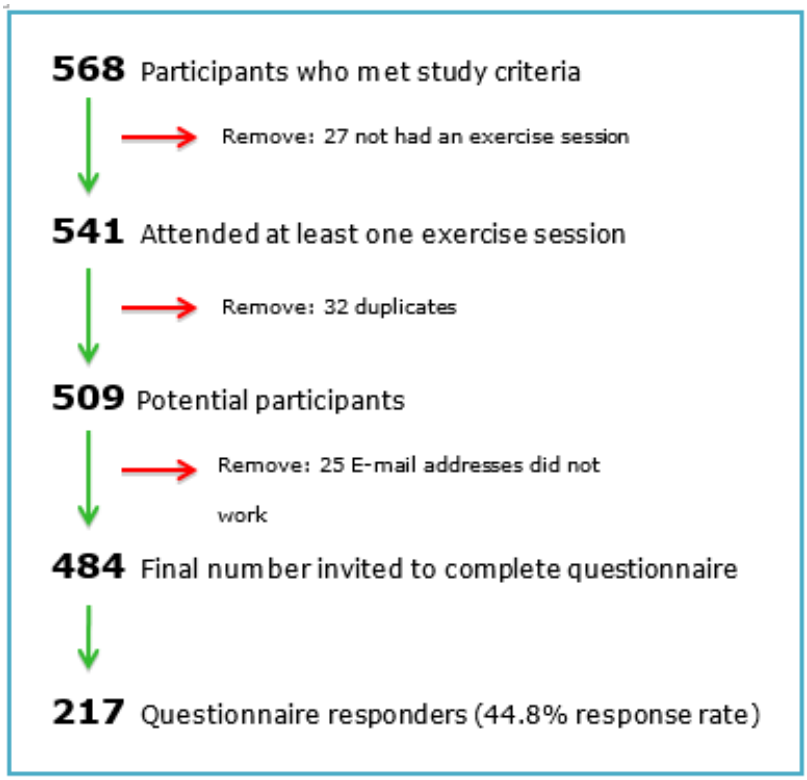


Figure 10 Participants for Study 2

The response rate in Study 2 (Danish sample) was over double that of Study 1 (UK sample; 19%); this may have been due to the different recruitment methods used for each study. The recruitment method used in Study 2 involved sending out the questionnaire study information to people who have just recently completed the GLA:D® programme asking them to consider taking part in a study about the programme, which they could relate to.

Whereas, in Study 1, people were sent a questionnaire study pack through their GP practice asking them about their knee OA and some of these patients may not have needed to see their GP recently about their knee OA and may find the study harder to relate to in terms of how they are managing their condition.

6.3.2 Description of Questionnaire Sample Characteristics

The characteristics and demographics of people from this dataset were 75.1% women, with a mean age of 64.6 (SD 7.71) years old and an average BMI of 27.6kg/m^2 (overweight; Table 33). Most participants were retired (64.1%) and over half (57.6%) of participants were educated to university level (Table 29).

Most participants had been diagnosed with knee OA in the last 0-4 years (60.8%; Table 34). The average number of symptoms was 3.13 (SD 1.63; Table 34) and the three most common symptoms were knee pain (68.2%), crepitus (48.4%), and swelling (47%; data not shown). The majority had co-morbidities and the two most common comorbidities were cardiovascular diseases (29.1%), which included heart disease, blood pressure, and high cholesterol, and endocrine diseases (12.9%), which included Type 2 Diabetes Mellitus (data not shown). Over half (54.4%) reported that they had a high physical activity level, which was defined as participating in vigorous-intensity activity on at least three days achieving a minimum total physical activity of at least 1500 MET-minutes/week or seven or more days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum of total physical activity of at least 3000 MET-minutes/week (Table 34).

Table 33 Participants' demographics of people with knee OA who has recently participated in the GLA:D® programme

Demographics	Respondents (n=217)
Sex, n (%)	
Male	54 (24.9)
Female	163 (75.1)
Age, mean (SD), y	64.53 (7.74)
45-54, n (%)	22 (10.1)
55-64	80 (36.9)
65-74	95 (43.8)
75-84	18 (8.3)
85+	1 (0.5)
Missing	1 (0.5)
Body Mass Index, mean (SD), kg/m^2	27.61 (4.51)
Underweight, n (%)	3 (1.4)
Healthy weight	54 (24.9)
Overweight	95 (43.8)
Obese	56 (25.8)
Missing	9 (4.1)
Employment status, n (%)	
Employed	71 (32.7)
Unemployed	3 (1.4)
Retired	139 (64.1)
Carer	1 (0.5)
Sick leave	1 (0.5)
Part-time employment	1 (0.5)
Other	0 (0)
Missing	1 (0.5)
Highest education level, n (%)	
None	0 (0)
Primary-Lower Sec School	28 (12.9)
Upper Sec school (16-20 years old)	30 (13.8)
UK Higher National Diploma equivalent	33 (15.2)
University degree	125 (57.6)
Missing	1 (0.5)

Table 34 Clinical characteristics of people who have recently participated in an education and exercise programme

Clinical characteristics	Respondents (n=217)
Duration of knee OA, n (%)	
0-4 years	132 (60.8)
5-9 years	38 (17.5)
10-14 years	22 (10.1)
15-19 years	10 (4.6)
20+ years	7 (3.2)
Missing	7 (3.2)
Mean number of symptoms (SD)	3.13 (1.63)
Painkiller usage for knee OA? n, (%)	
No	194 (89.4)
Yes	21 (9.7)
Missing	2 (0.9)
Comorbidities? n, (%)	
No	97 (44.7)
Yes	118 (54.4)
Missing	2 (0.9)
Physical activity (PA) levels, n (%)	
Now/low PA level	27 (12.4)
Moderate PA level	52 (24)
High PA level	118 (54.4)
Missing	20 (9.2)
Total sitting time, mins/day	300 (180)

The average knee pain perception (from the NRS pain scale) was 3.90 (SD 2.03; Table 35). Participants were highly satisfied with the GLA:D® education, physiotherapists, and the NEMEX exercise components of the programme (Table 35). Over half of the participants (55.8%) started off the programme with education sessions then progressed to exercise classes and the majority (44.2%) completed the recommended 10-12 classes, with a further 40.1% completing more than 12 classes (Table 35), thus indicating that participants had continued with these classes after the 6-week period of the programme.

Furthermore, after 6-10 months of completing the programme, over half of the participants (57.6%) reported continuing with the exercises weekly and 23.5% complete the programme daily (Table 35).

Participants reported high multidimensional outcomes expectations of exercise (i.e. perceived benefits with exercise), moderate sense of arthritis self-efficacy (6.88 (SD 1.83), had very high sense of exercise self-efficacy (median 80 (IQR 50), were not depressed (2 (SD 5), had a good general health status (80 (SD 20), and the majority (39.6%) were mildly troubled by the lack of knee confidence (Table 35).

Table 35 Study variables from GLA:D® participants

Study variables	**Respondents (n=217)**
Knee pain perception[1] (NRS), mean (SD)	3.90 (2.03)
Missing	11 (5.1)
GLA:D® Programme Components	
GLA:D® Education[3], mean (SD)	4.49 (0.69)
GLA:D® Physiotherapist[3], mean (SD)	4.48 (0.79)
GLA:D® NEMEX[3], mean (SD)	4.43 (0.68)
Education vs training, n (%)	
No education	40 (18.4)
Education then training	121 (55.8)
Education after training	8 (3.7)
Simultaneous education and training	48 (22.1)
Number of training sessions attended, n (%)	
0 classes	1 (0.5)
1-6 classes	12 (5.5)
7-9 classes	21 (9.7)
10-12 classes	96 (44.2)
12+ classes	87 (40.1)
How often do you still use what you learned from GLA:D®? n (%)	
Never	17 (7.8)
Monthly	24 (11.1)
Weekly	125 (57.6)
Daily	51 (23.5)

Study variables (Table 35 continued)	Respondents (n=217)
Motivation to adhere to exercise[4], mean (SD)	
The health benefits/gains	4.47 (0.69)
The outcome of the GLA:D® regime	4.35 (0.78)
Short and long-term goals established with physiotherapist	3.84 (0.87)
	3.20 (1.11)
Social aspect of group exercise	3.70 (1.02)
Established agreements with physiotherapist	3.49 (0.89)
Access to results and feedback	3.64 (0.97)
Further information about health benefits of exercise	3.67 (0.92)
General results and GLA:D® updates	3.64 (0.97)
Regular contact with physiotherapist	4.24 (0.92)
Exercises can be done at home	4.44 (0.76)
Exercises allow you to perform daily activities	4.20 (0.78)
Easy access to exercise facilities	
Multidimensional outcomes expectations for exercise[5] (MOEES), median (IQR)	
Physical MOEES	28 (6)
Social MOEES	15 (5)
Self-evaluative MOEES	21 (5)
Arthritis self-efficacy[6], mean (SD)	6.88 (1.83)
Exercise self-efficacy[7] %, median (IQR)	80 (50)
Depression[8], median (IQR)	2 (5)
General health status[9], median (IQR)	80 (20)
KOOS sub-scales, mean[10] (SD)	
KOOS Pain	66.96 (17.87)
KOOS Symptom	53.08 (11.24)
KOOS ADL	72.38 (18.22)
KOOS Sport/Rec	35.44 (24.79)
KOOS QOL	48.82 (16.88)
Knee confidence[11], n (%)	
Not at all troubled by lack of KC	22 (10.1)
Mildly troubled by lack of KC	86 (39.6)
Moderately troubled by lack of KC	67 (30.9)
Severely troubled by lack of KC	34 (15.7)
Extremely troubled by lack of KC	8 (3.7)
Missing	0 (0)

[1]Knee pain perception measured using the numeric rating scale (NRS) for pain = continuous measure (0 = no knee pain to 10 = severe knee pain); [2]Knee pain perception measured using the VAS for pain = continuous measure (0 = no knee pain to 100 = severe knee pain); [3]Satisfaction with the Good Life with osteoArthritis in Denmark (GLA:D®) initiative – split into three subscales: education, physiotherapist, and NEMEX (NEuroMuscular EXercise). These are categorical measure ranging from 1 (very dissatisfied) to 5 (very satisfied). ; [4]Motivation to adhere to exercise = categorical measure ranging from 1 (strongly disagree) to 5 (strongly agree); [5]Physical subscale of the multidimensional outcomes expectations for exercise (MOEES) = continuous measure (6 = low expectations in the physical benefits of exercise to 30 = high expectations in the physical benefits of exercise); [5]Social subscale of the MOEES = continuous measure (4

= low expectations in the social benefits of exercise to 20 = high expectations in the social benefits of exercise); [5]Self-evaluative subscale of the MOEES = continuous measure (5 = low expectations in the self-evaluative aspect of exercise to 25 = high expectations in the self-evaluative aspect of exercise) ; [6]Arthritis self-efficacy = continuous measure (0 = no self-belief in managing arthritis to 10 = high self-belief in managing arthritis); [7]Exercise self-efficacy = continuous measures (0% =no self-belief in ability to exercise to 100% = high self-belief in ability to exercise); [8]Depression measured using the Patient Health Questionnaire-8 = continuous measure (0 = no depression to 24 = severe depression); [9]General health status measured using EQVAS (of the EQ-5D-5L)= continuous measure (0 = bad health status to 100 = good health status); [10]KOOS = Knee injury and Osteoarthritis Outcome Score has five subscales (pain, symptoms, activities of daily living (ADL), sports and recreation, and quality of life (QOL). Each subscale was independent of each other and was continuous measures (0 = good to 100 = bad). ; [11]Knee confidence = measured from the KOOS quality of life subscale (question 3) = categorical measure (0 =not troubled; 1 = mildly troubled; 2 = moderately troubled; 3 = severely troubled; 4 = extremely troubled by the lack of knee confidence)

6.3.3 Missing Data

The number of missing data was relatively low (Tables 36 and 37); the highest percentage of missing data was 9.22% for the reporting of time spent sitting /sedentary and for physical activity categories (Table 36). Five per cent of knee pain perception data (NRS) was missing (Table 37).

Table 36 Missing data from questionnaire respondents (demographics and clinical characteristics)

Variable*	Valid no. (total n = 217) n=126 for enough power	% of missing data
Sex	217	0
Age (continuous)	216	0.46
BMI (continuous)	208	4.15
Height	210	3.23
Weight	214	1.38
Ethnicity	N/A	N/A
Smoking status	217	0
Employment	216	0.46
Education	216	0.46
Vigorous PA	205	5.53
Moderate PA	203	6.45
Walk time	206	5.07
Sit time	197	9.22
Physical activity categories	197	9.22
No. of symptoms	208	4.15
No. of comorbidities	216	0.46

Table 37 Missing data from questionnaire respondents (study variables)

Variable*	Valid no. (total n = 217) n=126 for enough power	% of missing data
Dependent variable		
Arthritis self-efficacy	217	0
Independent variables		
NRS Pain (0-10)	206	5.07
Physical MOEES	217	0
Social MOEES	217	0
Self-evaluative MOEES	217	0
Exercise self-efficacy	217	0
PHQ 8	217	0
EQ VAS	217	0
KOOS Pain	217	0
KOOS Symptom	217	0
KOOS ADL	217	0
KOOS Sport/Rec	217	0
KOOS QOL	217	0
Knee confidence	217	0

6.3.4 Differences between Danish and UK Populations

There were similarities and differences between the populations in Study 1 (UK sample) and Study 2 (Danish sample). Participants in Study 1 were older (mean age 67.8 years) and had a higher BMI (28.65 kg/m2) compared to Study 2 (Table 38). Study 1 also comprised of more males compared to Study 2 (52.6% versus 24.9%; Table 38). However, when looking at the frequencies for age and BMI, many participants in both studies were between 65-74 years old and had a BMI classification of “overweight” (Table 38).

Table 38 Demographics of baseline participants in Study 1 and Study 2

Demographics	Study 1 UK (n = 152)	Study 2 Denmark (n = 217)
Sex, n (%)		
Male	80 (52.6)	54 (24.9)
Female	72 (47.4)	163 (75.1)
Age, mean (SD), y	67.80 (10.59)	64.53 (7.74)
45-54, n (%)	18 (11.8)	22 (10.1)
55-64	35 (23)	80 (36.9)
65-74	52 (34.2)	95 (43.8)
75-84	32 (21.1)	18 (8.3)
85+	5 (3.3)	1 (0.5)
Missing	10 (6.6)	1 (0.5)
Body Mass Index, mean (SD), kg/m^2	28.647 (5.86)	27.61 (4.51)
Underweight, n (%)	2 (1.3)	3 (1.4)
Healthy weight	38 (25)	54 (24.9)
Overweight	53 (34.9)	95 (43.8)
Obese	47 (30.9)	56 (25.8)
Missing	12 (7.9)	9 (4.1)
Smoking status, n (%)		
Non-smoker	77 (50.7)	171 (78.8)
Ex-smoker	61 (40.1)	35 (16.1)
Current smoker	11 (7.2)	11 (5.1)
Missing	3 (2)	0 (0)
Employment status, n (%)		
Employed	36 (23.7)	71 (32.7)
Unemployed	9 (5.9)	3 (1.4)
Retired	101 (66.4)	139 (64.1)
Sick leave	2 (1.3)	1 (0.5)
Part-time employment	1 (0.7)	1 (0.5)
Other	3 (2)	0 (0)

Most participants from Study 1 and 2 had been diagnosed with knee OA relatively recently (0-4 years) and lived with other co-morbidities (Table 39). Participants from both studies experienced an average of 3 symptoms due to knee OA (3.63 in Study 1 and 3.13 in Study 2; Table 39). However, more participants in Study 1 reported using painkillers compared to those in Study 2 (36.2% versus 9.7% using painkillers, respectively; Table 39).

Table 39 Clinical characteristics of baseline participants in Study 1 and Study 2

Clinical characteristics	Study 1 UK (n = 152)	Study 2 Denmark (n = 217)
Duration of knee OA, n (%)		
0-4 years	31 (20.4)	132 (60.8)
5-9 years	22 (14.5)	38 (17.5)
10-14 years	16 (10.5)	22 (10.1)
15-19 years	14 (9.2)	10 (4.6)
20+ years	13 (8.6)	7 (3.2)
Missing	56 (36.8)	7 (3.2)
Number of symptoms, mean (SD)	3.63 (1.61)	3.13 (1.63)
Comorbidities? n (%)		
No	39 (25.7)	97 (44.7)
Yes	110 (72.4)	118 (54.4)
Missing	3 (2)	2 (0.9)
Painkiller usage for knee OA, n (%)		
No	30 (19.7)	194 (89.4)
Yes	55 (36.2)	21 (9.7)
Missing	67 (44.1)	2 (0.9)
Physical activity (PA) level, n (%)		
Now/low PA level	34 (22.4%)	27 (12.4%)
Moderate PA level	52 (34.2%)	52 (24%)
High PA level	43 (28.3%)	118 (54.4%)
Missing	23 (15.1%)	20 (9.2%)

Over half of the participants (54.4%) in Study 2 reported having high physical activity levels, against only 28.3% in Study 1 (Table 39). The differences in physical activity levels could be a result of participants in Study 2 being recruited from the GLA:D® programme (which involved being active), and as such, they may have remained physically active post-programme. Another reason could be that the Danish population were more physically active in general. According to the Cycling Embassy of Denmark: Facts about cycling in Denmark, nine of out ten Danes own a bike, compared to 4 out of ten Danes own a car (Cycling Embassy of Denmark., 2016). Cycling accounts for 16% of all trips and Danes cycle on average of 1 mile a day for the purpose of leisure

(37%), going to work (34%), running errands (15%), and 49% of children aged 11-15 years old cycle to school in Denmark (Cycling Embassy of Denmark., 2016). The infrastructure in Denmark separate pedestrian pavements from bicycle lanes and car driving lanes by curbs at each level and there are more than 7,500 miles of cycle lanes in Denmark, which makes it easier and safer for people to cycle (Cycling Embassy of Denmark., 2016).

In contrast, Walking and Cycling Statistics, England 2017 data released by the Department of Transport. (2018), reported that 14% of people cycle at least once a week, and on average 17 cycling trips were made per person per year, and 60 miles was cycled per person per year (0.16 miles per day), which is clearly less than the Danish data. The most common purposes for cycling trips were commuting/business (37%), cycling for leisure (36%), which are similar to that reported in Denmark (Department of Transport., 2018).

Østerås et al. (2015) measured adherence to standards of care and guideline recommendations in Denmark, Norway, Portugal, and the UK by using quality indicators (QIs). A QI was defined as “measurable (element) of practice performance for which there is evidence or consensus that it can be used to assess the quality and hence change in the quality, of care provided” (Lawrence 1997 Indicators of quality in health care). Out of the four countries, the UK data (Dziedzic et al., 2014) demonstrated the highest achievement rates regarding information about the joint problem (72% achieved), treatment alternatives (72%) and self-management (68%) QIs (all other countries achieved <59%). Conversely, Denmark had the lowest percentage of

achievement for 13 of the 14 QIs measured out of the four countries (Østerås et al., 2015).

The differences in healthcare systems in these countries may explain the variation in QI achievement rates (Østerås et al., 2015). The results of this study indicated that there exists a potential for improvement in OA care in all four countries, and health professionals should aim for higher adherence to standards of care and guideline recommendations (Østerås et al., 2015). However, multifaceted approaches, including system-level interventions and patient-focused interventions among others, may be needed to improve the quality of OA care (Grol et al., 2013).

6.3.5 Factors Associated with Arthritis Self-Efficacy in Participants who have had an Education and Exercise Programme

6.3.5.1 The relationship between the Changes in Arthritis Self-Efficacy and Independent Variables

Simple linear regressions were run for arthritis self-efficacy score (dependent variable) and each of the independent variables (exercise self-efficacy, depression, general health status, knee pain perception, knee confidence, age, sex, and BMI) to investigate how much these independent variables explained the variance in arthritis self-efficacy score and to investigate the change in arthritis self-efficacy score with a unit change in the independent variables.

The assumptions of a simple linear regression were: 1) one dependent variable measured at a continuous level; 2) one independent variable measured at a continuous level; 3) a linear relationship between the dependent variable and the independent variable; 4) independence of observations; 5) no significant outliers; 6) there should be homoscedasticity; and 7) residuals of the regression line are approximately normally distributed.

A scatterplot was plotted for arthritis self-efficacy and each independent variable to visually assess their linear relationship. There were no relationships the on scatterplot for the three subscales of the multidimensional outcomes expectations for exercise, age, sex, and BMI with arthritis self-efficacy. So, the multidimensional outcomes for exercise subscales (physical, social, and self-evaluative) were not analysed in the linear regression models, but age, sex, and BMI were still included to control for these variables in the analyses.

Firstly, simple linear regressions were run to investigate how much of the variance in arthritis self-efficacy was explained by knee pain perception, exercise self-efficacy, depression, general health perception, knee confidence, age, sex, and BMI. To determine how well the linear regression model fit with the data, the adjusted R^2 was used to indicate the variation in one variable that is explained by the other. Table 40 summarises the variances in arthritis self-efficacy score. Knee pain perception (NRS pain) accounted for the highest variation in the database of people who have taken part in the GLA:D® programme (adjusted R^2 = 23.1%). The next highest variance in arthritis self-efficacy was explained by general health status (adjusted R^2 = 18.1%) and then knee confidence (adjusted R^2 = 12.9%; Table 40). There were

independence of residuals in all the variables, as assessed by the Durbin-Watson statistic being close to 2 (Table 40).

Another measure to determine the goodness of fit of the regression model, the statistical significance of the model was determined from the *F*-test. The simple linear regressions showed that average exercise self-efficacy, depression score, general health status, knee pain perception, knee confidence, and BMI statistically significantly predicted arthritis self-efficacy score compared to a model with no independent variables (Table 40). However, age and sex were not statistically significant.

The outputs from the simple linear regressions were used to investigate the change in arthritis self-efficacy score with a unit change in the independent variables (i.e. exercise self-efficacy, depression, general health status, knee pain perception, and knee confidence). Age, sex, BMI, number of symptoms was included to control for these variables.

Table 40 Variances and *F*-statistics between arthritis self-efficacy and study independent variables for the questionnaire data

Variables	R	Adjusted R^2	Standard error of the estimate	Durbin-Watson	*F*-statistic (degrees of freedom)	*p*-value
Exercise self-efficacy	.359	.125	1.707	1.974	31.819 (1, 215)	**< .001**
Depression[1]	.322	.099	1.732	1.878	24.863 (1, 215)	**< .001**
General health status[2]	.430	.181	1.651	1.920	48.872 (1, 215)	**< .001**
Knee pain perception[3]	.456	.203	1.532	1.869	47.159 (1, 180)	**< .001**
Not troubled by the lack of knee confidence[4]	.150	.018	1.809	1.974	4.975 (1, 215)	**.027**
Mildly troubled by the lack of knee confidence[4]	.285	.077	1.753	1.971	19.050 (1, 215)	**< .001**
Moderately troubled by the lack of knee confidence[4]	.219	.043	1.785	1.915	10.780 (1, 215)	**.001**
Age	.106	.007	1.811	1.928	2.411 (1, 214)	.122
Sex	.059	-.001	1.826	1.961	.754 (1, 215)	.386
Body Mass Index	.190	.031	1.772	1.898	7.706 (1, 206)	**.006**

[1]depression = Patient Health Questionnaire-8 (Kroenke and Spitzer, 2002); [2]general health status = EQ-VAS section of the EQ-5D-5L questionnaire (EuroQol, 1990); [3]knee pain perception = numeric rating scale (NRS) for pain (Hawker et al., 2011); [4]knee confidence = question 3 of the KOOS quality of life subscale (Roos and Lohmander, 2003).

Outliers were detected from the Casewise Diagnostics output for exercise self-efficacy (1 outlier); depression (2 outliers); general health status (3 outliers); knee pain perception (1 outlier); not troubled by the lack of knee confidence (1 outlier); mildly troubled by the lack of knee confidence (1 outlier); moderately troubled by the lack of knee confidence (1 outlier); age (1 outlier); sex (1 outlier); and BMI (1 outlier) variables. These outliers were from the same three participants. Checks were made to ensure these were not due to data entry error, measurement error, and they were genuine unusual values. Additionally, simple linear regressions were run with and without these outliers; there were no appreciable differences in the results (i.e. the variables were still statistically significant), therefore the outliers were kept in the model.

There were homoscedasticity across the independent variables with the dependent variables, visually inspected using the Regression Standardised Residual against Regression Standardised Predicted Value scatterplots; the variances of errors were constant across the values of the independent variables. Finally, there were normality of residuals for the independent variables, which were visually inspected from the histograms and Normal P-P plots.

Table 41 Simple linear regressions for questionnaire data

Variable	Unstandardized coefficient (B)	Unstandardized coefficient Standard Error	95% Confidence Interval	Standardized coefficient (Beta)	*p*-value
Exercise self-efficacy[1]	.021	.004	.014 to .028	.359	**< .001**
Depression[2]	-.180	.036	-.251 to -.109	-.322	**< .001**
General health status[3]	.042	.006	.030 to .054	.430	**< .001**
Knee pain perception[4]	-.384	.056	-.495 to -.274	-.456	**< .001**
Not troubled by the lack of knee confidence[5]	.907	.407	.106 to 1.709	.150	**.027**
Mildly troubled by the lack of knee confidence[5]	1.062	.243	.582 to 1.542	.285	**< .001**
Moderately troubled by the lack of knee confidence[5]	-.861	.262	-1.378 to -.344	-.219	**.001**
Age[6]	-.025	.016	-.056 to .007	-.106	.122
Sex[7]	.249	.287	-.316 to .814	.059	.386
Body mass index[8]	-.076	.027	-.130 to -.022	-.190	**.006**

Dependent variable = arthritis self-efficacy

[1]Exercise self-efficacy = continuous measures (0% =no self-belief in ability to exercise to 100% = high self-belief in ability to exercise)

[2]Depression measured using the Patient Health Questionnaire-8 = continuous measure (0 = no depression to 24 = severe depression)

[3]General health status measured using EQVAS (of the EQ-5D-5L)= continuous measure (0 = bad health status to 100 = good health status)

[4]Knee pain perception measured using the numeric rating scale for pain = continuous measure (0 = no knee pain to 10 = severe knee pain)

[5]Knee confidence = measured from the KOOS quality of life subscale (question 3) = categorical measure (0 =not troubled; 1 = mildly troubled; 2 = moderately troubled; 3 = severely troubled; 4 = extremely troubled by the lack of knee confidence)

[6]Age = continuous measure; [7]Sex = binary measure, male coded as 0 and female coded as 1; [8]Body mass index = continuous measure

The simple linear regression outputs presented on Table 41 showed that single unit increase in their exercise self-efficacy score and general health status led to a statistically significant increase in their arthritis self-efficacy score by .021 and .042 points, respectively (Table 41). Therefore, the more self-belief people had about exercising (higher exercise self-efficacy score) and perceived a better overall general health status (higher score), the more self-belief people had about managing their arthritis successfully (higher arthritis self-efficacy score).

Participants who perceived themselves as not being troubled with the lack of knee confidence reported a statistically significantly higher arthritis self-efficacy score of .907 points than those who perceived themselves to be severely extremely troubled by the lack of knee confidence (Table 41). Those who were mildly troubled by the lack of knee confidence reported a statistically significantly higher arthritis self-efficacy score of 1.062 points than those who were severely extremely troubled by the lack of knee confidence (Table 41). Those who were moderately troubled by the lack of knee confidence reported a statistically significantly lower arthritis self-efficacy score of .861s point than those who were severely extremely troubled by the lack of knee confidence (Table 41).

A single unit increase in depression score (one point), knee pain perception (one point), and BMI ($1kg/m^2$) led to a statistically significant decrease in the arthritis self-efficacy scores by -.180, -.384, and -.076 point, respectively (Table 41). Therefore, someone who was more depressed (higher PHQ-8 score), perceived more knee pain (higher NRS for pain) and had a higher BMI

had less self-belief in their ability to successfully manage their arthritis (lower arthritis self-efficacy) (Table 41).

Age and sex showed non-significant results, indicating the increasing age and whether one was male or female did not lead to a statistically significant change in the arthritis self-efficacy score (Table 41).

6.3.5.2 **Variances in Arthritis Self-Efficacy Explained by the Independent Variables**

A multiple linear regression was run with the variables that were significant from the simple linear regressions (i.e. exercise self-efficacy, depression, general health status, knee pain perception, not troubled by the lack of knee confidence, mildly troubled by the lack of knee confidence, moderately troubled by the lack of knee confidence, and BMI) to investigate the change in arthritis self-efficacy score in the presence of multiple independent variables (Table 42).

In the presence of multiple independent variables, exercise self-efficacy, general health status, knee pain perception, and mildly troubled by the lack of knee confidence remained significant (p<.01; Table 42). Subsequently, the non-significant variables (depression, not troubled by the lack of knee confidence, moderately troubled by the lack of knee confidence, age, sex, and BMI) were removed from the multiple regression model. The model now consisted of all significant variables (data not shown): exercise self-efficacy

(*p*=.001), general health status (*p*<.001), knee pain perception (*p*<.001), and not troubled by the lack of knee confidence (*p*=.001).

Then, all the non-significant variables from both the previous multiple linear regression model (Table 42) were added back into the model one at a time to see if they became significant; these variables included depression, not troubled by the lack of knee confidence, moderately troubled by the lack of knee confidence, age, sex, and BMI in this order. If the variable did not become significant, it was removed from the model and if it became significant, it was kept in the model. This process was repeated for all non-significant variables mentioned above, but no variables became significant. Therefore, the final multiple linear regression is presented in Table 43.

Table 42 Multiple linear regression model with the variables from the simple linear regressions

Variables	Unstandardized coefficient (B)	Standard error of unstandardized coefficient	95% Confidence Interval	Standardized coefficient (Beta)	*p*-value	Tolerance†	VIF††
Constant	5.706	1.391	2.959 to 8.453		**< .001**		
Exercise self-efficacy[1]	.010	.003	.003 to .017	.181	**.005**	.841	1.190
Depression[2]	-.035	.038	-.110 to .040	-.064	.360	.696	1.437
General health status[3]	.029	.007	.015 to .043	.290	**< .001**	.716	1.397
Knee pain perception[4]	-.191	.055	-.299 to -.083	-.227	**.001**	.807	1.240
Not troubled by lack of knee confidence[5]	.629	.412	-.184 to 1.442	.100	.129	.790	1.265
Mildly troubled by lack of knee confidence[6]	.722	.268	.193 to 1.252	.210	**.008**	.558	1.792
Moderately troubled by lack of knee confidence[7]	-.198	.270	-.731 to .335	-.056	.464	.593	1.687
Age[8]	-.020	.013	-.046 to .006	-.093	.123	.946	1.057
Sex[9]	.446	.236	-.020 to .913	.114	.061	.940	1.064
Body mass index[10]	-.014	.022	-.057 to .030	-.038	.541	.875	1.142

Dependent variable = arthritis self-efficacy; [1]Exercise self-efficacy = continuous measures (0% =no self-belief in ability to exercise to 100% = high self-belief in ability to exercise); [2]Depression measured using the Patient Health Questionnaire-8 = continuous measure (0 = no depression to 24 = severe depression); [3]General health status measured using EQVAS (of the EQ-5D-5L)= continuous measure (0 = bad health status to 100 = good health status); [4]Knee pain perception measured using the numeric rating scale for pain = continuous measure (0 = no knee pain to 10 = severe knee pain); [5]Not troubled by the lack of knee confidence (coded 1) vs severely and extremely troubled by the lack of knee confidence (coded 0); [6]Mildly troubled by the lack of knee confidence (coded 1) vs severely and extremely troubled by the lack of knee confidence (coded 0); [7]Moderately troubled by the lack of knee confidence (coded 1) vs severely and extremely troubled by the lack of knee confidence (coded 0); [8]Age = continuous measure; [9]Sex = binary measure, male (coded 0) and female (coded 1); [10]Body mass index = continuous measure
†Tolerance = reciprocal of VIF (1/VIF) values below 0.1 indicate serious problems and values below 0.2 are worthy of concern (Menard, 1995)
††variance inflation factor (VIF) – indicates if a predictor has a strong relationship with the other predictor(s). Values of greater than 10 are of concern (Myers, 1990)

Table 43 Final multiple linear regressions model from the Denmark questionnaire study

	Unstandardized coefficient (B)	Standard error of unstandardized coefficient	95% Confidence Interval	Standardized coefficient (Beta)	*p*-value	Tolerance†	VIF††
Constant	3.991	.612	2.783 to 5.198		<.001		
Exercise self-efficacy[1]	.011	.003	.005 to .018	.209	.001	.937	1.068
General health status[2]	.033	.006	.020 to .045	.331	<.001	.799	1.252
Knee pain perception[3]	-.210	.053	-.314 to -.106	-.256	<.001	.819	1.220
Mildly troubled by the lack of knee confidence[4]	.667	.200	.272 to 1.062	.196	.001	.971	1.030

Dependent variable is arthritis self-efficacy

[1]Exercise self-efficacy = continuous measures (0% =no self-belief in ability to exercise to 100% = high self-belief in ability to exercise)
[2]General health status measured using EQVAS (of the EQ-5D-5L)= continuous measure (0 = bad health status to 100 = good health status)
[3]Knee pain perception measured using the numeric rating scale for pain = continuous measure (0 = no knee pain to 10 = severe knee pain)
[4]Mildly troubled by the lack of knee confidence (coded 1) vs severely and extremely troubled by the lack of knee confidence (coded 0)
†Tolerance = reciprocal of VIF (1/VIF) values below 0.1 indicate serious problems and values below 0.2 are worthy of concern (Menard, 1995)
††variance inflation factor (VIF) – indicates if a predictor has a strong relationship with the other predictor(s). Values of greater than 10 are of concern (Myers, 1990)

In the final multiple linear regression model (Table 43), exercise self-efficacy, general health status, knee pain perception, and not being troubled by the lack of knee confidence statistically significantly predicted the arthritis self-efficacy score, $F(4, 174) = 30.640$, $p<.001$, $R^2 = .643$, adjusted $R^2 = .400$, thus the overall final model together explained 40.0% of the variance in arthritis self-efficacy score. All four variables added statistically significance to the prediction of arthritis self-efficacy score, $p<.005$ (Table 43).

The unstandardised coefficient for exercise self-efficacy was .011; one percent increase in exercise self-efficacy score statistically significantly increased arthritis self-efficacy score by .011 points (95% Confidence Interval (CI), .005 to .018, $p=.001$) while the other independent variables in the model were held constant (Table 43).

An increase in general health status by one point statistically significantly predicted an increase in arthritis self-efficacy score by .033 points. The unstandardised coefficient for general health status was .021 (95% CI, .020 to .045, $p<.001$), while the other independent variables in the model were held constant (Table 43).

The unstandardised coefficient for knee pain perception (NRS pain) was -.210 (95% CI, -.314 to -.106, $p<.001$), so the predicted arthritis self-efficacy score decreased by .210 points for every point increase in knee pain perception while the other independent variables in the model were held constant (Table 43).

The unstandardised coefficient for mildly troubled by the lack of knee confidence was .667 (95% CI, .272 to 1.062, *p*=.001), so the predicted arthritis self-efficacy score increased by .667 points for those who perceived to be mildly troubled by the lack of knee confidence compared to those who were severely extremely troubled by the lack of knee confidence, while the other independent variables in the model were held constant (Table 43).

Therefore, people who perceived better self-belief in their ability to exercise (higher exercise self-efficacy score), had better health status (higher general health status score) and perceived less knee pain (lower NRS pain score) had more self-belief in their ability to successfully manage their arthritis (higher arthritis self-efficacy score). Also, people who were mildly troubled by the lack of knee confidence (lower knee confidence score) had a higher self-belief in their abilities to successfully manage their arthritis compared to those who perceived themselves to be severely extremely troubled by the lack of knee confidence.

Multiple Linear Regression Assumptions Met

Checks were made to ensure multiple linear regression assumptions were met. There were linear relationships between arthritis self-efficacy score and each of the independent variables as visually assessed by partial regression plots. The Durbin-Watson statistic tests for autocorrelation (i.e. errors/residuals of adjacent observations are not independent). There were independence of residuals in this data, as assessed by a Durbin-Watson statistic of 1.934 (values close to 2 show independence of errors). The

assumption of homoscedasticity is that the residuals are equal for all values of the predicted arthritis self-efficacy score (dependent variable). There was homoscedasticity, as assessed by visual inspection of a scatterplot of Studentised Residuals versus Unstandardized Predicted Value. There was no evidence of multicollinearity, which indicated the independent variables were not highly correlated with each other. This was assessed by an inspection of the correlation coefficients matrix (no variables had correlations greater than 0.7(Field, 2009)), the Tolerance values were greater than 0.1 (Menard, 1995)and VIF were less than 10(Myers, 1990); Tables 43).

Checks in the data were made for unusual points such as outliers, high leverage points, and highly influential points, as these can be detrimental to the fit or generalisation of the regression equation. Firstly, there were no Studentised Deleted Residuals greater than ±3 standard deviations to indicate potential outliers (the highest and lowest scores were +2.439 and -2.799. To confirm this, no Casewise Diagnostics table was produced from the multiple linear regression model. There were no high leverage points, as all values were less than 0.2 (the highest being 0.135). Further checks also showed no highly influential points, as the Cook's Distance values remained below 1 (the highest being 0.184;(Cook and Weisberg, 1982). Finally, there were normality of the residuals, as visually assessed by a histogram of the Regression Standardised Residual and the Normal Q-Q plot of the Studentised Residual.

6.3.6 Patients' Perspectives of Factors Influencing their Arthritis Self-Efficacy

6.3.6.1 **Interview Respondents**

All 217 respondents to the questionnaire were asked at the end of the questionnaire to provide their email address and municipality if they were also interested in participating in an interview. Forty-two respondents expressed their interest by providing their email addresses and municipalities, and a further five respondents did not provide their municipality. Figure 11 shows the current residential location of the Danish participants. Of the 42 respondents interested in the interview study, 14 requested an interpreter, 26 did not request an interpreter, and 2 did not indicate if they would like an interpreter.

The star on the map (Figure 11) showed that four participants from Odense were interested in participating in an interview and it was also the location of the University of Southern Denmark. Initially, the author wanted to interview participants from different locations in Denmark, however, due to logistical issues of finding available rooms at physiotherapy clinics, availability of the translator, and the time limitation, it was decided that participants nearest to the University of Southern Denmark were to be contacted via email to invite them to the University for their interview. In total, six respondents were invited to an interview, five of which accepted the invitation and one participant did not respond. Of the five interviewees, two requested an interpreter.

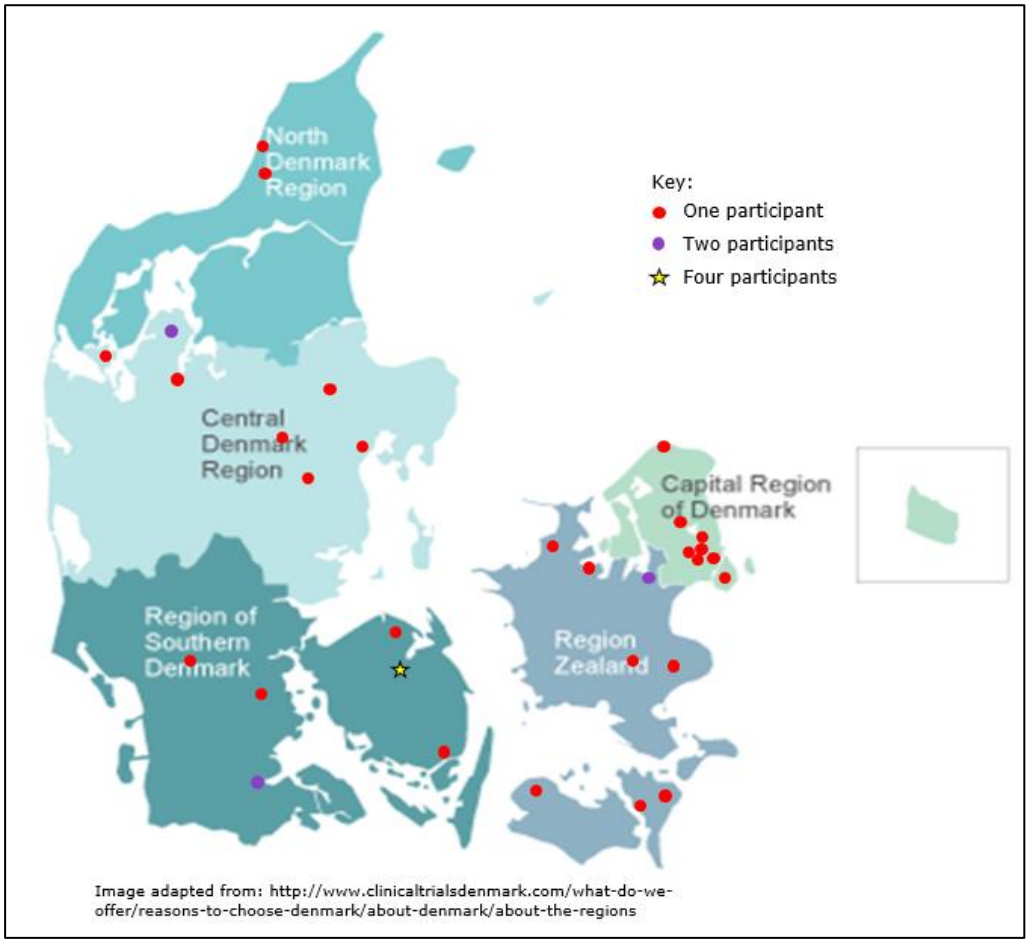


Figure 11 Locations of GLA:D® programme patients who were interested in participating in the interview phase of the study

6.3.6.2 **Interview Sample Characteristics**

Due to the author's limited in Denmark for this study, only five of the 42 participants who were interested in the interview study were invited for the semi-structured interview. The interviews ranged from 32 minutes to 77 minutes, with an average duration of 56 minutes.

The professional interpreter was present in two of these interviews, as participants requested an interpreter; these interviews were conducted in English/Danish. The interviews without the interpreter were conducted in

English. The sample of interview participants has similar characteristics as the questionnaire participants for this study (Table 44). Most participants in the questionnaire and interview groups were female, mainly aged between 65-74 years old. Most of the participants from the interviews had a BMI classification of healthy weight or obese (NHS, 2016) (Table 44). All five participants in the interview group were retired, and most had a university degree (Table 44).

Table 44 Participant demographic characteristics comparing the interview participants to the other questionnaire participants.

Demographics	Questionnaire participants (n=212)	Interview participants (n=5)
Sex, n (%)		
Male	53 (25.0)	1 (20.0)
Female	159 (75.0)	4 (80.0)
Age, mean (SD), y	64.42 (7.75)	69.20 (5.93)
45-54, n (%)	22 (10.4)	0 (0.0)
55-64	79 (37.3)	1 (20.0)
65-74	92 (43.4)	3 (60.0)
75-84	17 (8.0)	1 (20.0)
85+	1 (0.5)	0 (0.0)
Missing	1 (0.5)	0 (0.0)
Body Mass Index, mean (SD), kg/m^2	27.57 (4.48)	29.09 (6.23)
Underweight, n (%)	3 (1.4)	0 (0.0)
Healthy weight	52 (24.5)	2 (40.0)
Overweight	94 (44.3)	1 (20.0)
Obese	54 (25.5)	2 (40.0)
Missing	9 (4.2)	0 (0.0)
Smoking status, n (%)		
Non-smoker	166 (78.3)	5 (100.0)
Ex-smoker	35 (16.5)	0 (0.0)
Current smoker	11 (5.2)	0 (0.0)
Missing	0 (0)	0 (0.0)
Employment status, n (%)		
Employed	71 (33.5)	0 (0.0)
Unemployed	3 (1.4)	0 (0.0)
Retired	134 (63.2)	5 (100.0)
Carer	1 (0.5)	0 (0.0)
Sick leave	1 (0.5)	0 (0.0)
Part-time employment	1 (0.5)	0 (0.0)
Other	0 (0)	0 (0.0)
Missing	1 (0.5)	0 (0.0)

Demographics (Table 44 continued)	Questionnaire participants (n=212)	Interview participants (n=5)
Highest education level, n (%)		
None	0 (0)	0 (0.0)
Primary-Lower Sec School	27 (12.7)	1 (20.0)
Upper Sec school (16-20 years old)	30 (14.2)	0 (0.0)
UK Higher National Diploma equivalent	32 (15.1)	1 (20.0)
University degree	122 (57.5)	3 (60.0)
Missing	1 (0.5)	0 (0.0)

Three participants (60%) in the interview group had knee OA between 0-4 years, which also reflects the questionnaire participants sample as the majority group (60.8%) (Table 45). Both interview and questionnaire participants reported a similar number of symptoms (Table 45). Most interview participants reported a moderate physical activity level, whereas most questionnaire participants reported a high physical activity level (Table 45).

Interview participants reported a higher average knee pain perception score (NRS score of 5.75 out of 10) compared to the questionnaire participants (3.86 out of 10) (Table 46). All of the participants in the interview group attended at least 10 training sessions, which reflects the majority of people in the questionnaire sample (Table 46). Three participants from the interview group reported continuing with the GLA:D® exercises weekly, whereas the other two participants reported not continuing with the exercises (Table 46).

Table 45 Participant clinical characteristics comparing the interview participants to the other questionnaire participants.

Clinical characteristics	Questionnaire participants (n=212)	Interview participants (n=5)*
Duration of knee OA, n (%)		
0-4 years	129 (60.8)	3 (60.0)
5-9 years	37 (17.5)	1 (20.0)
10-14 years	22 (10.4)	0 (0.0)
15-19 years	9 (4.2)	1 (20.0)
20+ years	7 (3.3)	0 (0.0)
Missing	8 (3.8)	0 (0.0)
Mean number of symptoms (SD)	3.10 (1.64)	4.2 (0.837)
Painkiller usage for knee OA? n, (%)		
No	189 (89.1)	1 (20.0)
Yes	21 (9.7)	0 (0.0)
Missing	2 (0.9)	4 (80.0)
Comorbidities? n, (%)		
No	95 (44.8)	2 (40.0)
Yes	115 (54.2)	3 (60.0)
Missing	2 (0.9)	0 (0.0)
Physical activity (PA) levels, n (%)		
Now/low PA level	26 (12.3)	1 (20.0)
Moderate PA level	49 (23.1)	3 (60.0)
High PA level	117 (55.2)	1 (20.0)
Missing	20 (9.4)	0 (0.0)
Total sitting time, mins/day	322.72 (142.63)	415 (221.92)

Participants from the interview group had lower arthritis self-efficacy, lower exercise self-efficacy, higher depression score, and lower general health status compared to those in the questionnaire sample (Table 46). Participants from the interview group also reported lower KOOS in all subscales compared to the questionnaire group (Table 46).

Table 46 Participant study variables comparing the interview participants to the other questionnaire participants.

Study variables	Questionnaire participants (n=212)	Interview participants (n=5)*
Knee pain perception[1] (NRS), mean (SD)	3.86 (2.03)	5.75 (0.957)
Missing, n (%)	34 (16)	0 (0.0)
Number of training sessions attended, n (%)		
0 classes	1 (0.5)	0 (0.0)
1-6 classes	12 (5.7)	0 (0.0)
7-9 classes	21 (9.9)	0 (0.0)
10-12 classes	94 (44.3)	2 (40.0)
12+ classes	84 (39.6)	3 (60.0)
How often do you still use what you learned from GLA:D®? n (%)		
Never	15 (7.1)	2 (40.0)
Monthly	24 (11.3)	0 (0.0)
Weekly	122 (57.5)	3 (60.0)
Daily	51 (24.1)	0 (0.0)
Multidimensional outcomes expectations for exercise[5] (MOEES), median (IQR)		
Physical MOEES	28 (6)	28 (12.5)
Social MOEES	14.5 (4.75)	15 (6.5)
Self-evaluative MOEES	21 (5)	23 (10.5)
Arthritis self-efficacy[6], mean (SD)	6.92 (1.81)	5.02 (1.42)
Exercise self-efficacy[7] %, median (IQR)	80 (50)	70 (55.63)
Depression[8], median (IQR)	2 (5)	7 (10)
General health status[9], median (IQR)	80 (20)	60 (35)
KOOS sub-scales, mean[10] (SD)		
KOOS Pain	67.24 (17.77)	55.00 (19.97)
KOOS Symptom	53.13 (11.24)	50.71 (11.95)
KOOS ADL	72.77 (17.94)	55.88 (24.85)
KOOS Sport/Rec	35.75 (24.53)	22.00 (34.93)
KOOS QOL	48.99 (16.81)	41.25 (20.10)
Knee confidence[11], n (%)		
Not at all troubled by lack of KC	21 (9.9)	1 (20.0)
Mildly troubled by lack of KC	85 (40.1)	1 (20.0)
Moderately troubled by lack of KC	66 (31.1)	1 (20.0)
Severely troubled by lack of KC	34 (16.0)	0 (0)
Extremely troubled by lack of KC	6 (2.8)	2 (40.0)
Missing	0 (0)	0 (0)

Table 47 A cross-tabulated table for the sampling of participants interviewed (pseudonyms used)

	High Arthritis Self-Efficacy	**Low Arthritis Self-Efficacy**
High Knee Confidence (KC) (i.e. not at all & mildly troubled by lack of KC)	**Anne** (mildly troubled by lack of KC) **Total: 1 participant**	**Pernille** (not troubled by lack of KC) **Total: 1 participant**
Low Knee Confidence (KC) (i.e. moderately, severely, extremely troubled by lack of KC)	**Rikke** (moderately troubled by lack of KC) **Total: 1 participant**	**Caroline** (extremely troubled by lack of KC) – interpreter present **Mikkel** (extremely troubled by lack of KC) – interpreter present **Total: 2 participants**

Table 47 shows the participants interviewed concerning the purposive sampling strategy quadrant that they were attributed based on their questionnaire responses for knee confidence and arthritis self-efficacy. Even though only five participants were interviewed in this study and they lived in the same area, at least one participant was purposively sampled to be included into each sampling quadrant, to provide different and varied perspectives of their experiences living with OA and their participation in the GLA:D® programme.

Tables 48 and 49 provide detailed individual data for the five interview participants regarding their demographics, clinical characteristics and study variable results for the participants.

Table 48 Demographics and clinical characteristics of interview participants

Participant (pseudonym)	Sex	Age	Body mass index	Employment status	Highest education	Duration of knee OA	No. of symptoms	No. of comorbidities
Rikke	Female	64	24.841	Retired	University	20+years	7	Missing
Caroline	Female	64	29.032	Retired	Primary School	0-4 years	5	3
Pernille	Female	65	23.398	Retired	University	15-19 years	4	Missing
Anne	Female	79	23.244	Retired	University	0-4 years	4	1
Mikkel	Male	69	38.155	Retired	Diploma equivalent	0-4 years	5	3

Table 49 Study variables of interview participants

Participant (pseudonym)	Physical activity level	NRS knee pain	Arthritis self-efficacy	Physical MOEES	Social MOEES	Self-evaluative MOEES	Exercise self-efficacy	PHQ8	EQ-VAS	Troubled by lack of Knee confidence
Rikke	High	3	10	30	15	21	100%	0	95	Moderately troubled
Caroline	Moderate	7	5.727	11	12	12	75%	7	60	Extremely troubled
Pernille	Moderate	6	4.091	30	17	25	35%	10	50	Not troubled
Anne	High	Missing	7	28	15	23	100%	0	100	Mildly troubled
Mikkel	No/Low	5	4.909	30	20	25	29%	11	50	Extremely troubled

Themes from the Interviews

A coding scheme (Figure 12) was developed from thematic analysis of the views of people who were living with knee OA who had recently completed the GLA:D® education and exercise programme on how they were currently managing their knee OA post-programme, why they felt certain factors would influence their self-beliefs in their abilities to successfully manage their knee OA (arthritis self-efficacy), and how the programme had affected their perception of managing their knee OA compared to before the programme.

1. **Managing and awareness of knee OA**
    a. Increased awareness of knee problems
    b. Treatments for knee OA
        i. Thoughts on total knee replacements
        ii. Painkillers to manage knee OA

2. **Symptoms of knee OA**
    a. Lack of trust and confidence in knees
    b. Interpretation of knee pain
    c. Knee symptoms during GLA:D™ exercises

3. **Thoughts of the GLA:D™ programme**
    a. Description of the GLA:D™ programme
    b. Introduction to the GLA:D™ programme
    c. Expectations from the GLA:D™ programme
    d. Motivation, support, and guidance from physiotherapists
    e. Satisfaction with the GLA:D™ programme

4. **Payment for the GLA:D™ programme**
    a. Comparison of the cost of GLA:D™ with TKR and normal physiotherapy and gymnasiums
    b. Affordability of the GLA:D™ programme
    c. Payment influences adherence to the GLA:D™ exercises
    d. Support needed with the GLA:D™ payments

5. **Life after the GLA:D™ programme**
    a. Ability to exercise and resume activity after the GLA:D™ programme
    b. Improvement in the management of OA and being more independent
    c. Notices a difference after starting the GLA:D™ programme
    d. Follow-up from physiotherapists after the GLA:D™ programme

6. **Adherence to GLA:D™ exercises**
    a. Importance of adherence to the GLA:D™ programme
        i. Preference with going to GLA:D™ classes than doing them at home
        ii. Strong sense of self-efficacy for GLA:D™ exercises
    b. Lack of adherence to the GLA:D™ programme

Figure 12 Coding scheme from thematic analysis of interviews

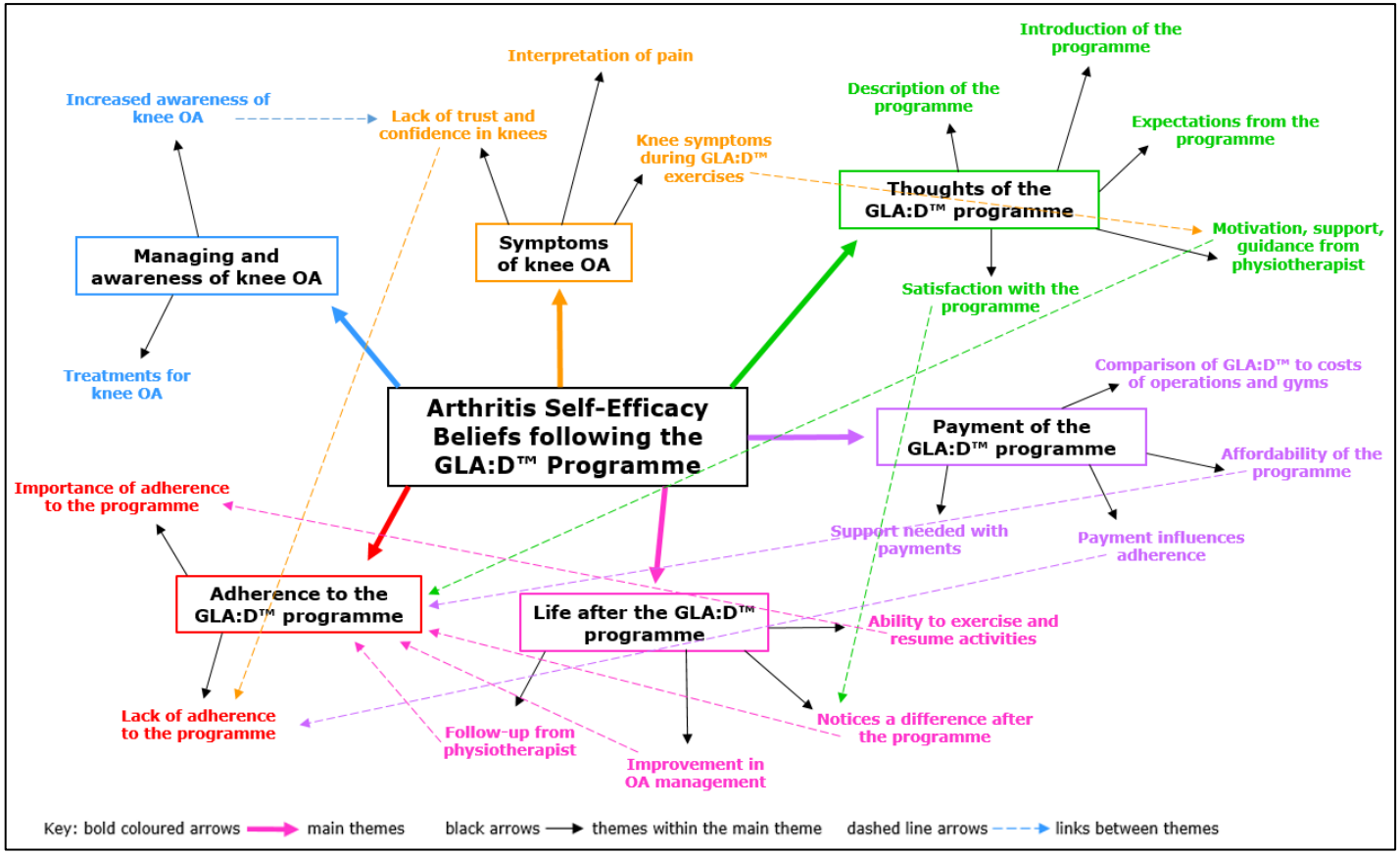


Figure 13 Thematic map of themes and links between the themes from interviews with GLA:D® participants

Additionally, a thematic map (Figure 13) was created to show a visual representation of the links between the themes. The following sections will describe each theme, the interesting aspects of the theme and why, the story that each theme and its sub-theme tells, and how they relate to other themes.

Six main themes and its sub-themes will be discussed in this section: 1) managing and awareness of knee OA; 2) symptoms of knee OA; 3) thoughts of the GLA:D® programme; 4) payment for the GLA:D® programme; 5) life after the GLA:D® programme; and 6) adherence to the GLA:D® exercises.

6.3.6.3 **Managing and Awareness of knee OA**

As a topic of the interview was how participants were managing their knee OA, this was explored in more detail, which developed the themes and sub-themes listed in Table 50.

Table 50 Themes and sub-themes within the main theme of 'Managing and awareness of knee OA

Main Theme	Themes	Sub-themes
Managing and awareness of knee OA and symptoms	Increased awareness of knee problems	
	Treatments for knee OA	Thoughts on total knee replacements
		Painkillers to manage knee OA

Increased awareness of knee problems

Before participating in the GLA:D® programme, most participants recalled becoming more aware of certain movements of activities that would aggravate their knee problems or simply found difficult due to their knees and limitations.

Participants described that they would avoid certain daily living activities which could worsen their symptoms, thus made activities such as walking up and downstairs more difficult.

"Before, it was, one pain from I open my eyes in the morning and also my legs woke me up at night. I mean it's still difficult for me to walk downstairs. Stairs are a pest." - Rikke

Treatments for knee OA

Thoughts on total knee replacements

There was a strong sense of participants not wanting to have a total knee replacement, as they had heard of experiences from others, which influenced their perception of potential negative outcomes of a total knee replacement. The knowledge of potential negative outcomes had led them to form a strong self-efficacy for exercise, as they viewed that exercise was beneficial for people with knee OA, to delay and avoid the need for a total knee replacement.

"You have to continuously do it [exercise], but I think it's a good thing, I'm very motivated that instead of being operated, you should exercise, it's very, very good. It's a good thing instead of just making operations." - Pernille

Painkillers to manage knee OA

The consensus from participants was that they did not like to take painkillers, as they have experienced bad side effects with them. Caroline also reflected that she did not see a difference that the painkillers make to her symptoms and does not understand why she was not feeling the effects of the painkillers

Well before I started the GLAD training, I took pain killers, during training, I also did and now afterward I'm also taking pain killers. No difference basically at all." – Caroline

6.3.6.4 **Symptoms of knee OA**

Participants discussed that they were more aware of their symptoms and described a range of different symptoms such as knees giving way, pain, how they felt about symptoms during GLA:D® exercises, and other symptoms such as stiffness and how these symptoms affect their management of knee OA (Table 51).

Table 51 Themes for the main theme of 'Symptoms of knee OA'

Main Theme	Themes
Symptoms of knee OA	Lack of trust and confidence in knees
	Interpretation of knee pain
	Knee symptoms during GLA:D® exercises

Lack of trust and confidence in knees

Even though participants had taken part the GLA:D® exercise programme, they talked about not being able to trust their knees again and still have a lack of confidence in their knees, because their knees have given way in the past and they were aware it could happen again without warning. This surprise factor has made them more aware of their own movements and has lowered their confidence about their ability to successfully manage their knee OA.

"Last Saturday, for instance, when I was doing my physical activity, well, my legs actually didn't buckle, so they gave way under me and that was quite unpleasant. I was surprised, and I would say also, a bit nervous that this might happen at some other time." - Mikkel

Interpretation of knee pain

Participants felt that pain was subjective, and everyone would have different thresholds and interpret pain very differently. Pernille also said that pain was psychological; it was not always easy to mark pain level on a piece of paper, because sometimes the feel of pain does not correlate with the damage in the knee.

"Sometimes it's very difficult to mark pain. What is pain? I think pain is sometimes also, erm, psychological it doesn't always need to be because you're knee is damaged or things like that." - Pernille

Knee symptoms during GLA:D® exercises

Some participants were aware that when they first started on the programme, they experienced knee pain due to the introduction of new movements to their

knees that had not performed before. However, with the guidance of a physiotherapist running the sessions, they persevered and noticed that their experience of knee pain gradually disappeared with time as their knees got used to the new movement.

"*Suddenly I had to do some new movements I mean move my knee in new and different ways. You know when your knee hurts, you kind of are over cautious, a little bit too careful and so when we started the training I could feel that immediately. Up until the time when you've actually gotten used to the specific movements, motion of the joint." – Caroline*

6.3.6.5 **Thoughts of the GLA:D® Programme**

Participants discussed in detail about their thoughts of participating in the GLA:D® programme (Table 52) from how they were introduced to the programme to what they programme, their expectations of the programme, to what the programme has given them in return in terms of motivation, support, and guidance on how to exercise and manage their OA.

Table 52 Themes within the main theme of 'Thoughts of the GLA:D® programme' (no sub-themes)

Main Theme	Themes
Thoughts of the GLA:D® programme	Description of the GLA:D® programme
	Introduction to the GLA:D® programme
	Expectations from the GLA:D® programme
	Motivation, support, and guidance from physiotherapists
	Satisfaction with the GLA:D® programme

Description of the GLA:D® programme

Participants described the GLA:D® programme and how many sessions they had. There was also a discussion about the class sizes; a couple of participants did not like the larger class sizes (between 8-9 people), as they felt it was too busy and there was not enough one-to-one time with the physiotherapist. Additionally, some stronger and chattier personalities in the class also took away some of the physiotherapist's attention for other patients in the class. Therefore, a class size of about 3-4 was the preferred size, as participants thought that this would allow the physiotherapist to spend some important one-to-one time with participants during the exercise class.

"The group was kind of big, I mean there were a lot of us there, 8 or 9 people there and, and some people just kept asking and asking questions, so it's like not all of us got a chance to ask our questions." – Caroline

Introduction to the GLA:D® programme

Participants described the different ways they were first introduced to the GLA:D® programme. Some participants heard of the programme due to word-of-mouth from their friends or relatives, some were recommended by their GP, and some saw it through advertisements through media outlets such as a radio or through their insurance company.

"A woman I know who participated in this GLA:D® study here and who were in the exercise group, she told me it was great, she could almost keep her knees free of pain." - Rikke

Furthermore, Pernille mentioned that GLA:D® should be more widely advertised because if it wasn't for seeing an advert through her health insurance company, she would not have heard about this programme.

"The information around this [GLA:D® Programme] is very poor because if I wasn't a member of the erm [points to her Arthritis Society membership pen], in Denmark and I didn't read it in this journal that I get every month I wouldn't know it existed, why should I know? From where?" - Pernille

Expectations from the GLA:D® programme

The main reason participants mentioned about why they sought help from GLA:D® programme was because they had no other choices and they had exhausted all avenues of non-surgical treatment options for knee OA. This was like a last resort for them and they had nothing to lose but to try out this programme. All they had was hope that GLA:D® would help them better manage their condition and lead to a better life. Most of the participants interviewed did not want a total knee replacement surgery, so they had to try this programme and hope for the best.

Rikke: I had to hope for a better life. And I got it. So now when people say to me "Oh you're doing these exercises twice a week, are you really? Oh, that's great." I don't think it's great, [it's] because I have no choice.

Interviewer: So, did you go in thinking "oh, just try it and we'll see what happens".

Rikke: Yeah, yeah. That's what I thought. It cannot get worse I thought. What should I do? My life was awful. So, I, I had no choice. At the moment when I bought the course, I really had no choice. I just had to hope.

Motivation, support, and guidance from physiotherapists

Nonetheless, participants were very complimentary about the physiotherapists. They felt that during the programme, they were able to develop a good relationship with their physiotherapist and they felt cared for by them. The physiotherapists were patient and let the participants have as much of their time as they needed to ensure that they were doing the exercises correctly and motivated them, reassured them, and provided them with encouragement to keep going. However, this was only during the 6-week period of the programme, as after that they either had to pay to have more sessions or you were not seen to after the programme ended.

"He would come over very nicely come and say "Ohhh, well it doesn't seem you're doing that quite in the right way and did you finish that other exercise completely and stuff?" [Participant laughs]. But it was good, I mean again, this person who is just keeping an eye on me. And that way it makes me get it done." - Caroline

Satisfaction with the GLA:D® programme

Overall, the five participants interviewed expressed their satisfaction with the programme as a whole and would highly recommend the programme to others who have knee OA. The main factor for this was being educated on the exercises that were safe and effective for people with OA and also seeing the difference that the programme has made in their mobility and quality of life.

"It was the two things, so it was two things, firstly, just the getting out of the house, having the activity as such and secondly, the improvement with the knee, so those two things together, it was really good." - Caroline

Rikke and Mikkel also spoke about the way the GLA:D® physiotherapists were able to tailor the programme and exercises for each individual to ensure that the exercises suited their abilities. This was important because it was also one of the reasons participants were satisfied with the programme and they were able to do the exercises at their own pace.

"We were 3 in the group and we could do different things, so they said, "if you cannot do it, or it hurts too much, you can try first to do it this way, or that way". So that was very nice…so when we improved they made that harder." - Rikke

"We had a coach who actually assessed us to find out how much we were able to do… that was a very good thing that the programme became based on the individual person." - Mikkel

6.3.6.6 **Payment for the GLA:D® Programme**

One major theme, which was unexpected from the semi-structured interview guide had not anticipated, was about the payment required to participate in the GLA:D® programme. All of the participants interviewed discussed this in detail from the pros of the costs of running this programme to the cons that people may not be able to afford the programme. Table 53 shows a summary of the themes within this major theme of payment for the GLA:D® programme.

Table 53 Themes within the main theme of 'Payment for the GLA:D® programme' (no sub-themes)

Main Theme	Themes
Payment for the GLA:D® programme	Comparison of the cost of GLA:D® with TKR and normal physiotherapy and gymnasiums
	Affordability of the GLA:D® programme
	Payment influences adherence to the GLA:D® exercises
	Support needed with the GLA:D® payments

Comparison of the cost of GLA:D® with TKR and normal physiotherapy

Participants discussed a lack of understanding of the cost of the GLA:D® programme and why it is so expensive and also made comparisons of the GLA:D® programme being expensive compared to physiotherapy sessions. Pernille was aware that total knee replacements are expensive and may not relieve patients of their symptoms of knee OA, so participating in an exercise class could be cheaper.

"But, if you then think, "ok, it's 2,000 kroner". But, if you then think of the operations made, for many, many people in Denmark, for bad knees and what I have learned is that they don't get better. So, I could then say it's very expensive to have these expensive operations and then instead of this, you should have another mindset saying "well, we will start this GLA:D® project and then we will have twice a month small classes where those who have been through this project can come" I think it will be motivating, very motivating. So, something could be done there, I think." - Pernille

Rikke mentioned that patients do not need to pay a knee replacement, so why do they have to pay so much to participate in an exercise programme? The

Danish healthcare system is like the NHS, where patients receive free healthcare including operations. Therefore, patients need to pay to participate in the GLA:D® programme, as it is not part of usual care for patients with OA.

"If you go to the hospital and have a new knee, you don't pay anything." - Rikke

"Why does the GLAD programme have to be so expensive when regular physiotherapy is not that expensive?" - Caroline

Affordability of the GLA:D® programme

All the participants interviewed had paid for the 6-week GLA:D® programme and praised the programme was worthwhile because they had noticed an impact on their life and the quality of life post programme. However, they expressed their disappointment about having to pay for the programme and mentioned that as knee OA often affects people who are retired (with low or limited income), therefore paying around 3,000 Danish kroner (approximately £300 Great British Pounds) for 6-weeks of education and exercise was seen as very expensive. Therefore, perhaps those who could afford the programme will be ones who benefitted from it.

"But you have to pay 3,000 kroner for this course. Very often it's people at my age, that we suffer from arthritis and many of them have, have stopped working and, ahh, for many it would probably be not easy to pay for the course. And that irritates me a little." - Rikke

But, Rikke expressed that she was willing to pay for the GLA:D® programme because she felt it was their last resort because she found the other previous methods to manage the condition and its symptoms hopeless. Paying for the GLA:D® programme was in the hope for a better quality of life.

Payment influences adherence to the GLA:D® exercises

Payment was a strong factor of influencing whether participants adhered to the GLA:D® programme after the 6-week programme period. Different people had different priorities; some put a huge amount of importance of the GLA:D® exercises, whereas others had other more important priorities in comparison.

Anne self-reported in the questionnaire that she was 100% confident she would be able to continue with the exercise programme and from the interview, she has kept up with the programme at home independently. She also preferred to be in an environment where she was physically at a class to receive extra support and guidance from the physiotherapist, so has paid for extra classes.

"*The great worry was how do we keep on? Luckily, this clinic has courses where you can join, you pay ahead five sessions that is just under 1,000 kroner. Again, hard for an old aged pensioner. But, luckily, I have erm, sick insurance that does cover part of the lessons. So that's great help. It's easier to do the lesson at home knowing that I've just been and I can go next week."*
- Anne

For Caroline, who was less fortunate with receiving extra help with payments from the health insurance company found that she could not afford to pay for the extra lessons, therefore she reflected that she has struggled to adhere with these exercises independently at home.

"It was said back then, I mean, at that time when we were doing the programme, it was said to us that "yes you can, come back", but it's expensive. As a retired person or a pensioner, you just don't have that kind of money. And so you have to say to yourself, ok, what do I want to pay? What bill do I want to pay? Or my rent? Or GLAD exercise sessions? And then that's just the last thing you choose. So if it could be done more cheaply then I do think I probably would have continued. Because I must say, my knee was doing quite well." - Caroline

For those who could afford to pay for extra sessions, the reason for continuing with the payment was because they could see the difference that it has made for them and they value the continued guidance and support they have received from the physiotherapist.

"It's the best money that I spent for years. But, in my case, I don't care. I don't care I just know [that] whooooa! It has had a huge impact on my life." - Rikke

"I do feel that those exercises are very important. So, I'm ready to do all I can to keep up with them. But I would love them to become cheaper." - Anne

Support needed with the GLA:D® payments

Participants saw that exercises were beneficial and helped them with their knee OA symptoms and management. Thus, they felt that the National Health

Insurance and Municipality needed to help cover parts of the payment in some way as this would be helpful for someone who is retired and may not be able to afford to pay for this useful programme.

"Well, I think that if society's interesting in people keeping fit and healthy and away from the operating theatre as long as possible, I think they should give more support, financial support to the participant. Now, I think that the Danish healthcare ought to support the exercise bit more than they do because it does save a lot of money at the other end."- Anne

6.3.6.7 **Life after the GLA:D® Programme**

Participants spent some time reflecting on what life was like after participating in the GLA:D® programme compared to life before, how they have seen improvements in how they managed their OA and noticed a difference in themselves and their health after starting the programme (Table 54).

Table 54 Themes within the main theme of 'Life after the GLA:D® programme'

Main Theme	Themes
Life after the GLA:D® programme	Ability to exercise and resume activity after the GLA:D® programme
	Improvement in the management of OA and being more independent
	Notices a difference after starting the GLA:D® programme
	Follow-up from physiotherapists after the GLA:D® programme

Ability to exercise and resume activity after GLA: (before and after, knees still bad)

All the participants' interview compared what life was like before and after participating in the GLA:D® programme, paying particular attention to describing how daily activities were much more difficult before they started the GLA:D® programme and their ability to resume activities they previously found difficult.

"I mean the arthritis has not gone away but I mean [short pause] I can almost keep my legs free from pain. I can walk, I cannot say that it's painless, but it's ok!" - Rikke

Confidence in managing knee OA

Participating in the GLA:D® programme had gained confidence in their beliefs and ability to perform these exercises at home independently because they were able to feel the positive outcomes of the exercise sessions. Additionally, for participants with higher self-beliefs in their ability to exercise, they had the determination and drive, which helped enabled them to integrate the exercise routine into their normal routine compared to participants with lower self-efficacy for exercise.

"I'm feeling more confident this way that I'm doing now. I'm an old lady and I'm not planning to become 110 [but I still have] another 15 years ahead of me, at least to remain independent. Now I know what to do, where to put things and in what order. That's part of my life doing those exercises." - Anne

Notices a difference after starting the GLA:D® programme

Participants described how they have noticed a difference since starting the GLA:D® programme and was surprised by how much the GLA:D® exercises had made a positive difference to them and improved their physical function and reduced their symptoms. Additionally, their friends and families have also seen a difference in them. The sense of being able to feel a difference in their physical function and reduced symptoms was very important for participants, as they felt positive and increase their self-beliefs in their abilities to successfully manage their arthritis.

"And then I suddenly realise that after a few weeks there was an improvement. I mean, I could walk from the training room, and I could just walk over to the bus without even taking a break. It did strike me quite suddenly [I] said "whoa, I'm standing at the bus stop, I didn't even take a break"… So there was big change…I could definitely feel the difference." - Caroline

Anne and Caroline also made comparisons of the GLA:D® programme with conventional gymnasiums and normal physiotherapy, which they could not see a difference in their health compared to the GLA:D® exercises. Therefore, being able to compare what GLA:D® was like to the other programmes that were out there helped inform patients that there was an exercise that was safe for them and could help them improve at how they manage their symptoms.

"But there was something about this GLA:D® group, about this programme that just made us do it, there really was a change. We could feel it, we could feel something." – Caroline

Follow-up from physiotherapists after the GLA:D® programme

Participants discussed in detail about the importance of wanting follow-up sessions from physiotherapists after the 6-week GLA:D® programme had ended. They reflected on the lack of follow-up with the physiotherapist to make sure they were still doing the exercises correctly. An aim of the GLA:D® programme was to provide patients with independence and build their confidence in the 6-weeks to ensure they can carry on with these programmes at home in the long-term and independently. However, from the participants' point of view, they got a sense from the programme that each movement they did in the class was specific and their feet and knees had to be aligned when bending, therefore their concerns were doing these movements wrong at home. Regardless of whether participants had a high or low sense of self-belief in their abilities to continue with these exercises at home, both groups reflected that they feared they would cause themselves more injury if they had developed bad habits and started to do the exercises wrong. Pernille was disappointed that she has had no contact with the physiotherapist a year after the programme and felt lost without that continued reassurance.

"It's painful to do these exercises and sometimes I think after a year? Is this still so? Why isn't it a little bit better? Or do I do the exercises correctly? That's very important. You can easily do the exercise wrong and you can make damage, so I think when the course is finished, then you're lost." – Pernille

6.3.6.8 **Adherence to GLA:D® Exercises**

Participants discussed the factors that were important for them and the reasons why they adhered or not adhere to the GLA:D® programme after the 6-week class with the physiotherapist (Table 55).

Table 55 Themes and sub-themes within the main theme of 'Adherence to GLA:D® exercises'

Main Theme	Themes	Sub-themes
Adherence to GLA:D® exercises	Importance of adherence to the GLA:D® programme	Preference with going to GLA:D® classes than doing them at home
		Strong sense of self-efficacy for GLA:D® exercises
	Lack of adherence to the GLA:D® programme	

Importance of adherence to the GLA:D® programme

Rikke, Anne, and Pernille all stressed the importance to continue keeping up with the programme and how they felt they must do it for the rest of their lives and be able to integrate the exercises into their lifestyle from now on. From the interview, these three participants seemed to have the most self-belief in their abilities to continue exercising (exercise self-efficacy) and confirmed in the interview that they were still doing the exercises at home and keeping active in general.

"I'm sure I must until I die [laughs] I think they're very important. But that's part of my life doing those exercises. Yeah, because I feel the difference and the fact that I've done them, sort of give me the right to feel better." - Anne

Mikkel mentioned that he was struggling to adhere to the GLA:D® programme after the 6-week programme period because he felt it was important for him to stay motivated and needed something interactive to continue with the programme. He suggested that the GLA:D® programme should come with a motivational tool, such as a mobile application that allowed him to track his progress, send reminders to exercise, and a place that allowed him to set goals and see his achievements. Another advantage of a motivation tool could allow patients to feel like they still have some guidance and direction to adhere to the programme after the programme has ended.

"Let's say that you had some sort of goal, something that said, "well, you can presumably reach that, this would be something you could strive for" and then that could relate to either the GLA:D® programme or the weight, or both, for instance. So, you had something, some sort of direction, some sort of indications." - Mikkel

Preference with going to GLA:D® classes than doing them at home

Participants discussed how they preferred to physically go to the clinic for their GLA:D® exercise sessions rather than doing it at home, because they felt that if they needed to physically go to an exercise class then they needed to have scheduled time out of their day to attend the class, whereas, at home, it was easier to make excuses not to exercise.

"I'm not very good at getting my training done at home, I mean if I'm sort of in pain that day I'll say that I'll wait 'til tomorrow, so actually I'm better at going

somewhere and then doing the exercises there. Because if you do that then you kind of get it done." - Caroline

Also, the aspect of having a physiotherapist there to listen to their concerns, reassured, and encourage them in a class setting made them preferred going to the class.

"If there's no one there to reflect on, it's like I just don't feel like doing it, I don't wanna do it, so what I need in a way is someone saying to me, you know, they're saying to me "whoa, you did it now, you done it. Look now, you've done it. And then that makes me want to actually do it and get it done."- Caroline

The social aspect was also important to the participants because they were with a group of people who they could bond with over the exercise sessions and it was a chance for them to get out of the house to meet people.

"You have this sort of interaction between you going on, you know, talking back and forth within the group there's also the social aspect. Yes, there's the teacher and there's the social aspect, and the fact that you actually have your scheduled time, you have your time slots." - Mikkel

Strong sense of self-efficacy for GLA:D® exercises

Participants who have shown a strong sense of self-efficacy for exercise had more resilience and determination to keep going with the exercises even if they did not want to. They were able to integrate the programme into their

daily lives and adhere better to exercise as they were more willing to be flexible to ensure they fit in their weekly exercise session.

"It has changed my life, I have to put it into my diary, usually Saturday morning do GLA:D® exercises and if sometimes I must attend a social function on a Saturday, I cannot do them in the morning, because I never know whether I'm totally exhausted the rest of the day or whether I'm bouncing like a tennis ball. So, then I do them then either on Friday, which is really too early or on Sunday, which is ok." - Anne

Lack of adherence to the GLA:D® programme

Those with lower self-efficacy for exercise had the knowledge of the benefits of adhering with the exercises and have seen the benefits that the GLA:D® exercises have had on their mobility and symptoms, yet they have still found difficult to continue with them on their own. For Mikkel, it was due to the lack of willpower to continue with the exercises. Also, as he no longer felt any pain in his knees, he less motivated to continue with the exercises, because he felt fine. Similarly to Anne, Mikkel was aware that to continue regular exercise, he needed to set out time aside for it, however, the determination was not there to keep going, as he did not place enough importance of these exercises as Anne did with hers.

"I didn't have any pain, but then, unfortunately, I didn't continue the programme. It's, [laughs] lack of willpower [laughs]. When I don't have pain, I feel that things are going ok, then sort of, why would I need to, why would I feel like I need to do the exercises. Well, of course, I know that a person ought to exercise to improve the muscle strength and so on. I think that there should be, you know, some sort of structure you could say. One thing is making plan,

but then you also have to make a time-frame...It's easier not to do it than to do it." - Mikkel

Whereas, for Caroline, she explained that she was a sort of person that needed constant motivation and encouragement to exercise. Having lost her husband, whom was her main motivator has been really tough on her. Also, with the ending of the 6-week GLA:D® programme with the physiotherapist, she has felt a lack of motivation to continue with them, as she was no longer getting the encouragement from the physiotherapist.

"I've had one of those period where I said where I was in the cellar, you know down in the cold cellar, my mood had not been good and that also means that I've been gaining some weight! So putting on weight of course is not a good thing for my knee either. And also, if your mood is really not up to it, it's really not easy. I'm the type who needs to have someone flicking the whip over the back of my neck saying you can do it, you can do it. I'm not the kind of person who just is self-motivated, so I need someone to keep an eye on me." – Caroline

6.4 Discussion

Quantitative findings found that exercise self-efficacy, general health status, knee pain perception, and mildly troubled by the lack of knee confidence were statistically significant predictors of arthritis self-efficacy.

Self-efficacy is task-specific (McAuley et al., 1991) and exercise has been shown to improve mobility-related self-efficacy (Focht et al., 2005). Consistent with previous findings, the findings from this study showed that participants

with high exercise self-efficacy reflected in the interview that they were able to see positive differences the exercise has had on their symptoms and felt they needed to continue with these exercises for the rest of their lives to control the symptoms of their knee OA. This may explain why the high level of self-belief in continuing with exercise was predictive of their self-belief in their ability to successfully manage their arthritis.

On the other hand, those with lower exercise self-efficacy reflected that despite experiencing the positive benefits and improvement in symptoms from exercise, they still had very low motivation to continuing with the exercises independently at home. This finding was contrary with previous qualitative research compliance with physiotherapy in people with knee OA (Campbell et al., 2001), who found that patients who had noticed an improvement in their knee symptom after physiotherapy were more likely to comply than those who did not. The qualitative findings from the thesis indicated that motivation for exercise was a strong factor of whether participants had high self-efficacy to continue with exercise regardless of their knowledge about the benefits of exercise.

Knee confidence was the strongest predictor of arthritis self-efficacy. Specifically, those with high knee confidence had higher arthritis self-efficacy compared to those with lower knee confidence. When participants were asked during the interview study about what caused their perception of low knee confidence, their response mirrored the interview participants who had not participated in an OA specific education and exercise programme from the interview study in Chapter 5. Both groups of participants reported the lack of

knee confidence was due to previous negative experiences of their knee giving way and they could not predict when their knee would give way again, which decreased the confidence they had around their knees. Therefore, this indicated that involvement in the exercise programme was unlikely to have improved people's confidence around their knees, as they were still conscious that their knees could give way again in the future. This finding helps explain why Skou et al. (2015) may not have found an association between functional performance and muscle strength with knee confidence. This further support that the perception of low knee confidence could be due to a psychological factor rather than physical factors. Further research is required to how to improve people's knee confidence and explore the impact that negative experiences have had on people living with knee OA and the confidence around their knees.

Previous research had reported that strengthening exercises in rehabilitation programmes for people with OA had improved their strength, pain, function, and quality of life (Pelland et al., 2004) and having the confidence to exercise was a crucial behaviour for managing most arthritis conditions as it significantly improved the physical, social, and the health status of persons with arthritis (Wright et al., 2008). The quantitative phase of this study in the thesis contributed to the current literature that general health status was a predictor of arthritis self-efficacy beliefs in people with knee OA. This finding was consistent with previous findings on arthritis self-efficacy levels explained health status in people who have been diagnosed with rheumatoid arthritis and hip and knee OA (Cross et al., 2006). The interview study of this thesis extended the current knowledge, as participants reflected that being in the

exercise programme had improved their knee pain and physical functioning, such as being able to walk for longer, which has improved their quality of life. The improvement in their symptoms improved the perception of their quality of life and health status, as they had noticed a positive difference in their symptoms and physical function before and after the programme.

Furthermore, Bandura (1977) suggested that self-efficacy could improve when exercise was performed in a group setting due to the social interaction between study participants. Similarly to this, the participants from the interview study in this thesis reflected on the benefits of attending a group exercise class allowed them to leave the house and have social interactions with other people who also live with OA where they have a mutual understanding of what each other are experiencing.

Knee pain perception was a predictor of arthritis self-efficacy; those who perceived more knee pain were more likely to have lower self-beliefs in their ability to manage their arthritis. Participants from the interview study of this thesis were aware of the types of movements and activities that caused them more knee pain. Most participants also mentioned that when they started the GLA:D® programme, they felt symptoms in their knees, primarily knee pain as they were doing new movements from the exercises which their knees were not used to. However, participant reflected that it was useful to have a physiotherapist present, as they were able to discuss their concerns with them and they were reassured that a little bit of pain initially was to be expected and their pain should ease as their muscles became stronger.

Everyone who was interviewed was satisfied with the GLA:D® programme in terms of the guidance and support they received from their physiotherapist and the positive improvements in their symptoms. However, participants also mentioned that the payment for the GLA:D® programme frustrated them. This was a new theme that had not been anticipated by the author, so this was explored further with all the participants during the interviews. Participants mentioned the pros and cons of the payment of the programme, but the majority were concerned that other people with knee OA may not be able to afford to pay the equivalent of £300 for a 6-week programme. Participants who participated in the GLA:D® programme were able to afford to pay for the programme and felt they had no other choice but to try and see if the programme would have benefits for them.

But some mentioned that despite seeing the benefits the programme has had on their knees and their quality of life, they were unable to adhere to the programme, as they were unable to afford to continue to pay for the programme. These participants were the ones with lower self-efficacy to manage their arthritis and lower exercise self-efficacy, so felt they needed to physically attend a class in order to adhere to the exercises. For participants who had higher self-efficacy for managing their arthritis, they were able to integrate the exercises into their everyday lives and make time to do these exercises; seeing the benefits from the programme has motivated them to continue with the exercises independently.

However, participants felt that they did not have any follow-up from their physiotherapist after the programme had ceased. They wished that the follow-

up sessions with their physiotherapist would continue and would be beneficial to reassure them that they were still doing their exercises in the correct manner and as a motivation for them to continue to adhere with these exercises in the long-term. Even though the aim of the GLA:D® programme was to provide patients with independence and the confidence to do these exercises at home in the long-term once they have completed the programme. However, from the perspectives of participants who were interviewed, those with higher self-efficacy for exercise and arthritis felt that a review of their progress after 6 months or a year would have been beneficial as they feared that they could be doing more damage to their knees. This was of concern to one of the participants who felt that her knees have not improved, and she still felt pain one year after the programme, despite adhering to the exercise programme and integrating into her lifestyle.

'Service evaluation' aims to judge the quality of the current service and is initiated by the service providers (Twycross and Shorten, 2014). It does not involve new treatment or randomisation. In contrast, 'research' aims to generate new knowledge and/or add to the body of knowledge and is initiated by researchers. The results of service evaluations are mostly used to generate information that can be used to inform local decision-making. Research involves the attempt to extend the available knowledge by means of a systematically defensible process of inquiry.

The Denmark study in this thesis is 'research' because it aimed to provide new knowledge regarding arthritis self-efficacy in a population of people living with knee OA who had recently participated in an education and exercise and

comparisons were made with how they perceived their self-management and symptoms to be before and after the programme.

This study did not evaluate the quality of the content of the programme provided to patients/participants. A ‘service evaluation’ would have sought to assess how well the service was achieving its intended aims. It would have been undertaken to benefit the people using that particular healthcare service and would have been designed and conducted with the sole purpose of defining or judging the current service.

There were limitations to this study, the first being the sample size of the interview sample. Even though qualitative studies do not focus heavily on the sample size, but rather on the content and depth of information gained from each interview, the themes did not reach a saturation that was desired. On the last interview with Mikkel, he spoke about methods to use to motivate him to continue with exercising and spoke about potentials for creating an Application for mobile devices which could remind him and motivate him to exercise. It would have been beneficial to explore this future with subsequent participants. However, due to the lack of time and the logistical issues of not having locations to conduct interviews at other municipalities in Denmark, some new themes could not be explored further.

A selection bias may have occurred in the selection of interview participants in this study. Due to time and logistical limitations, only five participants were interviewed, all of who came from the same city. However, a similar selection process of participants to Study 1 was used. That is, participants in Study 2

were also selected using a purposive sampling method to ensure that the people interviewed were varied in their perception of arthritis self-efficacy (high or low) and their perception of their troubles with their knee confidence (not/mildly troubled and moderately/severely/extremely troubled) to have an understanding of the different points of views. Thus, at least one person from each arthritis self-efficacy and knee confidence quadrant was interviewed.

Conducting a study in Denmark when the author did not speak Danish was a linguistic issue and a limitation for this study, as language and meaning of words and phrases were changed during the process of translation and interpretation. Therefore, precautions were taken to ensure one professional and experienced interpreter who is fluent in Danish and English, and culturally aligned with both countries, was used during the interview to maintain consistency and conceptual equivalence of the concepts and phrases they were interpreting. Also, some might argue there was a disadvantage of the interpreter asking participants to speak in shorter sentences. However, the participants were informed that this was to ensure that the interpreter could relay the information to the interview in as much detail and accuracy as possible to maintain conceptual equivalence. The interpreter also made sure to discuss with the participant to reaffirm that they had grasped the meaning of what the participant was trying to say accurately and in the correct concept has been understood.

Chapter 7

Discussion

Chapter 7: Discussion

7.1 Chapter Introduction

This chapter will revisit the purpose of the thesis. The key results from the surveys will be discussed alongside the qualitative interview findings, as these interview findings were used to help provide explanations for the survey findings. These results will be examined in relation to existing research, the importance of the finding, and how this adds to the current literature will be described. The strengths, limitations, and implications of the studies in this thesis will be presented in the second half of this chapter.

7.2 Discussion of Findings

7.2.1 Factors Associated with Arthritis Self-Efficacy

The purpose of this thesis was to investigate and explore the factors associated with arthritis self-efficacy from the perspectives of people living with knee OA.

A review of the current literature identified that psychosocial factors such as self-efficacy, anxiety, and depression affected patients' arthritis outcomes such as knee pain and physical function; particularly, self-efficacy can act as a mediator for the outcomes of knee pain in a people with knee OA. Patients living with arthritis with lower arthritis self-efficacy had a higher pain perception, more symptoms, and more physical limitations. Furthermore, people with lower exercise self-efficacy were less likely to adhere to exercise,

and people with worse knee confidence had poorer functional outcomes and higher pain perception.

Findings from the multiple linear regression model in the sample of participants with knee OA described in Study 1 (Chapter 4) found that exercise self-efficacy, depression, knee pain perception, not being troubled by the lack of knee confidence, and being female statistically significantly predicted the arthritis self-efficacy score. However, the variances in arthritis self-efficacy remained unexplained, suggesting that there are still additional factors that affect arthritis self-efficacy beliefs in people living with knee OA.

From Study 2 (Chapter 6), a sample of participants living with knee OA who had recently participated in the GLA:D® education and exercise programme, found that exercise self-efficacy, general health status, knee pain perception, and being mildly troubled by the lack of knee confidence were statistically significantly predicted arthritis self-efficacy score. But, there were also variances in arthritis self-efficacy which remained unexplained.

The following sections will explore potential explanations for why these factors predicted arthritis self-efficacy beliefs. Additionally, other factors that were not investigated in this thesis may have contributed to arthritis self-efficacy in people with knee OA will also be explored.

7.2.1.1 **Exercise Self-Efficacy**

The new finding from this thesis of exercise self-efficacy being predictive of arthritis self-efficacy adds to the current literature on self-efficacy, as this could suggest that exercise self-efficacy may improve people's arthritis self-efficacy. However, the marginally significant findings from Hughes et al. (2006) and the findings from this thesis should be interpreted with caution, as there are still variances that are unaccounted for.

The sample from Study 1 and Study 2 were not directly comparable with each other as the participants were recruited from different countries (UK and Denmark, respectively). The aim was not to make a direct statistical comparison between the samples, but the differences from the sample characteristics were considered an advantage of the thesis, as the results provided a wider range of perspectives from those who have received standard care and those who have recently received an OA-specific programme.

The importance of exercise self-efficacy had been reported in previous studies. Enhancing exercise self-efficacy was associated with exercise adherence (Gecht et al., 1996, McAuley et al., 2003, Oliver and Cronan, 2002), important for sustaining initial programme benefits (Stenstrom, 1994) and physical activity goal achievements (Knittle et al., 2011). Most participants from Study 2 of this thesis reported a high exercise self-efficacy and reported to adhering with the GLA:D® programme after the 6-week programme period had ceased. However, it was unclear if these findings if participation in the programme led them to have higher exercise self-efficacy and exercise

adherence. There could be a bias in over-reporting of physical activity level and exercise adherence from the participants in Study 2.

Furthermore, baseline self-efficacy is important in predicting a decline in physical function and for participants who have poor baseline quadriceps and hamstring muscle strength (Rejeski et al., 2001, Sharma et al., 2003). If people have low self-efficacy, they may have reduced physical function due to their poor muscle strength. People with higher self-efficacy may have higher physical function capability, due to their stronger muscle strength. Thus, participants from Study 2 of this thesis who reported higher self-efficacy may have stronger knee muscle strength and better physical capacity compared to those with lower self-efficacy, and a better outcome was reported for participants in Study 2. But these objective outcomes were not measured in the thesis. Future studies should address the aspects of objective measures such as quadriceps and hamstring muscle strength and objective physical function tests (such as stair climb test or the sit-to-stand test) and their relationship with arthritis self-efficacy and exercise self-efficacy before and after an intervention programme.

Findings from semi-structured interviews from both Study 1 and Study 2 contributed to, and extended the knowledge in the current literature in self-efficacy and OA by allowing the exploration with people living with knee OA on how they perceived their self-beliefs in their abilities to exercise influenced whether they adhered to exercise and the extent of their self-beliefs in their ability to successfully manage their arthritis.

Even though participants from Study 1 had not recently been involved in an OA-specific education and exercise programme, exercise self-efficacy was the highest predictor of arthritis self-efficacy. The interview study revealed a reason for this could be because they were keeping active by participating in general sports and exercise such as hiking, cycling, playing golf, and swimming. These participants had actively integrated these into their weekly routine and set out certain days of the week for each activity. These findings were true for people with higher exercise self-efficacy and were able to adhere to these activities in the long-term, as they saw it as a part of their lifestyle.

When participants were asked why they were able to adhere to exercise and physical activity, they reflected on their enjoyment of the sport and the social aspect. However, most of the participants were able to adjust their lifestyle to suit their functional capability and their abilities and this also included the amount and type of exercise they were doing. They saw exercising and staying physically activity as part of the management of their knee OA by keeping mobile and coping with their symptoms. It is important for people with knee OA to increase the confidence they have in their ability to maintain exercise to help increase their self-beliefs in their ability to successfully managing their condition. Thus, this evidence also supports previous studies who reported that supporting and enhancing patients' arthritis self-efficacy beliefs was important (Brassington et al., 2002) as this affected the extent to which they were physically active (Reinseth et al., 2011) and their ability to adjust to their condition (Packham and Hall, 2002, Wright et al., 2008).

Study 2 of this thesis had a cross-sectional study design and thus, a cause-effect relationship of the programme on self-efficacy could not be determined. However, participants made comparisons during their interviews of what their symptoms and physical function was like before and after the programme and reflected that they felt positive changes in their symptoms and mobility after being involved in the programme.

The participants from Study 2 of this thesis also reflected that the programme had increased the confidence they had in their ability to continue exercising regularly after the programme (they had a high exercise self-efficacy). Especially as they were shown how to conduct these exercises safely and effectively by a physiotherapist. This also supported one of the sources of self-efficacy beliefs, mastery experiences, which is gained through task performance accomplishments and can strengthen perceived self-efficacy and bring about behaviour change (Bandura, 1977). This was particularly evident in the individuals who also had more self-motivation and determination to integrate the exercises into their routine, as these individuals would mark out specific days each week for them to do the GLA:D® exercises.

Kerns et al. (1997) proposed that people living with chronic pain varied in their readiness to accept and adopt a self-management approach to manage their pain. According to the readiness-for-change model (Kerns and Habib, 2004), some people who believed strongly that their pain was “medical” and required surgical treatment, were unlikely to accept a self-management approach. Other individuals, such as some participants from Study 2 acknowledged that medical interventions were limited and they were against having a total knee

replacement, so these participants may have been more willing to accept a self-management treatment, such as the GLA:D® programme. Additionally, self-determination and motivation to want to keep active and exercise were important factors in increasing exercise self-efficacy and improve self-beliefs in people's ability to manage their exercise self-efficacy. However, self-determination and motivation to exercise were not measured in the questionnaire studies in this thesis, so statistical predictions could not be made about whether these factors could predict exercise self-efficacy and arthritis self-efficacy.

A previous study reported that people with knee OA who had poor self-efficacy for self-management had lower motivation for exercise (Bennell and Hinman, 2011). Motivation and self-determination were not explored through a survey in this thesis but was discussed during the interviews with participants who had recently been a part of the GLA:D® programme (Study 2). The individuals who did not continue with the GLA:D® exercises after the programme discussed their lack of motivation for exercise despite seeing the benefits and positive change in their symptoms and mobility during the programme. When asked about how they felt they were managing their knee OA, individuals with higher exercise self-efficacy felt they were managing their knee OA well and their symptoms were better than before.

Whereas, participants who had less exercise self-efficacy felt they were unable to manage their arthritis and its symptoms as effectively as when they were involved in the programme and some participants feared they were doing the exercises incorrectly. As performance accomplishments of

successfully performing GLA:D® exercises can improve self-efficacy, Turk and Okifuji (2002) suggested that self-efficacy may play a role in fear avoidance. Therefore, those who feared to injure themselves when they were exercising may have lower self-efficacy. Having the presence of a physiotherapist and a guided exercise programme was important in exposing patients to their feared activities (i.e. exercises for their knee OA) without experiencing their anticipated negative consequences of exercise (such as causing themselves more injuries) can reduce their fears and increase their perceived self-efficacy for exercise and arthritis management. Fear avoidance was not measured in this thesis and would benefit from investigating if this is a factor for people who have experienced the GLA:D® programme.

The findings from this thesis indicated the importance of targeting people with low self-efficacy for exercise and try to build on their self-beliefs and motivation for exercise, as people with low motivation were aware and had seen the benefits of exercising, but having this awareness of the positive effects of exercise was not enough to motivate the participants to increase their self-beliefs in their abilities to continue with the exercises and their motivation to exercise.

7.2.1.2 **Depression**

Previous studies that investigated pain and physical function as main outcomes in people with knee OA have reported that depression and anxiety were associated these outcome measures (Ayers et al., 2005, Ayers et al., 2004, Brander et al., 2007). The prevalence clinical moderate to severe

depression (PHQ score of ≥10) in Study 1 of this thesis was lower than that of another study that recruited lower limb OA participants from a rheumatology clinic in the UK (Axford et al., 2010). The difference in prevalence may have been due to the location of recruitment of these participants. People recruited from rheumatology clinics may have more severe symptoms of OA compared to those in primary care (GP practices) and may have been more depressed and or anxious.

However, the sample in Study 2 of this thesis had considerably less prevalence of depression with 7.4% reported a PHQ-8 score of ≥10 (data not shown) compared to the sample in Study 1. The prevalence of depression in Denmark was reported in 2004 as 4.1% of the population (Olsen et al., 2004), therefore not too dissimilar the prevalence of depression reported in the UK. A possible reason for a low number of people with depression could be due to those with severe depression might be physically less able to participate in an exercise programme due to their functional limitations (Riddle et al., 2011). Depressive symptoms have also been consistently demonstrated to be associated with increased pain and functional limitations in people living with knee OA and OA from previous studies (Axford et al., 2010, Dunlop et al., 2005, Kroenke et al., 2011, Rathbun et al., 2017, Riddle et al., 2011).

Even though overall, the sample of participants in Study 2 showed no signs of depression from the questionnaire survey, during an interview with Caroline, who fell under the “mildly depressed” category in the PHQ-8, reflected that she had sprained her ankle and could not continue with the GLA:D® exercises at home. This was partly due to initially the pain of the sprained ankle and

latterly lost all motivation to exercise. She explained that she had recently lost her husband, who was her main motivator and life companion, and she would sit in the cellar feeling down. Despite seeing the positive difference in her symptoms and physical functioning during the GLA:D® programme (i.e. less knee pain and could walk further without a break), and feeling more knee pain again after not continuing with the exercises, she had been unable to get herself out of the house or motivate herself to exercise, and therefore unable to manage her arthritis pain, which she felt had worsened. From what Caroline mentioned, it seemed like having depressive symptoms independently affected her self-efficacy to manage her arthritis, regardless of knowing the reasons why she should continue with exercise and previously feeling good about herself and her ability to successfully manage her arthritis. This interpretation is similar to findings from previous authors (Turk and Okifuji, 2002), that patients who felt little they could do to control their symptoms will expend minimal effort to control their symptoms, and may become emotionally distressed, which in turn amplified their symptom perception.

Marszalek et al. (2016) reported that less depressed mood was significantly associated with higher outcome expectations of exercise. This supported previous research that depressed individuals were more inclined to hold a pessimistic attitude about exercise outcomes (Pomp et al., 2012). Depressed individuals tended to think negatively, which in turn reduced their outcome expectations for exercise (Kramer et al., 2014). However, Marszalek et al. (2016) did not find a significant association with outcome expectations for exercise and OA-specific variables such as pain, function, and radiographic severity at baseline, indicating these factors may not influence people's

expectations of exercise. Caution is needed while interpreting these results, as this study population were people with knee OA seeking treatment and were willing to participate in an exercise intervention, which reflected a positive skewed outcomes expectation score. A variation in outcome expectations may occur in a population that also included community-dwelling adults with knee OA and may not be actively seeking treatment for OA.

7.2.1.3 **Knee Pain Perception**

Knee pain was the most common symptom in people with knee OA in both samples from Study 1 and Study 2. Previous research reported that higher arthritis self-efficacy was associated with good 2-year pain experience outcome (Rayahin et al., 2014), and arthritis patients with low perceived self-efficacy were likely to experience poor health outcomes, especially excessive pain (Somers et al., 2009). The findings from this thesis added to the literature specifically in terms of how people with knee OA perceived their knee pain, which statistically significantly predicted their arthritis self-efficacy. Thus, those with higher levels of knee pain were predicted to have lower arthritis self-efficacy (lower self-beliefs in their abilities to successfully manage their arthritis).

The interview findings from Study 1 helped explain, from the perspective of people living with knee OA, how people perceived their pain and how they felt this affected their self-efficacy to manage their knee OA. A large part of their perception about being able to successfully manage their condition was to do with their ability to manage their knee pain, remain physically active, and the

ability to carry out their daily activities. Therefore, participants were determined to manage their knee OA by keeping their knee pain levels low.

Participants in this thesis were highly aware of the activities that would cause them knee pain, such as bending, kneeling, playing tennis, or going on long hikes (more than 10 miles), so they would avoid these activities. Turk and Okifuji (2002) suggested that fear is a natural consequence of pain and avoidance of activities might aggravate an initial injury was a reasonable action for people experiencing pain, but this could exacerbate further pain and functional limitations. During the interviews for Study 1, Iris and Martha both came across as hyper-vigilant, cautious of their movements, and feared they would have functional limitations and unable to continue to carry out their daily activities if their knee OA became more severe and they could no longer manage their symptoms. This hyper-vigilant behaviour could lead to fear avoidance of activities. However, even though Iris and Martha were aware of what activities would increase their knee pain, they were extremely determined in keeping moving and remaining as active as possible to mitigate against and find solutions to the problems and symptoms associated with their knee OA. Therefore, it could be argued that from Iris' and Martha's perspectives, the fears and worries about progression to severe knee OA and limited function had increased their motivation ensuring they did everything they could to successfully manage their arthritis and knee pain level. This indicated that fear and activity avoidance may play a role in knee pain and arthritis self-efficacy.

Participants with higher self-efficacy for managing their OA were more willing to adjust their activities and lifestyle, such as going on shorter hikes and participate in low impact sports such as golf instead of tennis, to remain active and to reduce their knee pain. The ability to remain active and mobile was important for the participants interviewed. They reflected that they continued to be physically active because they enjoyed the activities and they were aware of how to adjust their activities levels. This finding was similar to that reported by Wright et al. (2008) who stated that people with lower self-efficacy in the management of knee OA had less ability to adjust to their condition. Thus, being able to reduce their pain to a manageable level was key to having a good quality of life and their positive outlook on knee OA management.

Knee pain was a predictor of arthritis self-efficacy from the multiple regression model for participants from Study 2, who had recently participated in an OA-specific education and exercise programme (the GLA:D® programme). To explore the reasons why this factor was an important predictor of people's self-beliefs in their abilities to successfully manage their knee OA, participants discussed at the interview at their shock and surprise that they could feel a difference in their knee pain level after three to four weeks of being on the programme. They noticed that they were able to walk longer distances without their knees being in pain and had better mobility compared to what they were like before the programme. The ability to see the difference in their knee pain before and after the programme had probably made an impact on how participants perceived their abilities to successfully manage their arthritis, as they had gained knowledge from the programme on how to manage their knee pain and therefore had a positive outlook on managing their arthritis.

Previous research into pain coping strategies had reported that in a population with OA, those who relied on passive pain coping strategies such as retreating, worrying, and resting the knee, were significantly more likely to report higher levels of pain and functional impairment compared to those who adopted active coping strategies such as using distraction, and reducing demands (Perrot et al., 2008). However, pain coping strategies were not measured from the questionnaires in this thesis, therefore comparisons cannot be made with pain coping strategies and arthritis self-efficacy. Although, the interview studies from this thesis was able to provide additional new information to the current literature from patients' perspectives. Most people living with knee OA seemed to have active pain coping strategies, in the sense that they were reducing the demands of the activities that heightened their pain and they were adjusting their lifestyle and activities to decrease their knee pain whilst still maintaining physically active. Those who worried more about their pain were more aware and cautious of what would increase their knee pain level. It could be argued that not all people who have a passive coping strategy will report a higher level of pain compared to those with active coping strategies, because those who were more cautious would avoid activities that caused them pain, to try and maintain the low keep pain they were feeling.

7.2.1.4 **General Health Status**

Previous studies have shown that higher self-efficacy was associated with better health status in people with OA (Cross et al., 2006). The studies from

this thesis confirmed these findings, but also added new information specifically relating to people with knee OA. However, it should be highlighted that different measures of general health status were used; the EQ-VAS proportion of the EQ-5D-5L was used in this thesis and in previous work by Cross et al 2006, the Short-Form Survey 36 (SF-36) was used.

The perception of good health status from participants from this thesis was explored in the interview studies to find out how this is related to their self-beliefs in their ability to manage their arthritis. Most participants interviewed in Study 1 reflected that they were able to adjust their activities and lifestyle to manage their arthritis and control their knee pain. Thus they were unlikely to participate in activities that they were aware of that would increase their knee pain. Even though pain and other symptoms of their knee OA were still present, most participants were still able to carry out activities of daily life and their recreational physical activities, which made them feel that they were able to manage their knee OA.

7.2.1.5 **Female Sex**

A previous study that investigated sex and knee OA (Glass et al., 2014) reported that women perceived greater pain compared to men; the difference in knee pain severity was explained by BMI, depressive symptoms, comorbid conditions, and socioeconomic status. The reasons for the sex differences in people with knee OA and its symptoms have yet to be fully clarified in previous literature. Differences in male and female hormones, body

composition, knee structure, and psychosocial characteristics may play a role (Glass et al., 2014).

Stubbs et al. (2010) argued that women had less arthritis self-efficacy in pain control compared to men. Women were more likely than men to acknowledge the emotional aspects of pain, but men had higher expectations for a medical cure. Contrary to previous findings, when sex differences in arthritis self-efficacy and knee pain perception were investigated in this thesis (data not shown), no statistically significant differences were found between these variables in men and women after independent-sample t-tests were run.

7.2.1.6 **Knee Confidence**

Knee confidence was measured from the quality of life subscale of the KOOS questionnaire. Given the central role of the knee in all weight-bearing activities, it made sense that an individual's confidence in their knees may be a factor influencing their self-beliefs in their ability to successfully manage their knee OA. Riddle et al. (2011) reported that knee confidence was not predictive of yearly change in pain, functional status, and physical performance in people with knee OA during the two-year follow-up. However, Colbert et al. (2012) argued that worse knee confidence at baseline was associated with a greater risk of poor functional outcomes measured by self-report. Similarly, Skou et al. (2014c) extended the findings from Colbert et al. (2012) and reported that higher knee pain intensity, worse self-reported knee instability, muscle weakness, greater varus-valgus joint motion, and worse

knee confidence may further exacerbate decreased activity, which further increased pain and reduced muscle strength.

The interview findings from this thesis helped explain the current knowledge on knee confidence and why, from the patients' perspectives, this was the predictors of arthritis self-efficacy for both participants from the samples in Study 1 and Study 2. Those who perceived themselves as being less troubled by the lack of knee confidence had statistically significantly higher self-beliefs in their ability to successfully manage their knee OA symptoms compared to those who perceived themselves as being more troubled by the lack of knee confidence. When asked about knee confidence during the interview for participants in Study 1, who have not recently participated in an education and exercise programme, they described that knee giving way was the main factor that led them having decreased confidence with their knees, as they could not trust their knees to not give way again. This affected their daily activities, such as walking, because they were more aware and had to take more care during their activities. This decreased their arthritis self-efficacy because they could not predict when their knees would give way due to the lack of warning of when it would happen, which made managing their condition more challenging.

Participants in Study 2, even though they had recently participated in the GLA:D® programme to educate them about knee OA and to strengthen the muscles and their stability, participants still expressed concerns about the lack of confidence with their knee a year after completing the programme. The reason was due to previous negative experiences of their knee giving way and

not knowing if or when it will happen again in the future. The findings from these interviews question whether knee-OA specific exercises and strengthening of the muscles around the knees would help patients feel more confident with their knee. Individuals from Study 1 who had fewer experiences of their knee giving way were less worried about it happening to them in the future. Furthermore, it was likely that other psychological factors could contribute to increasing one's knee confidence. Thus, participants becoming more aware of their movements and activities after experiencing their knee giving way could be a safety mechanism to try and prevent their knees from giving way again.

7.2.1.7 **Other Factors Not Investigated**

The multiple linear regressions models for both Study 1 (people living with knee OA who were not on an OA-specific education and exercise programme) and Study 2 (people living with knee OA who had recently participated in the GLA:D® programme) reported statistically significant factors that predicted knee OA discussed in the previous sections. However, there were variances in arthritis self-efficacy beliefs that remained unexplained by the multiple linear regression models. The factors chosen for the studies in this thesis were determined by a search of the literature on the psychosocial factors that have been associated with knee pain and physical function. As arthritis self-efficacy has been associated with knee pain and physical function in knee OA, investigations were conducted to see if these factors were predictive of arthritis self-efficacy. Therefore, there were still other psychological factors

that were not explored in this thesis, as it was unreasonable to ask participants to complete a lengthy questionnaire.

Knee confidence was the highest predictor of arthritis self-efficacy in both studies in this thesis. Participants had associated the lack of knee confidence with previous negative experiences of their knee giving way on them. Therefore, it would be interesting to quantitatively investigate whether fear is also a predictor of how people living with knee OA perceives their ability to successfully manage their arthritis. Specifically, the fear of falling and the fear of movement. Nguyen et al. (2014) reported knee buckling/giving way and the sensation of knee instability without knee instability was associated with fear of falling, poor balance confidence, limitations of activities, and poor physical function in older adults who have or were at high risk of OA. Furthermore, Gunn et al. (2017) recently reported that people with symptomatic knee OA had a fear of movement, which could impact on their physical activity level due to a lack of self-efficacy for exercise and more depressive symptoms. Since having better self-efficacy for arthritis was associated with better knee outcomes, such as knee pain and physical function, it is essential to address if and how fear plays a role in arthritis self-efficacy. If fear can predict arthritis self-efficacy, then psychological interventions can be developed for decreasing fear and improving arthritis self-efficacy in people living with knee OA.

Previous studies reported factors that were associated with higher self-reported self-efficacy scores that were not studied in this thesis, which is worth investigating in the samples in this thesis. Objective outcomes such as

maximum, isometric strength obtained for the quadriceps muscle and dynamic varus-valgus joint motion during waking was not measured in this thesis have been shown to affect self-efficacy (Rejeski et al., 2001, Sharma et al., 2003, Skou et al., 2014c). Muscle strength and self-efficacy for stair climbing task have been shown to interact when evaluating the effects on physical function in patients with OA-related knee pain (Rejeski et al., 2001). A close relationship was found between quadriceps and hamstring strength, knee pain intensity, and self-efficacy in their effect on physical function in people with knee OA (Sharma et al., 2003).

Pain is a common symptom in people with knee OA and participants from the interviews in both studies of the thesis had reflected on using different strategies to adapt to the intensity of their knee pain and other symptoms of their arthritis such as resting their knee when they experienced pain, adjusting their activities level, and ignoring the pain. Perrot et al. (2008) had previously reported that people with OA have active or passive pain coping strategies; active pain coping strategies included pain transformation, distraction, and reducing demands, whereas passive coping strategies included retreating, worrying, and resting. It would be beneficial to investigate whether pain coping strategies can predict arthritis self-efficacy in people with knee OA and to explore the differences in how people with active pain coping strategies perceived their arthritis self-efficacy compared to those with passive pain coping strategies. This could indicate that different interventions might be necessary to enhance arthritis self-efficacy depending on whether people used active or passive pain coping strategies.

7.2.2 Links to Behavioural Change Techniques and the Theories

The main outcome measure in the studies in this thesis was arthritis self-efficacy, which was measured using the arthritis self-efficacy scale developed by (Lorig et al., 1989), based on the social cognitive theory and its main construct of self-efficacy. The discussion of the findings from this study will be based on the social cognitive theory and self-efficacy.

The findings from the qualitative study in Study 2 of this thesis (interviews with participants who experienced the GLA:D® programme) emphasised the importance of long-term follow-up session with a physiotherapist and receiving reassurance from the physiotherapist about their ability to carry out the GLA:D® exercises correctly. These comments could suggest that BCTs such as “Verbal Persuasion about Capability”, and “Demonstration of Behaviour” might be valuable to address the lack of reassurance people felt post-programme post-intervention phase and increase their beliefs about their capabilities to continue with the programme. These BCTs have been linked to the mechanism of action called “Beliefs about Capabilities”, which is conceptually identical to the self-efficacy theory (Carey et al., 2018). Other BCTs such as “Feedback on Outcomes of Behaviour” and “Feedback on Behaviour” linked to “Subjective Norms”, “Feedback Processes”, and “Knowledge” mechanisms of actions could also be beneficial to provide the follow-up sessions and reassurance that participants from the GLA:D® programme (Study 2) would like from the programme.

Another factor that was found to be predictive of arthritis self-efficacy in this thesis in exercise self-efficacy, which was defined as people's self-beliefs in their ability to continue with exercise in their future (McAuley, 1993). The BCT that may be linked to this is the "Behavioural Practice/Rehearsal", which is similar to Bandura's "Mastery Experience" (Carey et al., 2018). By improving enhancing people's mastery experience, and through the verbal persuasion from the physiotherapist ("Verbal Persuasion about Capability" BCT), this may change behaviour by increasing beliefs about one's capabilities (Carey et al., 2018).

The quantitative findings from Study 2 should be interpreted with caution, as the cross-sectional study design does not allow for the cause-effect relationship of the GLA:D® programme and arthritis self-efficacy to be determined, and the views for the interviews were perceptions from five participants. However, the interview findings did provide insight into participants' feelings about what they thought of the programme and what could improve their ability to successfully manage their arthritis, which might be beneficial to consider during the design and planning of interventions for people with knee OA.

The interview findings from Study 1, where participants were not receiving an OA-specific education and exercise programme, revealed that these participants felt that they had a lack of knowledge about the correct exercises they could do to manage their condition and there was a lack of follow-up with their clinicians (such as GPs and physiotherapists) for the management of their condition. The findings from Study 1 and Study 2 of this thesis indicated

that participants found follow-up sessions and advice around OA-specific exercises important to the perception of their ability to manage their OA. Future interventions to enhance arthritis self-efficacy could include BCTs, such as “Behavioural Practice/Rehearsal”, “Demonstration of Behaviour”, and “Verbal Persuasion about Capability”, based on the “Beliefs of Capabilities” mechanism of action to investigate the relationship between these BCTs and arthritis self-efficacy. Additionally, it would be interesting to investigate the relationship between arthritis self-efficacy and other BCTs such as “Feedback on Outcomes of Behaviour” and “Feedback on Behaviour” linked to “Feedback Processes”, and “Knowledge” mechanisms of actions to explore if BCTs linked to other mechanisms can also enhance arthritis self-efficacy and address the need for regular feedback from clinicians.

7.3 Strengths of the Studies in this Thesis

One of the strengths of the studies in this thesis was the mixed methods methodology that was followed to meet the aim and objectives of this thesis. The quantitative questionnaire findings provided new information to contribute to the field of self-efficacy and knee OA, in particular, the factors which have been found to be predictors of the arthritis self-efficacy in people living with knee OA. The qualitative interview findings provided insightful explanations of why these factors may have been predictors of arthritis self-efficacy and provided patients’ perspectives of why they felt these factors affected their self-beliefs in their ability to successfully manage their knee OA. Furthermore, self-efficacy had been reported in the literature as behaviour-specific, so people living with knee OA who may undertake multiple tasks would have

various factors that could affect their self-efficacy. It was beneficial to have explored the different variants of self-efficacy and confidence to see how these all play a role in affecting someone's arthritis self-efficacy.

Previous researchers focused their work on how arthritis self-efficacy affected arthritis outcomes, such as functional limitations and knee pain perception. However, to the author's knowledge, no previous studies have investigated what factors can predict arthritis self-efficacy in people with knee OA, in particular, focusing on the psychological factors rather than biomechanical and functional factors. Therefore, the findings from this thesis has added new information on factors such as knee confidence, depression, exercise self-efficacy, knee pain perception, general health status, and being female were statistically significant predictors of arthritis self-efficacy. This new findings are important for clinicians, as they can help clinicians characterise those who they think will have lower arthritis self-efficacy and target care that is individualised to these patients to enhance their arthritis self-efficacy and knee OA outcomes. This is also important for researchers, as new interventions can target people's knee confidence and exercise self-efficacy for example to enhance their arthritis self-efficacy.

Furthermore, two samples were recruited from two different populations. Samples from Study 1 were those who have knee OA who were receiving standard care from the UK (these participants did not report participating in an OA-specific education and exercise programme in the last year). Additionally, to the author's knowledge, there was no Nottinghamshire-wide education and exercise programme specifically designed for people with knee OA at present.

The sample from Study 2 were those who were living with knee OA and had recently participated in an OA-specific education and exercise programme from Denmark. As the aim of the thesis was not to provide comparisons of arthritis self-efficacy beliefs and its predictive factors in those who have not recently been on an OA-specific education and exercise programme and those who have, it is argued that having a varied study sample helped provide a fuller picture and different perspectives of why certain factors were found to be associated with changes in arthritis self-efficacy in these different groups of people living with knee OA.

Additionally, a purposive sampling method (maximum variation) was used to select participants to be interviewed (i.e. those with high and low arthritis self-efficacy and those with high and low exercise self-efficacy, and knee confidence) to ensure that the different perspectives of participants in these different groups were explored. This was also fitting with why the mixed methods methodology that was used, in which as many different methods were used as possible to try to gather a more complete picture and understanding of how people living with knee OA were perceived themselves at managing their condition(Creswell, 2014).

An advantage of gaining a better understanding from a different perspective helped provide better recommendations for future interventions involving education and exercise for people living with knee OA or implementation work into primary and secondary care for people living knee OA. For instance, the findings from Study 2, where people have completed a programme, they discussed the benefits of having continued follow-up with the physiotherapists

for reassurance and advice on how they were doing their exercises. When providing patient care and treatment for OA through running exercise programmes, long-term (i.e. yearly) follow-up sessions should also be considered for participants to maintain an open discussion with the physiotherapist and gain some reassurance that they are not damaging their knee and ensure they have the confidence to carry out these exercises at home. This could in turn help increase patients' confidence about their management of a chronic condition and increase their continued adherence to the programme.

7.4 Limitations of the Studies in this Thesis

There are some limitations in this thesis that needs to be addressed. The limitations in the quantitative studies will be discussed first. Firstly, even though a longitudinal design was used in Study 1, the follow-up period was six months, and no statistically significant change occurred in this group of participants. This could have been due to different reasons; the period of six months was a short period and no interventions were given to participants in Study 1 of this thesis, thus, a change in arthritis self-efficacy was unlikely to have occurred. In contrast, other researchers have who included an intervention targeted at self-efficacy had reported changes in self-efficacy at 8-weeks, 6-month, and 12-month follow-ups (Lorig et al., 2008). Additionally, OA is a chronic disease and progresses over time, thus six months duration was a short amount of time to observe changes that may occur in the physical and psychological aspects of OA (such as in disease progression/severity and health behaviour change) (Johnson and Hunter, 2014). Furthermore,

according to the Transtheoretical Model of behaviour change (Prochaska and Diclemente, 1983), it could take people at least six months before they are able to maintain a changed behaviour. People are usually in their pre-contemplation, contemplation, preparation, and action stages and may go back and forth between these stages before they are able to successfully maintain their behaviour change (Prochaska and Diclemente, 1983). Thus, observing the changes in arthritis self-efficacy, knee pain, and progression in knee OA requires more time so it would have been beneficial to include longer follow-up time, such as 1-year, 2-year, 3-year, 4-year, and 5-year follow-ups.

Secondly, the study design for Study 2 was cross-sectional, so a causal relationship could not be determined to see if being in the GLA:D® programme changed people's arthritis self-efficacy, knee pain perception, exercise self-efficacy, and general health status. However, interviewing the participants was useful, as the discussions were based around whether they felt the programme had helped them become more confident at managing their arthritis and how they felt before and after the programme was explored in depth during these interviews to gain a better picture about the reasons why they felt the programme has helped them notice a reduction in their knee pain and ability to walk further during the programme compared to before entering the programme.

Thirdly, in the questionnaire study in Study 1, loss to follow-up was higher than anticipated, 33% was the rate of participants lost to follow-up. Previous questionnaire studies had a lost to follow-up of around 7-8% and a conservative estimate was used for the study in this these and set the lost to

follow-up at 20% (Dawson et al., 2005, Hoogeboom et al., 2013). Efforts were made to call and email participants to politely ask if they were still interested in taking part in the study and if they were then they were asked to return their follow-up questionnaire. To improve the response rate in future studies, a pen could have been sent out with the questionnaire to make it easier for the participant to respond. Another method to improve response rate is by keeping in touch with the participants during the interim period of the first and second questionnaires through updates in a newsletter or sending them a letter, email or text a week prior to them receiving the second questionnaire to inform them that they will receive it in the post shortly.

Fourthly, there may have been a bias in non-responders compared to responders to the questionnaire in Study 1. These participants lost to follow-up perceived less knee pain (VAS score of 36 out of 100) compared to responders (VAS score 42 out of 100). There could have been a bias in participants who were interviewed in Study 1, as they were likely to be ones who had more knee pain and the study was more relevant to those with less knee pain. To overcome this bias, participants were selected purposively to ensure a range of participants from high to low self-efficacy beliefs were given the chance to participate in the interview. Some participants who were called regarding the interview expressed that they felt they would not add to research for this thesis as they felt fine and were confident at managing their arthritis. These participants were reassured that a variety of life experiences of living with knee OA would be helpful for the study to ensure a range of perspectives were explored.

There were also limitations in the qualitative studies in this thesis. Firstly, inter-rater reliability tests were conducted, which is a type of researcher triangulation by having more than one researcher involved in the data analysis and converge to draw on the same conclusion, making the conclusion more credible (Kitto et al., 2008). Themes from the semi-structured interviews were checked from the interviews by having a second coder code 10% of the transcripts. However, both the primary coder and second coder are novices to qualitative researcher both from different academic backgrounds and life experiences, which resulted in large discrepancies before a discussion to resolve their differences. Having another qualitative researcher to help code and discuss the themes would have increased the reliability of the themes from the thesis. However, some researchers argued that qualitative research is very subjective, especially in terms of people with different backgrounds and different worldviews on a certain subject and different methods of data collection and different researchers should yield different results (Tracy, 2010). Some researchers argued that even if the data all converge on the same conclusion, this does not assure that this specified reality is correct. Rather, "all research findings are shaped by the circumstances of their production, so findings collected by different methods will differ in their form and specificity to a degree that will make their direct comparison problematic" (Emerson, 2005).

Secondly, a selection bias from the interview participants in Study 2. Due to time and logistical limitations, only 5 participants were interviewed, all of who came from the same city. Those who were confident at speaking English would have accepted the invitation to participate in the interview, but

participants were also given an option of having an interpreter present if they wished. Most participants who expressed an interest in participating in the interview did not wish for an interpreter to be present. Similarly, to the selection process of participants for the interviews in Study 1, the participants in Study 2 were also selected to ensure there was a variation in people with high and low exercise self-efficacy and high and low arthritis self-efficacy.

Thirdly, the author has a BSc and MRes in Pharmacology, and has had more experience conducting quantitative research and gained some experience in conducting mixed methods research during her MRes. This affected her own experiences and own worldviews when designing the studies and when analysing the qualitative results and the choice of conducting mixed methods studies for this thesis. Furthermore, the author's novice experiences of qualitative research may have influenced the quality of the qualitative studies in this thesis. Further training in qualitative research methods and analysis will be beneficial for the author in future to ensure knowledge and understanding of the range of techniques and analysis methods in qualitative research. Additional strategies could have been included to increase the quality and rigour of the qualitative studies, such as respondent validation or member checking when researchers offer interview participants the opportunity to view and amend their interview transcript as a type of data validity (Lincoln and Guba, 1985). Additionally, participants may be asked to reflect on the study's findings and share their thoughts, questions, and critique. This approach may yield new data and provide deeper and richer analyses and interpretations (Emerson, 2005). However, there are limitations to this approach, the account produced by the researcher is designed for a wide audience and will be

different from that of an individual because of their different roles in the research process (Pope et al., 2000). Thus, some researchers argue that it is better to think of respondent validation as part of a process of error reduction which also generates further original data, which in turn requires interpretation (Pope et al., 2000).

Lastly, the interview questions in both Study 1 and Study 2 contained leading questions, for example, “what would you like the NHS to do to help?” (Study 1), and “how has the GLA:D® programme increased or decreased your confidence with managing your arthritis in the future?” (Study 2). These questions should have been changed into “Can you describe your experiences with the NHS in terms of receiving treatment your knee OA?” and “Can you talk about your self-beliefs in your ability to manage your arthritis in the future?”. The themes emerging from the interviews may have been different and enabled a wider exploration of these topics. In future studies, the interview guide will be piloted on more participants prior to the main study.

7.5 Implications of this Thesis

Study 1 – People living with knee OA

Research implications

The findings from this study provided an understanding of the term “knee confidence” from the perspective of people living with knee OA. Patients reflected they felt a lack of knee confidence when their knee gave way, which was potentially due to an instability of the knee and the fear of their knee

giving way. A previous study found that worse knee confidence was associated with higher pain perception, worse self-reported knee instability, lower quadriceps muscle strength and greater dynamic varus-valgus joint motion during walking (Skou et al., 2014c). However, they did not explore psychosocial measures that could be associated with knee confidence. Even though the findings from this thesis highlighted that knee confidence was predictive of arthritis self-efficacy, there is a gap in how other psychosocial factors affect knee confidence that needs to be explored. Furthermore, as knee confidence was a measure taken from question 3 of the 'quality of life' subscale in the KOOS (Roos and Toksvig-Larsen, 2003) and has not yet been validated, hence there is a need to explore the meaning of the term "knee confidence", validate its measure, and investigate the factors associated with this in a larger population (for example, fear of knee giving way).

The findings from this thesis highlighted that exercise self-efficacy, depression, knee pain perception, knee confidence, and being female are predictive of arthritis self-efficacy. Future studies could explore which BCTs can successfully change behaviour linked to these factors (except for sex). As the study from this thesis focused on arthritis self-efficacy, the selected BCTs to explore should be based on the theoretical construct of self-efficacy and the SCT (Bandura, 1997). For example, studies could explore whether a BCT such as "Graded Tasks" could help improve exercise self-efficacy in people living with knee OA and whether a BCT such as "Reduce Negative Emotion" could help reduce self-reported depression scores and improve arthritis self-efficacy. These two BCTs have been linked with the "Beliefs about

Capabilities" mechanism of action (Carey et al., 2018) which is a similar concept to Bandura's self-efficacy construct (Bandura, 1997).

The findings from this thesis found that participants felt that a chronic disease, such as OA, long-term follow-ups would be beneficial in terms of providing feedback on their condition. A recent study by Nicolson et al. (2018) investigated the perceived effectiveness of BCTs, based on the CALO-RE taxonomy developed by Michie et al. (2011) found discrepancies between patients and physical therapists. Follow-up sessions >3 months after the initial exercise session had the 5th highest perceived effectiveness rating score by people with knee OA, but this was ranked the 19th highest by the physical therapists (Nicolson et al., 2018). This finding was consistent with previous qualitative interviews which reported that people with knee OA would like more time with clinicians, while some clinicians consider regular follow-up sessions to be an inappropriate use of their time (Mann and Gooberman-Hill, 2011). There is a gap to investigate the feasibility and the economic costs of long-term follow-ups are in clinical practice and what benefits these could provide to patients with OA and clinicians.

Clinical implications

The findings from this study highlighted the importance of arthritis self-efficacy in people's self-beliefs in their ability to manage their OA symptoms. Previous findings from the literature also emphasised the role self-efficacy played on knee OA outcomes, such as knee pain and physical function (McAuley et al., 1991, Rejeski et al., 1998). Clinicians could consider including BCTs that are linked to the "Beliefs about Capabilities" mechanism of action if they would like

ways to improve their patient's self-efficacy; these BCTs include: "Graded Tasks" (i.e. by setting easy-to-perform tasks and making them increasing difficult until the desired behaviour is achieved); "Verbal Persuasion about Capability"; "demonstration of the behaviour"; "problem-solving"; "behavioural practice/rehearsal" (for showing people how to perform the exercises); and reduce negative emotions" (Carey et al., 2018).

The quantitative findings from Study 1 had identified characteristics of patients most at risk of having low arthritis self-efficacy (i.e. those who have less knee confidence/more incidences of their knee giving way, less self-beliefs in exercise, more depressed, experienced severe knee pain, and being male). Clinicians could explore arthritis self-efficacy with their OA patients who have less self-beliefs in their ability to manage their OA and screen those who have these characteristics that are most at risk of having low arthritis self-efficacy, as they may benefit from interventions aimed at increase self-efficacy.

Furthermore, from the perspectives of participants interviewed in this study, they reflected the need for clearer information about how to manage their knee OA and OA-specific exercises that are safe and effective at improving their symptoms, which is more accessible to them, as they are currently managing their OA in the way they perceived as best for them. There are some merits here, as participants demonstrated taking ownership of the management of their condition. Clinicians could promote currently available information on OA and treatments for OA from reliable sources to patients, such as Versus Arthritis (previously Arthritis Research UK) or NHS Choices. Both sources can be accessed on the Internet through the computer or mobile

telephones. If patients do not have access to have access to the Internet, a computer or a mobile telephone, the physiotherapist could print this information for the patient. There is also a section on the Versus Arthritis website where patients can “find help in your area”, where they can type in their postcode to find local groups, bringing people with arthritis together to share their experiences and access face-to-face support (https://www.versusarthritis.org/get-help/)

Study 2 – people living with knee OA who had recently participated in the GLA:D® programme

Research implications

The findings from this study highlighted that mildly troubled by lack of knee confidence, exercise self-efficacy, general health status, and knee pain perception were statistically significant predictors of arthritis self-efficacy in people living with knee OA who had recently participated in the GLA:D® programme.

The qualitative research implication helped provide an understanding of what the term “knee confidence” meant to patients living with knee OA who had recently participated in an exercise programme. Similarly, to participants in Study 1, participants who had recently participated in an exercise programme also reflected that the lack of knee confidence was due to previous negative experiences of their knee giving way. However, despite this group of participants seeing the benefits of exercise in reducing their knee pain and improving their physical function and mobility, their past experiences of their

knee giving way still influenced how confident they felt with their knee. Participants explained that their knee gave way without any warning, so they felt cautious that it could happen again in the future, which made managing this more challenging.

As lack of knee confidence was an issue for people living with knee OA even after they have had education and exercise sessions about how to manage their OA, future research is warranted to explore the factors that may be associated with the lack of knee confidence (such as findings that were not measured in the quantitative questionnaire component of this study (i.e. fear of falling and negative experiences). There is a need to explore the meaning of the term “knee confidence” and validate its measure before exploring factors that could be associated with knee confidence. These factors to be explored should be selected based on theoretical constructs of behaviour change and focus on investigating whether there is a change in knee confidence pre-intervention, post-intervention, and long-term follow-ups post-intervention.

Participants reflected that long-term follow-up is beneficial, as they would like to receive continuous feedback about their progress and condition and receive reassurance from their physiotherapist. Furthermore, the aim of the GLA:D® programme was to enable participants to independently continue to carry out these exercises twice a week, post the 6-weeks implementation period. A recent meta-analysis evaluating interventions to increase adherence to therapeutic exercise in older adults with low back pain, hip, and/or knee OA provided moderate-quality evidence that booster sessions with a

physiotherapist assisted people with hip/knee OA to better adhere to therapeutic exercise in the mid-to-long-term (Nicolson et al., 2017). The use of such sessions provides ongoing contact and reinforcement, both of which are recognised as facilitators to exercise adherence in this population (Dobson et al., 2016). There is potential for future research within the GLA:D® programme to include booster sessions (post-12-months) and longer follow-up periods to investigate if this affects participants' adherence to the programme in the long-term and whether there have been any benefits in terms of their symptoms and self-efficacy if these long-term follow-ups were included.

Clinical implications

A clinical implication from this study was that people with knee OA who had high knee confidence, high self-efficacy for exercise, good health status, and experienced less knee pain had higher self-beliefs in their ability to successfully manage their arthritis. These characteristics of patients could help clinicians identify those living with knee OA who at more at risk of having low arthritis self-efficacy, so treatment can be focused on improving their arthritis self-efficacy.

Participants from the interviews mentioned that paying for the programme was a big issue for them as it was expensive, but all willingly paid for the programme because they felt it was their last option in order to avoid having a knee replacement surgery. Similarly, the interview participants from Study 1 also mentioned that if they were desperate enough, they were willing to make a small payment (£2-£5 per session) to have some education and exercise

guidance from the physiotherapist on safe exercise people living with knee OA could do, to avoid deteriorating and need a total knee replacement surgery. They were more willing to pay if they could see the benefits of an OA-specific education and exercise programme.

However, in Study 2, payment of additional exercise classes influenced whether people with low self-efficacy for exercise adhered to the exercises in the long-term, especially if they felt the need to physically go to the classes in order to maintain their exercises. Therefore, more needs to be done to ensure that all patients living with knee OA have access to an OA-specific education and exercise programme. Additionally, more efforts should be focused on improving exercise self-efficacy to encourage and motivate this group of people that they can successfully self-manage their knee OA independently.

Follow-up consultations were still necessary for people with knee OA who participated in the GLA:D® programme. Participants reflected the importance in maintaining continuous contact with their physiotherapist, perhaps a yearly follow-up to discuss the management of their arthritis, to provide reassurance and encouragement to help with their adherence to the GLA:D® exercises at home. This finding provided useful contributions for an additional component in education and exercise implementation programmes in the UK to consider; the importance of including regular follow-up with their patients post-programme because participants perceives OA as a chronic condition that requires long-term management, care, and guidance.

7.6 Chapter Summary

This chapter has discussed that arthritis self-efficacy is amenable to change and clinicians should focus on patients' arthritis self-efficacy as part of their care and treatment for people living with knee OA. This thesis has found that knee confidence, depression, general health status, knee pain perception, exercise self-efficacy, and female sex were predictors of arthritis self-efficacy. All the variables except female sex are amenable to changes through different strategies, so future research should focus on enhancing these variables in forms of designing interventions to include self-efficacy related-BCTs to improve patients' arthritis self-efficacy.

People living with knee OA were very self-aware of what strategies worked for them and what did not, in terms of pain management. Participants were active in adjusting their activities to suit their abilities and were taking ownership in manage their condition. Future research should emphasis incorporating strategies that focus on improving people's psychological health, such as enhancing their confidence around exercising, confidence with their knees, and depression and education people on how to cope with the symptoms of their knee OA to enhance their self-beliefs in their ability to manage their arthritis and improve their knee pain perception and physical function.

Chapter 8

Conclusions

Chapter 8: Conclusions

This thesis has highlighted novel contributions to the field of self-efficacy in people living with knee OA. The studies in this thesis has identified characteristics that are predictors of low arthritis self-efficacy, which are low knee confidence, being female, depression, exercise self-efficacy, and knee pain perception.

Participants living with knee OA reflected in this thesis the importance of receiving appropriate information on self-management of arthritis, the knowledge of exercises that are safe for their knee and receiving long-term follow-up with their clinician for them to perceive a better sense of successful self-management of arthritis. Similarly, participants with knee OA who had participated in the GLA:D® programme also reflected the importance of maintaining continue contact with their physiotherapist after the programme for support and reassurance that they were still performing their exercises in the correct manner and to help with motivation to maintain the GLA:D® exercises in the long-term. These comments suggested by participants in both studies of this thesis demonstrated that components of BCTs such as “Instruction on How to Perform the Behaviour” and “Demonstration of Behaviour” to gain knowledge on safe exercises and “Verbal Persuasion about Capability” and “Feedback on Outcomes of Behaviour” should be considered when designing intervention programmes aimed at enhancing arthritis self-efficacy in people living with knee OA to address these comments.

Furthermore, clinicians could explore arthritis self-efficacy with their OA patients and screen those who have these characteristics that are most at risk of having low arthritis self-efficacy, as they may benefit from interventions aimed at increase self-efficacy.

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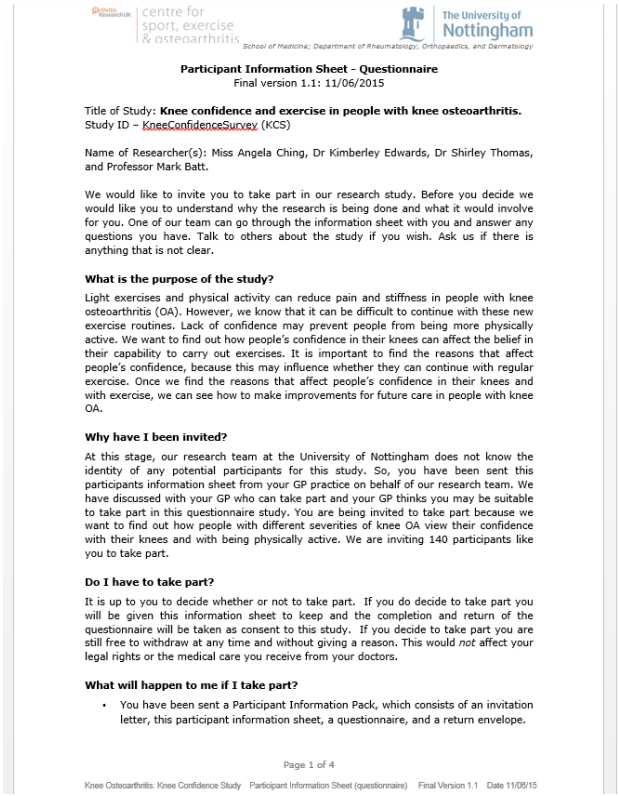
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Appendices

Appendix 1 Study 1 participant information sheet



centre for sport, exercise & osteoarthritis

The University of Nottingham

School of Medicine; Department of Rheumatology, Orthopaedics, and Dermatology

Participant Information Sheet - Questionnaire

Final version 1.1: 11/06/2015

Title of Study: **Knee confidence and exercise in people with knee osteoarthritis.**
Study ID – KneeConfidenceSurvey (KCS)

Name of Researcher(s): Miss Angela Ching, Dr Kimberley Edwards, Dr Shirley Thomas, and Professor Mark Batt.

We would like to invite you to take part in our research study. Before you decide we would like you to understand why the research is being done and what it would involve for you. One of our team can go through the information sheet with you and answer any questions you have. Talk to others about the study if you wish. Ask us if there is anything that is not clear.

What is the purpose of the study?

Light exercises and physical activity can reduce pain and stiffness in people with knee osteoarthritis (OA). However, we know that it can be difficult to continue with these new exercise routines. Lack of confidence may prevent people from being more physically active. We want to find out how people's confidence in their knees can affect the belief in their capability to carry out exercises. It is important to find the reasons that affect people's confidence, because this may influence whether they can continue with regular exercise. Once we find the reasons that affect people's confidence in their knees and with exercise, we can see how to make improvements for future care in people with knee OA.

Why have I been invited?

At this stage, our research team at the University of Nottingham does not know the identity of any potential participants for this study. So, you have been sent this participants information sheet from your GP practice on behalf of our research team. We have discussed with your GP who can take part and your GP thinks you may be suitable to take part in this questionnaire study. You are being invited to take part because we want to find out how people with different severities of knee OA view their confidence with their knees and with being physically active. We are inviting 140 participants like you to take part.

Do I have to take part?

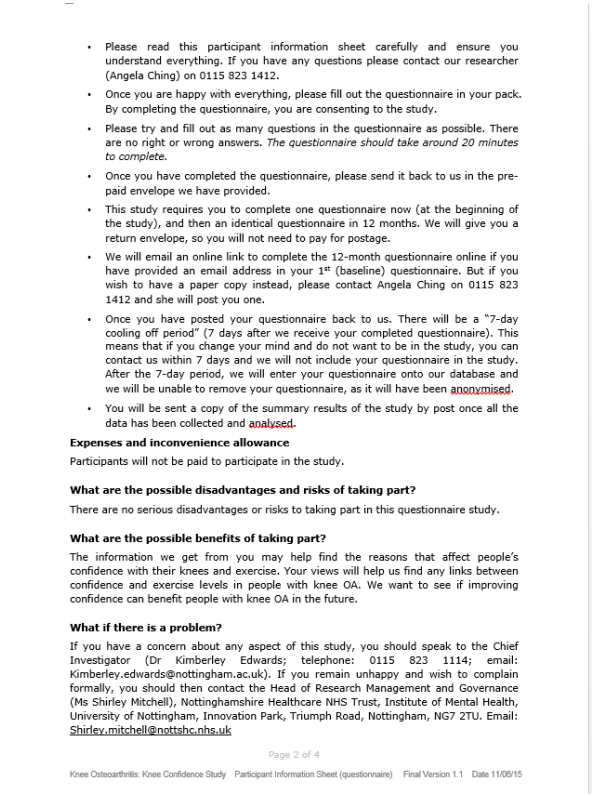
It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and the completion and return of the questionnaire will be taken as consent to this study. If you decide to take part you are still free to withdraw at any time and without giving a reason. This would *not* affect your legal rights or the medical care you receive from your doctors.

What will happen to me if I take part?

- You have been sent a Participant Information Pack, which consists of an invitation letter, this participant information sheet, a questionnaire, and a return envelope.

Page 1 of 4

Knee Osteoarthritis: Knee Confidence Study Participant Information Sheet (questionnaire) Final Version 1.1 Date 11/06/15



- Please read this participant information sheet carefully and ensure you understand everything. If you have any questions please contact our researcher (Angela Ching) on 0115 823 1412.
- Once you are happy with everything, please fill out the questionnaire in your pack. By completing the questionnaire, you are consenting to the study.
- Please try and fill out as many questions in the questionnaire as possible. There are no right or wrong answers. *The questionnaire should take around 20 minutes to complete.*
- Once you have completed the questionnaire, please send it back to us in the pre-paid envelope we have provided.
- This study requires you to complete one questionnaire now (at the beginning of the study), and then an identical questionnaire in 12 months. We will give you a return envelope, so you will not need to pay for postage.
- We will email an online link to complete the 12-month questionnaire online if you have provided an email address in your 1st (baseline) questionnaire. But if you wish to have a paper copy instead, please contact Angela Ching on 0115 823 1412 and she will post you one.
- Once you have posted your questionnaire back to us. There will be a "7-day cooling off period" (7 days after we receive your completed questionnaire). This means that if you change your mind and do not want to be in the study, you can contact us within 7 days and we will not include your questionnaire in the study. After the 7-day period, we will enter your questionnaire onto our database and we will be unable to remove your questionnaire, as it will have been anonymised.
- You will be sent a copy of the summary results of the study by post once all the data has been collected and analysed.

Expenses and inconvenience allowance

Participants will not be paid to participate in the study.

What are the possible disadvantages and risks of taking part?

There are no serious disadvantages or risks to taking part in this questionnaire study.

What are the possible benefits of taking part?

The information we get from you may help find the reasons that affect people's confidence with their knees and exercise. Your views will help us find any links between confidence and exercise levels in people with knee OA. We want to see if improving confidence can benefit people with knee OA in the future.

What if there is a problem?

If you have a concern about any aspect of this study, you should speak to the Chief Investigator (Dr Kimberley Edwards; telephone: 0115 823 1114; email: Kimberley.edwards@nottingham.ac.uk). If you remain unhappy and wish to complain formally, you should then contact the Head of Research Management and Governance (Ms Shirley Mitchell), Nottinghamshire Healthcare NHS Trust, Institute of Mental Health, University of Nottingham, Innovation Park, Triumph Road, Nottingham, NG7 2TU. Email: Shirley.mitchell@nottshc.nhs.uk

Page 2 of 4

Knee Osteoarthritis: Knee Confidence Study Participant Information Sheet (questionnaire) Final Version 1.1 Date 11/06/15

Will my taking part in the study be kept confidential?

We will follow ethical and legal practice and all information about you will be handled in confidence.

If you join the study, some parts of the data collected for the study will be looked at by authorised persons from the University of Nottingham who are organising the research. They may also be looked at by authorised people to check that the study is being carried out correctly. All will have a duty of confidentiality to you as a research participant and we will do our best to meet this duty.

All information which is collected about you during the course of the research will be kept *strictly confidential*, stored in a secure and locked office, and on a password protected database. Any information about you which leaves the institution will have your name and address removed (anonymised) and a unique code will be used so that you cannot be recognised from it.

Your personal data (address, telephone number) will be kept for 12 months or less after the end of the study so that we are able to contact you about the findings of the study and possible follow-up studies (unless you advise us that you do not wish to be contacted). All other data (research data) will be kept securely by the Chief Investigator for 7 years. After this time your data will be disposed of securely. During this time all precautions will be taken by all those involved to maintain your confidentiality, only members of the research team will have access to your personal data. We will handle, process, storage and dispose of your data by meeting the requirements of the Data Protection Act 1998.

What will happen if I don't want to carry on with the study?

Your participation is voluntary and you are free to withdraw at any time, without giving any reason. However the information collected so far cannot be removed and may still be used in the study. This is because once the data has been entered onto the secure computer system and made anonymous and backed up by the University of Nottingham, which cannot be interfered with. Once you have returned your questionnaire back to us, we will give you a unique Participant ID number (e.g. 12345) and this ID number will be entered into our database instead of your name to make sure you are anonymous on our database. For the 2nd questionnaire sent to you 12 months after your first questionnaire, we will write your Participant ID number on your questionnaire (hard copy requests only) or we will let you know in your email invitation what your Participant ID number is, so you can enter this onto the online version of the questionnaire when you complete it.

Involvement of the General Practitioner/Family doctor (GP)

Your GP will not be informed directly of your involvement in this study. If you wish to tell your GP about taking part in this study, you may do so. A summary of the results of the study will be sent to your GP surgery at the end of the study. The results they get will be an overall summary of the results from the study rather than your individual results or answers you have provided in the questionnaire.

What will happen to the results of the research study?

If you have requested the results of the study, you will be sent a copy of the summary of the results once all of the questionnaires have been returned and analysed. The results from this study will be part of a Doctoral qualification. The knowledge we gain from this study will be shared through publications and at conferences for others in this area of research. You will not be identified in any report or publications.

Who is organising and funding the research?

This research is being organised by the University of Nottingham and is being funded by The University of Nottingham and Arthritis Research UK Centre for Sport, Exercise, and Osteoarthritis.

Who has reviewed the study?

All research in the University of Nottingham is looked at by independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and given favourable opinion by the National Research Ethics Service: South Central – Oxford C.

If you require the questionnaire or other research documents in large print, please contact Angela Ching on the contact details below.

Further information and contact details:

Angela Ching
Telephone: 0115 823 1412
or 07932 257448
Email address:
msxac1@nottingham.ac.uk

Postal address:
Orthopaedics, Trauma and Sports Medicine,
C Floor, West Block,
Queen's Medical Centre,
Nottingham, NG7 2UH

Appendix 2 Study 1 Questionnaire

centre for sport, exercise & osteoarthritis

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

The Knee Confidence Study

The University of Nottingham is working with Arthritis Research UK to undertake a study on how confident people with knee osteoarthritis feel with their knees and their ability to be physically active and do exercises.

This questionnaire takes approximately 20 minutes to complete.

Your contribution to this research will help improve the knowledge and understanding of how exercise can be used as a treatment for knee osteoarthritis in terms of reducing pain and improving mobility.

Your responses will be kept strictly confidential and you will not be identified in any study reports.

Please complete the questionnaire as accurately as possible. There are no right or wrong answers.

Please return this questionnaire in the pre-paid envelope provided. **You do not need a stamp.**

If you have any questions about this questionnaire or the study in general, please contact **Angela Ching** on

0115 823 1412 or 07932 257448

Or by email at: msxac1@nottingham.ac.uk

Office Use Only

Participant Study ID: __ __ __ __ __ Site ID:

Questionnaire: Date received:

Consent:

Other information:

YOUR DETAILS

Name: _____

Postal Address: _____

_____

Telephone Number: _____

E-mail address: _____

GP Surgery: _____

Please give consent:

If you would like to be contacted for further involvement in this study, please *initial* the box below (optional)	If you would like to be contacted about the results of this study, please *initial* the box below (optional)	If you would like to be contacted for opportunities to take part in future studies, please *initial* the box below (optional)
☐	☐	☐

Today's date (DD/MM/YYYY): _____/_____/_____

Gender: Male ☐ Female ☐

Date of birth (DD/MM/YYYY): _____/_____/_____

Height: _____ feet _____ inches **OR** _____ centimetres

Weight: _____ stones _____ pounds **OR** _____ kilograms

Ethnicity:

White-Caucasian ☐ White-Hispanic ☐ Black-Caribbean ☐

Black-African ☐ Indian ☐ Chinese ☐

Other ☐ Please specify _____

Smoking status:

Non-smoker/never smoked ☐

Current smoker ☐ How many cigarettes do you smoke a day? ____

Ex-smoker ☐ When did you quit smoking? _____

Employment status:

Employed ☐ Unemployed ☐ Retired ☐

Sick Leave ☐ Student ☐ Other ☐ Please specify _____

Highest education level obtained? _____

Do you have knee osteoarthritis (OA)? No ☐ Yes Right knee ☐ Left knee ☐ Both knees ☐

If both knees, which knee is more severe? Right ☐ Left ☐

When were you diagnosed with knee OA? _____

Have you had any treatments for your knee OA? No ☐ Yes ☐

If **yes**, please state them: _____

_____

_____

_____

Do you have knee pain? No ☐ Yes Right knee ☐ **Left knee** ☐ Both knees ☐

If both knees, which knee is more severe? Right ☐ Left ☐

If **yes**, how severe is your knee pain today in *your more severe knee*? Please mark a cross on the line below to indicate how your knee pain is today.

No pain |_____| Very severe pain

Do you have any of the following in your *more severe knee*? (tick appropriate)

Pain ☐ Knees becoming bent ☐ Knees giving way ☐

Stiffness ☐ Loss of movement ☐ Cracking/popping ☐

Swelling ☐

Have you ever had surgery/arthroscopy for ligament or meniscal repair in your knee(s)? ☐ No ☐ Yes If **yes**, which knee? Right ☐ Left ☐ Both ☐

Do you have a current significant knee injury (for example, one that you have sought medical treatment for)? ☐ No ☐ Yes

If **yes**, which knee(s)? Right ☐ Left ☐ Both ☐ and please provide details:

_____

_____

_____

Do you have any other medical condition(s)? ☐ No ☐ Yes

If **yes**, please state them: _____

_____

_____

Please feel free to use additional paper for your comments if necessary.

1. YOUR PHYSICAL ACTIVITY

Please think of the **last 7 days** when answering *Questions 1 A-G*. These questions are about the time you spent being physically active in the last 7 days that lasted at least 10 minutes at a time and was 'moderate' or 'vigorous' in nature (see definitions below).

- **MODERATE** physical activity: any activity that gets you mildly sweaty and out of breath, (e.g. brisk walking, carrying loads, digging, climbing ladders)
- **VIGOROUS** physical activity: any activity that involves hard physical effort and makes you breathe much harder than normal (e.g. heavy lifting, aerobics, or fast bicycling)

A. During the last 7 days, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

Think about *only* those physical activities that you did for at least 10 minutes at a time.

_____ **days per week** ➔ B. How much time in total did you usually spend on one of those days doing vigorous physical activities?

or

☐ **None** _____ **hours** _____ **minutes**

C. Again, think *only* about those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week** ➔ D. How much time in total did you usually spend on one of those days doing moderate physical activities?

or

☐ **None** _____ **hours** _____ **minutes**

E. During the last 7 days, on how many days did you **walk** for at least 10 minutes at a time? This includes walking at work and at home, walking to travel from place to place, and any other walking that you did solely for recreation, sport, exercise or leisure.

_____ **days per week** ➔ F. How much time in total did you usually spend walking on one of those days?

or

☐ **None** _____ **hours** _____ **minutes**

The next question is about the time you spent **sitting** on weekdays while at work, at home, while doing course work and during leisure time. This includes time spent sitting at a desk, visiting friends, reading, travelling on a bus or sitting or lying down to watch television.

G. During the last 7 days, how much time in total did you usually spend *sitting* on a **weekday**? _____ **hours** _____ **minutes**

2. YOUR EXPECTATIONS ABOUT THE BENEFITS OF REGULAR EXERCISE OR PHYSICAL ACTIVITY

Please respond to *Questions 2 A-O* by ticking one box for each statement.

A. Exercise will improve my ability to perform daily activities

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

B. Exercise will improve my social standing

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

C. Exercise will improve my overall body functioning

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

D. Exercise will help manage stress

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

E. Exercise will strengthen my bones

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

F. Exercise will improve my mood

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

G. Exercise will increase my muscle strength

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

H. Exercise will make me more at ease with people

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

I. Exercise will aid in weight control

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

J. Exercise will improve my psychological state

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

K. Exercise will provide companionship

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

L. Exercise will improve the functioning of my cardiovascular system

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

M. Exercise will increase my mental alertness

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

N. Exercise will increase my acceptance by others

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

O. Exercise will give me a sense of personal accomplishment

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

3. YOUR KNEES

Answer every question by **ticking the appropriate box, only one box for each question**. If you are unsure about how to answer a question, please give the best answer you can.

3.1 Symptoms

Questions 3.1 A-E should be answered thinking of your knee symptoms during the **last week**.

A. Do you have swelling in your knee?

Never	Rarely	Sometimes	Often	Always
☐	☐	☐	☐	☐

B. Do you feel grinding, hear clicking or any other type of noise when your knee moves?

Never	Rarely	Sometimes	Often	Always
☐	☐	☐	☐	☐

C. Does your knee catch or hang up when moving?

Never	Rarely	Sometimes	Often	Always
☐	☐	☐	☐	☐

D. Can you straighten your knee fully?

Always	Often	Sometimes	Rarely	Never
☐	☐	☐	☐	☐

E. Can you bend your knee fully?

Always	Often	Sometimes	Rarely	Never
☐	☐	☐	☐	☐

3.2 Stiffness

Questions 3.2 A-B concern the amount of joint stiffness you have experienced during the **last week** in your knee. Stiffness is a sensation of restriction or slowness in the ease with which you move your knee joint.

A. How severe is your knee joint stiffness after first wakening in the morning?

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

B. How severe is your knee stiffness after sitting, lying or resting **later in the day**?

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

3.3 Pain *(Questions 3.3 A-I)*

A. How often do you experience knee pain?

Never	Monthly	Weekly	Daily	Always
☐	☐	☐	☐	☐

What amount of knee pain have you experienced the **last week** during the following activities?

B. Twisting/pivoting on your knee

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

C. Straightening knee fully

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

D. Bending knee fully

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

E. Walking on flat surface

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

F. Going up or down stairs

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

G. At night while in bed

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

H. Sitting or lying

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

I. Standing upright

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

3.4 Function, daily living

Questions 3.4 A-Q concern your physical function. By this we mean your ability to move around and to look after yourself. For each of the following activities please indicate the degree of difficulty you have experienced in the **last week** due to your knee.

A. Descending stairs

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

B. Ascending stairs

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

For each of the following activities please indicate the degree of difficulty you have experienced in the **last week** due to your knee.

C. Rising from sitting

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

D. Standing

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

E. Bending to floor/pick up an object

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

F. Walking on flat surface

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

G. Getting in/out of car

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

H. Going shopping

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

I. Putting on socks/stockings

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

J. Rising from bed

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

K. Taking off socks/stockings

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

L. Lying in bed (turning over, maintaining knee position)

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

M. Getting in/out of bath

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

N. Sitting

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

O. Getting on/off toilet

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

P. Heavy domestic duties (moving heavy boxes, scrubbing floors, etc.)

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

Q. Light domestic duties (cooking, dusting, etc.)

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

3.5 Function, sports and recreational activities

Questions 3.5 A-E concern your physical function when being active on a higher level. The questions should be answered thinking of what degree of difficulty you have experienced during the **last week** due to your knee.

A. Squatting

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

B. Running

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

C. Jumping

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

D. Twisting/pivoting on your injured knee

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

E. Kneeling

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

3.6 Quality of Life *(Questions 3.6 A-D)*

A. How often are you aware of your knee problem?

Never	Monthly	Weekly	Daily	Constantly
☐	☐	☐	☐	☐

B. Have you modified your life style to avoid potentially damaging activities to your knee?

Not at all	Mildly	Moderately	Severely	Totally
☐	☐	☐	☐	☐

C. How much are you troubled with lack of confidence in your knee?

Not at all	Mildly	Moderately	Severely	Extremely
☐	☐	☐	☐	☐

D. In general, how much difficulty do you have with your knee?

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

4. YOUR ARTHRITIS

For *Questions 4.1 A-E and 4.2 A-F*, **please circle the number** that corresponds to how certain you are that you can do the following tasks regularly at the present time.

4.1 Self-Efficacy Pain Scale

A. How certain are you that you can decrease your pain **quite a bit**?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

B. How certain are you that you can continue most of your daily activities?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

C. How certain are you that you can keep arthritis pain from interfering with your sleep?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

D. How certain are you that you can make a **small-to-moderate** reduction in your arthritis pain by using methods other than taking extra medication?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

E. How certain are you that you can make a **large** reduction in your arthritis pain by using methods other than taking extra medication?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

4.2 Self-Efficacy Other Symptoms Scale

A. How certain are you that you can control your fatigue?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

B. How certain are you that you can regulate your activity so as to be active without aggravating your arthritis?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

C. How certain are you that you can do something to help yourself feel better if you are feeling blue?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

D. As compared with other people with arthritis like yours, how certain are you that you can manage arthritis pain during your daily activities?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

E. How certain are you that you can manage your arthritis symptoms so that you can do the things you enjoy doing?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

F. How certain are you that you can deal with the frustration of arthritis?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

Please turn over for more questions

5. YOUR CONFIDENCE WITH EXERCISE

Questions 5 A-H are designed to assess your beliefs in your ability to continue exercising on a three time per week basis at moderate intensities (upper end of your perceived exertion range; see page 4 for definition of 'moderate'), for **40+** minutes per session in the future. Using the scales listed below please indicate how confident you are that you will be able to continue to exercise in the future.

For example, if you have complete confidence that you could exercise three times per week at moderate intensity for **40+** minutes for the next four weeks without quitting, you would **circle 100%**. However, if you had no confidence at all that you could exercise at your exercise prescription for the next four weeks without quitting, (that is, confident you would not exercise), you would **circle 0%**.

Please remember to answer honestly and accurately. There are no right or wrong answers.

Mark your answer by circling a percentage (%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

NOT AT ALL CONFIDENT — MODERATELY CONFIDENT — HIGHLY CONFIDENT

A. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT WEEK.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

B. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT TWO WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

C. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT THREE WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

D. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT FOUR WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

E. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT FIVE WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

F. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT SIX WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

G. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT SEVEN WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

H. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT EIGHT WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Please turn over for more questions

6. YOUR HEALTH IN THE LAST 2 WEEKS *(Questions 6 A-I)*

Over the **last 2 weeks**, how often have you been bothered by any of the following problems? (tick the appropriate answer).

How often during the past 2 weeks were you bothered by...	Not at all	Several days	More than half the days	Nearly every day
A. Little interest or pleasure in doing things	☐	☐	☐	☐
B. Feeling down, depressed, or hopeless	☐	☐	☐	☐
C. Trouble falling or staying asleep, or sleeping too much	☐	☐	☐	☐
D. Feeling tired or having little energy	☐	☐	☐	☐
E. Poor appetite or overeating	☐	☐	☐	☐
F. Feeling bad about yourself, or that you are a failure, or have let yourself or your family down	☐	☐	☐	☐
G. Trouble concentrating on things, such as reading the newspaper or watching television	☐	☐	☐	☐
H. Moving or speaking slowly that other people could have noticed. Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	☐	☐	☐	☐

I. If you checked off **any** problems, how **difficult** have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

7. YOUR GENERAL HEALTH TODAY (*Questions 7 A-F*)

Under each heading, please tick the ONE box that best describes your health TODAY.

A. MOBILITY

- I have no problems in walking about ☐
- I have slight problems in walking about ☐
- I have moderate problems in walking about ☐
- I have severe problems in walking about ☐
- I am unable to walk about ☐

B. SELF-CARE

- I have no problems washing or dressing myself ☐
- I have slight problems washing or dressing myself ☐
- I have moderate problems washing or dressing myself ☐
- I have severe problems washing or dressing myself ☐
- I am unable to wash or dress myself ☐

C. USUAL ACTIVITIES *(e.g. work, study, housework, family or leisure activities)*

- I have no problems doing my usual activities ☐
- I have slight problems doing my usual activities ☐
- I have moderate problems doing my usual activities ☐
- I have severe problems doing my usual activities ☐
- I am unable to do my usual activities ☐

D. PAIN / DISCOMFORT

- I have no pain or discomfort ☐
- I have slight pain or discomfort ☐
- I have moderate pain or discomfort ☐
- I have severe pain or discomfort ☐
- I have extreme pain or discomfort ☐

E. ANXIETY / DEPRESSION

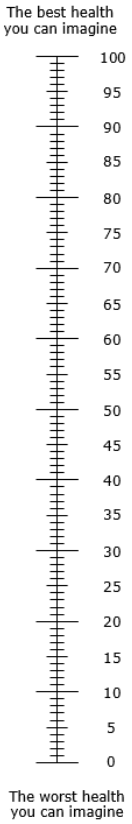
- I am not anxious or depressed ☐
- I am slightly anxious or depressed ☐
- I am moderately anxious or depressed ☐
- I am severely anxious or depressed ☐
- I am extremely anxious or depressed ☐

Please turn over for the final question

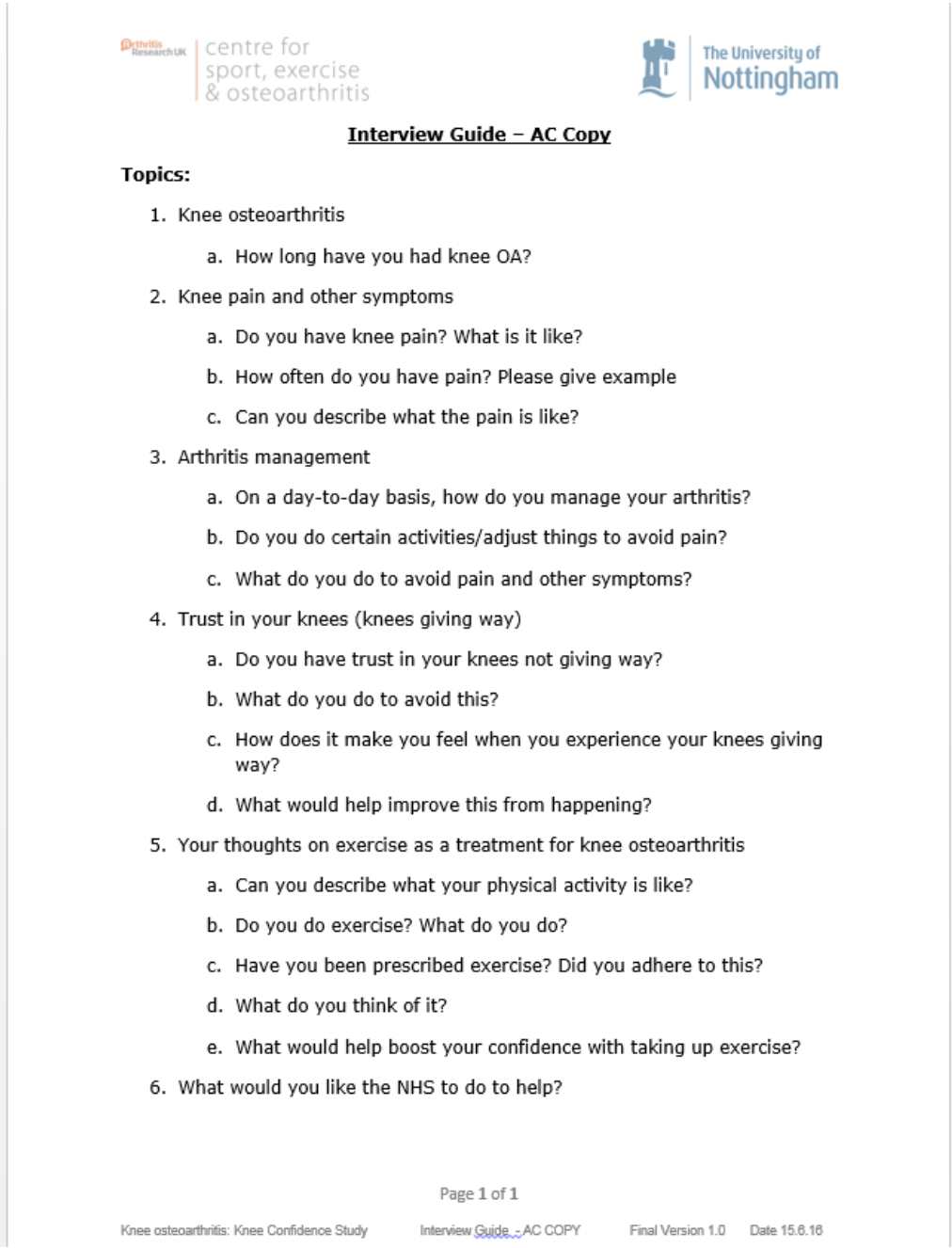
- We would like to know how good or bad your health is TODAY.
- This scale is numbered from 0 to 100.
- 100 means the best health you can imagine. 0 means the worst health you can imagine.
- Mark an X on the scale to indicate how your health is TODAY.
- Now, please write the number you marked on the scale in the box below.

F. YOUR HEALTH TODAY = ☐

This is the end of the questionnaire. Thank you very much for taking part. Please return this questionnaire in the pre-paid envelope provided.



Appendix 3 Study 1 interview guide



centre for sport, exercise & osteoarthritis

The University of Nottingham

Interview Guide – AC Copy

Topics:

1. Knee osteoarthritis
    a. How long have you had knee OA?
2. Knee pain and other symptoms
    a. Do you have knee pain? What is it like?
    b. How often do you have pain? Please give example
    c. Can you describe what the pain is like?
3. Arthritis management
    a. On a day-to-day basis, how do you manage your arthritis?
    b. Do you do certain activities/adjust things to avoid pain?
    c. What do you do to avoid pain and other symptoms?
4. Trust in your knees (knees giving way)
    a. Do you have trust in your knees not giving way?
    b. What do you do to avoid this?
    c. How does it make you feel when you experience your knees giving way?
    d. What would help improve this from happening?
5. Your thoughts on exercise as a treatment for knee osteoarthritis
    a. Can you describe what your physical activity is like?
    b. Do you do exercise? What do you do?
    c. Have you been prescribed exercise? Did you adhere to this?
    d. What do you think of it?
    e. What would help boost your confidence with taking up exercise?
6. What would you like the NHS to do to help?

Page 1 of 1

Knee osteoarthritis: Knee Confidence Study Interview Guide - AC COPY Final Version 1.0 Date 15.6.16

Appendix 4 Study 1 Extract of Billy's interview transcript

mm] and you know, I think I'm reasonable self-confident bloke [A: yeah], y-you know.

A: yeah, do you think you've always been that way?

BI: yeah, I've always, yeah, I've always been sort of [A: yeah], they used to say 'Jack the lad' years ago [A: oh yeah] [both laughs] [A: ok, yeah, yeah, yeah, yeah]. But, I just, you know, always, you know, and I think it's just a fact of life, you've got to go through life, you've got to respect people and you've got to be nice to people. I mean, it's all about karma [A: yeah], you know, and I'm, what I'm one of those, like [A: yeah], if you do good to people, you get it back [A: yeah], you know, and if you do bad to people, you get that back [A: yeah] twice as much [A: yeah, that's it, yeah]. But, I, I wanna be confident. If I'm not, if, if I lose me confidence a bit, erm, I'm always wary, I have to make sure I do everything right, you know, so [A: ooh, ok]. It's like at work sometimes you get in a sticky situation, you know things like that [A: yeah, yeah], but I don't let it knock me con-, I don't want it to knock me confidence [A: yeah], that's why, you know.

A: yeah, ok. And, what about when you're knee gives way then, your left knee [BI: yeah], how does that make you feel?

BI: Er, miserable, disappointed, you know [A: mm, mm], but not de-, I-I never get depressed [A: yeah], you know, erm, I get, I suppose

BI: I, oh yeah, I do crouches and you know, do crouches and leg raises, and turn on me side and do a leg raise, you know [A: yeah] and that's what they've shown me, and that's supposed to be for me back, but I, I've got a feeling it's done something good to me legs, you know.

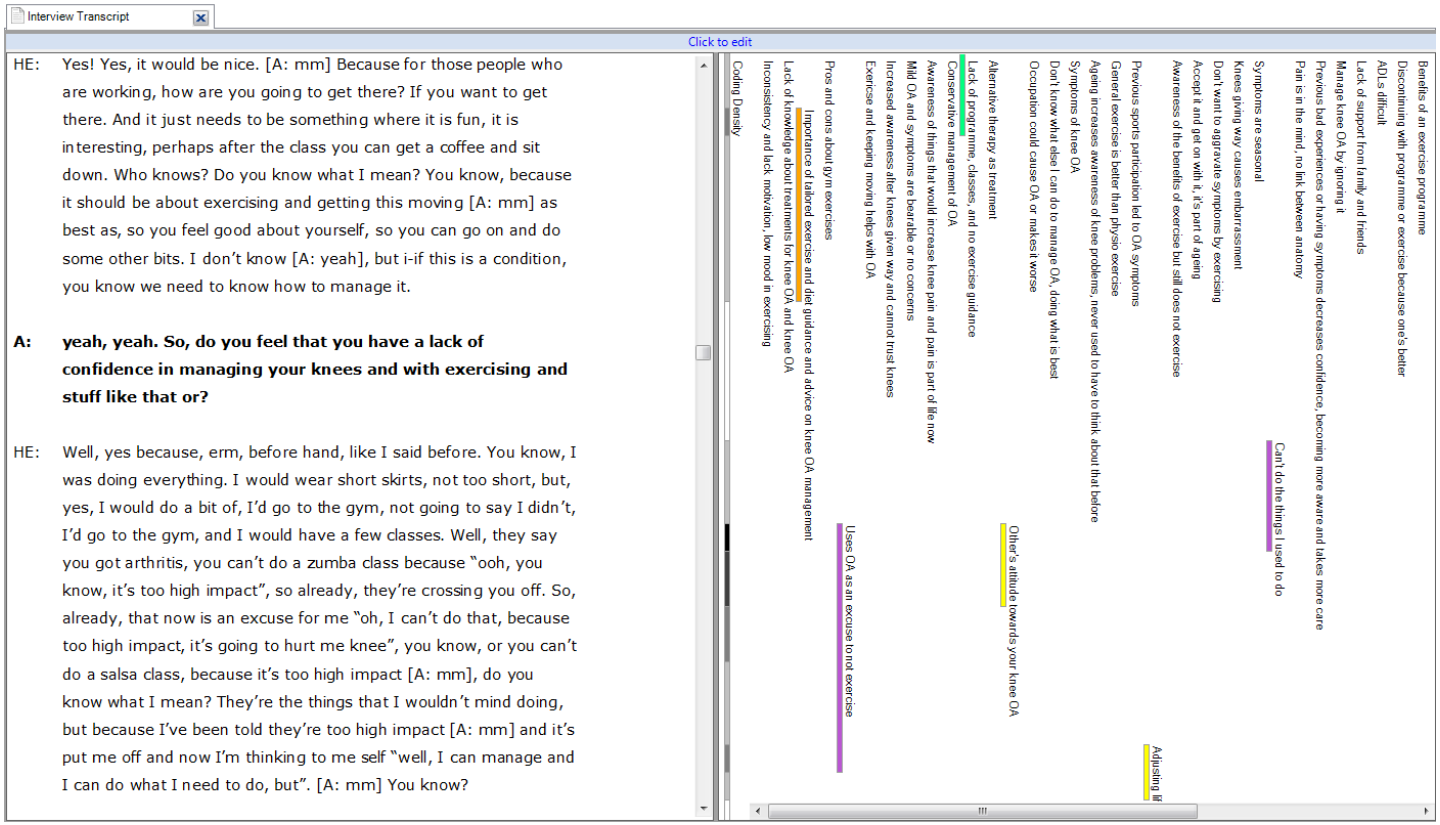
A: ok, ok [BI: yeah]. How do you feel about the confidence with exercising then?

BI: I feel good. I-I feel, I feel really good, yes [A: yeah]. Some, sometimes I try to do something, like, I can't do that, you know [A: mm, mm] and that does me a bit and I think about it, ahh, I should be able to do that and I can't.

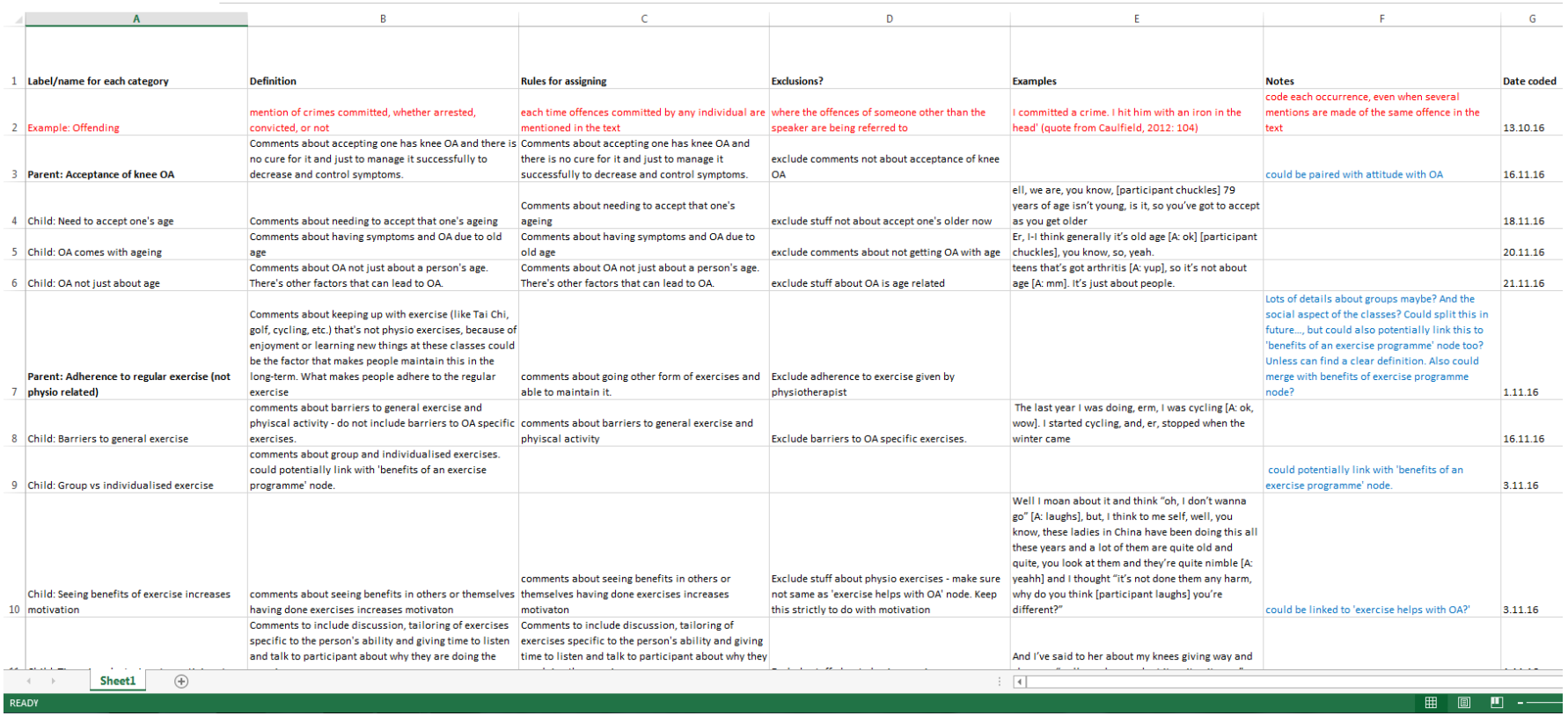
A: ok, ok [BI: yeah] and can you think of the reasons why you feel good from the exercises?

BI: I, well, I think to me self, in, I'm that sort of guy that, I, I wanna feel good [A: mm] and I think if you keep telling yourself "you wanna feel good", [A: yeah] you do feel good [A: yeah, yeah]. And I'm a big believer in looking at the mirror, it'll make her laugh, and I'll, I'll look in the mirror and say "you are good looking, you feel great today", [A: yeahhhh] you know. [A: yeah] [both laughs]. [A: yeah] And, it's just, it's just about self-confidence I think [A: mm,

Appendix 5 Study 1 Henrietta's NVivo coding density



Appendix 6 Study 1 Interview screenshot of coding table on Microsoft Excel



	A	B	C	D	E	F	G
1	**Label/name for each category**	**Definition**	**Rules for assigning**	**Exclusions?**	**Examples**	**Notes**	**Date coded**
2	Example: Offending	mention of crimes committed, whether arrested, convicted, or not	each time offences committed by any individual are mentioned in the text	where the offences of someone other than the speaker are being referred to	I committed a crime. I hit him with an iron in the head' (quote from Caulfield, 2012: 104)	code each occurrence, even when several mentions are made of the same offence in the text	13.10.16
3	**Parent: Acceptance of knee OA**	Comments about accepting one has knee OA and there is no cure for it and just to manage it successfully to decrease and control symptoms.	Comments about accepting one has knee OA and there is no cure for it and just to manage it successfully to decrease and control symptoms.	exclude comments not about acceptance of knee OA		could be paired with attitude with OA	16.11.16
4	Child: Need to accept one's age	Comments about needing to accept that one's ageing	Comments about needing to accept that one's ageing	exclude stuff not about accept one's older now	ell, we are, you know, [participant chuckles] 79 years of age isn't young, is it, so you've got to accept as you get older		18.11.16
5	Child: OA comes with ageing	Comments about having symptoms and OA due to old age	Comments about having symptoms and OA due to old age	exclude comments about not getting OA with age	Er, I-I think generally it's old age [A: ok] [participant chuckles], you know, so, yeah.		20.11.16
6	Child: OA not just about age	Comments about OA not just about a person's age. There's other factors that can lead to OA.	Comments about OA not just about a person's age. There's other factors that can lead to OA.	exclude stuff about OA is age related	teens that's got arthritis [A: yup], so it's not about age [A: mm]. It's just about people.		21.11.16
7	**Parent: Adherence to regular exercise (not physio related)**	Comments about keeping up with exercise (like Tai Chi, golf, cycling, etc.) that's not physio exercises, because of enjoyment or learning new things at these classes could be the factor that makes people maintain this in the long-term. What makes people adhere to the regular exercise	comments about going other form of exercises and able to maintain it.	Exclude adherence to exercise given by physiotherapist		Lots of details about groups maybe? And the social aspect of the classes? Could split this in future..., but could also potentially link this to 'benefits of an exercise programme' node too? Unless can find a clear definition. Also could merge with benefits of exercise programme node?	1.11.16
8	Child: Barriers to general exercise	comments about barriers to general exercise and phyiscal activity - do not include barriers to OA specific exercises.	comments about barriers to general exercise and phyiscal activity	Exclude barriers to OA specific exercises.	The last year I was doing, erm, I was cycling [A: ok, wow]. I started cycling, and, er, stopped when the winter came		16.11.16
9	Child: Group vs individualised exercise	comments about group and individualised exercises. could potentially link with 'benefits of an exercise programme' node.				could potentially link with 'benefits of an exercise programme' node.	3.11.16
10	Child: Seeing benefits of exercise increases motivation	comments about seeing benefits in others or themselves having done exercises increases motivaton	comments about seeing benefits in others or themselves having done exercises increases motivaton	Exclude stuff about physio exercises - make sure not same as 'exercise helps with OA' node. Keep this strictly to do with motivation	Well I moan about it and think "oh, I don't wanna go" [A: laughs], but, I think to me self, well, you know, these ladies in China have been doing this all these years and a lot of them are quite old and quite, you look at them and they're quite nimble [A: yeahh] and I thought "it's not done them any harm, why do you think [participant laughs] you're different?"	could be linked to 'exercise helps with OA?'	3.11.16
		Comments to include discussion, tailoring of exercises specific to the person's ability and giving time to listen and talk to participant about why they are doing the	Comments to include discussion, tailoring of exercises specific to the person's ability and giving time to listen and talk to participant about why they		And I've said to her about my knees giving way and		

Sheet1

READY

Appendix 7 Study 2 participant information sheet

Participant Information Sheet - Questionnaire
Final version 1.0: 25/06/2015

Title of Study: **Good Life with osteoArthritis in Denmark Initiative: What do patients think?** |
Study ID – GLA:D Initiative: Patients' Perspective (Questionnaire)

Name of Researcher(s): Miss Angela Ching, Dr Søren Skou, Ms Sarah Kroman, Dr Shirley Thomas, Professor Mark Batt, Professor Ewa M. Roos and Dr Kimberley Edwards.

We would like to invite you to take part in our research study. Before you decide we would like you to understand why the research is being done and what it involves for you. One of our team can go through the information sheet with you and answer any questions you have. Talk to others about the study if you wish. Ask us if there is anything that is not clear.

What is the purpose of the study?

Physical activity and exercise can reduce pain and stiffness in people with knee osteoarthritis (OA). But, we know that it can be tough do regular exercises. We want to find out your thoughts about the Good Life with osteoArthritis in Denmark (Godt Liv med Artrose i Danmark; GLA:D) initiative. Learning more about your views will be key to make advances for future care in people with knee OA.

Why have I been invited?

You have been selected from the GLA:D registry. We think you may be suitable to take part in this online questionnaire study. You are being invited to take part because we want to find out how satisfied you are with the GLA:D program and how confident you feel about continuing with the exercises in the long-term. We are inviting at least 129 participants like you to take part.

Do I have to take part?

It is up to you to decide whether or not to take part. If you decide to take part, you will need to provide your consent on the online questionnaire before you can do so. You will need to click on the link in the email, which will take you to the questionnaire where there will be instructions. If you take part you are still free to withdraw at any time and without giving a reason. This would *not* affect your legal rights or the medical care you receive from your doctors.

What will happen to me if I take part?

- You have been sent this invitation email enclosed with this participant information sheet and a link to complete the online questionnaire.
- Please read this "participant information sheet" and ensure you are happy with the information. If you have any questions please contact our researchers (Søren Skou or Angela Ching) on +45 XXXX XXXX.

- If you decide to take part in this study, please click on the link in your email, which will take you to the online questionnaire. If this link does not work, please copy and paste the link into your search bar.
- You will need to provide consent after you click on the link before you will be able to complete the questionnaire.
- If you would like to be contacted for further involvement in this study, please consent to this also and we may contact you in the future.
- Please try and answer as many questions as possible. There are no right or wrong answers. *The questionnaire should take about 20 minutes to complete.*

Expenses and inconvenience allowance

You will not be paid to take part in the online questionnaire.

What are the possible disadvantages and risks of taking part?

There are no disadvantages or risks with taking part in this questionnaire.

What are the possible benefits of taking part?

The information we gain from you will help us learn more about people's views with the GLA:D initiative. Your views will help inform future research to provide better care for patients with knee OA.

What if there is a problem?

If you have a concern about any aspect of this study, you should ask to speak to our researchers (Angela or Søren) who will do their best to answer your questions. Their contact details are at the end of this information sheet. If you remain unhappy and wish to complain formally, you should contact the Head of the Research Unit (Professor Ewa M. Roos), Campusvej 55, DK-5230 Odense M. Phone: +45 6550 3448. Email: eroos@health.sdu.dk

Will my taking part in the study be kept confidential?

We will follow ethical and legal practice and all information about you will be handled in confidence.

If you join the study, some parts of the data collected for the study will be looked at by authorised persons from the University of Southern Denmark and the University of Nottingham who are organising the research. They may also be looked at by authorised people to check that the study is being carried out correctly. All will have a duty of confidentiality to you as a research participant and we will do our best to meet this duty.

All the information collected about you during the research will be kept *strictly confidential*, stored in a locked office, and on a password protected database. Any information about you which leaves the institution will have your name, address, and any other personal identifiable information removed (anonymised) and a unique code will be used so that you cannot be recognised from it.

Your personal data (email address) will be kept for 12 months or less after the end of the study. This is so we are able to contact you about the findings of the study and possible follow-up studies (unless you advise us that you do not wish to be contacted). All other data (research data) will be kept securely by the Chief Investigator (Dr Kimberley Edwards) for 7 years. After this time your data will be destroyed securely. During this time all precautions will be taken by all those involved to maintain your confidentiality. Only members of the research team will have access to your personal data. We will handle, process, storage and dispose of your data by meeting the requirements of the Data Protection Act 1998 (United Kingdom).

What will happen if I don't want to carry on with the study?

Your participation is voluntary. You are free to withdraw at any time, without giving any reason. But, the information you have provided us with so far cannot be removed and may still be used in the study. This is because the data has been entered onto the secure computer system. We make sure to remove your personal details so you cannot be identified. You will be given a unique Participant ID number (e.g. 12345) and this ID number will be entered into our database instead of your name to make sure you are anonymous. We will also back-up the data onto the servers at the University of Southern Denmark and the University of Nottingham.

Involvement of the General Practitioner/Family doctor

Your family doctor will not be informed about your involvement in this study. If you wish to tell them about taking part in this study, you may do so.

What will happen to the results of the research study?

If you have requested the results of the study, you will be sent a copy of the summary of the results (via email) at the end of the study. The results from this study will be part of a Doctoral qualification. The knowledge we gain from this study will be shared through publications and at conferences for others in this area of research. You will not be identified in any report or publications.

Who is organising and funding the research?

This research is being organised by the University of Southern Denmark and the University of Nottingham. Arthritis Research UK Centre for Sport, Exercise Fellowship Award, and Osteoarthritis and Osteoarthritis Research Society International Collaborative Scholarship are funding this study.

Who has reviewed the study?

This project has been reviewed and given a favourable opinion by the University of Nottingham, Faculty of Medicine and Health Sciences Research Ethics Committee. The Regional Committee on Health Research Ethics for Southern Denmark has confirmed in writing that this project does not need to be notified. The Danish Law states that only projects using human biological material need approval and our project will not be taking any human biological materials.

If you would like more information or have any questions, please contact:
Angela Ching/Søren Skou
Telephone: XXXX XXXX

Email address: Angela: msxac1@nottingham.ac.uk or Søren: stskou@health.sdu.dk
Postal address: University of Southern Denmark, Institute of Sports Science and Clinical Biomechanics, Research Unit for Musculoskeletal Function and Physiotherapy, Campusvej 55, DK-5230 Odense M, Denmark.

Appendix 8 Study 2 Questionnaire

GLA:D Patients' Perspectives

The University of Nottingham is working with Arthritis Research UK and the University of Southern Denmark to start a study to find out your views about the Godt Liv med Artrose i Danmark (Good Life with osteoArthritis in Denmark; GLA:D) Initiative.

You have been invited to complete this questionnaire. The questionnaire takes about 20 minutes to complete. The information collected will aim to find out more information about your satisfaction with the GLA:D initiative and how you feel about continuing with the exercises in the future.

Your contribution to this research will help improve the knowledge and understanding of how exercise can be used as a treatment for knee osteoarthritis in terms of reducing knee pain and improving mobility.

Your responses will be kept strictly confidential and you will not be identified in any study reports.

Please complete the questionnaire as accurately as possible. There are no right or wrong answers.

If you have any questions about this questionnaire or the study in general, please contact **Angela Ching or Søren Skou** on

ADD TELEPHONE NUMBER

Or by email at: msxac1@nottingham.ac.uk

Office Use Only

Participant Study ID: _____ __ __ __

Date questionnaire returned:

YOUR DETAILS

Email address: _____

Please give consent:

If you would like to take part in this questionnaire, please *tick* in the box below (optional)	If you would like to be contacted for further involvement in this study, please *tick* in the box below (optional)	If you would like to be contacted about the results of this study, please *tick* in the box below (optional)
☐	☐	☐

Today's date (DD/MM/YYYY): _____/_____/_____

Gender: Male ☐ Female ☐

Age today (years): _____

Height: _____ centimetres

Weight: _____ kilograms

Ethnicity:

White-Caucasian ☐ White-Hispanic ☐ Black-Caribbean ☐

Black-African ☐ Indian ☐ Chinese ☐

Other ☐ Please specify _____

Smoking status:

Non-smoker/never smoked ☐

Current smoker ☐ How many cigarettes do you smoke a day? ____

Ex-smoker ☐ When did you quit smoking? _____

Employment status:

Employed ☐ Unemployed ☐ Retired ☐

Sick Leave ☐ Student ☐ Other ☐ Please specify _____

Highest education level obtained? _____

Which month did you first register onto the GLA:D Initiative? _____

Which of these did you have first?

Education classes ☐ Exercise classes ☐ Both at the same time ☐

Do you have knee osteoarthritis (OA)? No ☐ Yes Right knee ☐ Left knee ☐ Both knees ☐

If both knees, which knee is more severe? Right ☐ Left ☐

When were you diagnosed with knee OA? _____

Have you had any treatments for your knee OA? No ☐ Yes ☐

If **yes**, please state them: _____

_____

_____

_____

Do you have knee pain? No ☐ Yes Right knee ☐ **Left knee** ☐ Both knees ☐

If both knees, which knee is more severe? Right ☐ Left ☐

If **yes**, how severe is your knee pain today in *your more severe knee*? Please mark a cross on the line below to indicate how your knee pain is today.

No pain |_____| Very severe pain

Do you have any of the following in your *more severe knee*? (tick all that apply)

Pain ☐ Knees becoming bent ☐ Knees giving way ☐

Stiffness ☐ Loss of movement ☐ Cracking/popping ☐

Swelling ☐

Have you ever had surgery/arthroscopy for ligament or meniscal repair in your knee(s)? ☐ No ☐ Yes If **yes**, which knee? Right ☐ Left ☐ Both ☐

Do you have a current significant knee injury (for example, one that you have sought medical treatment for)? ☐ No ☐ Yes

If **yes**, which knee(s)? Right ☐ Left ☐ Both ☐

Do you have any other medical condition(s)? ☐ No ☐ Yes

If **yes**, please state them: _____

_____

_____

1. During your participation in the GLA:D Initiative…

How satisfied have you been with each of the components of the GLA:D initiative? (Please select one box for each statement)

	Very dissatisfied	Dissatisfied	Unsure	Satisfied	Very satisfied
Education					
A. Patient education provided by the physiotherapist	☐	☐	☐	☐	☐
B. Patient education provided by a former patient of GLA:D	☐	☐	☐	☐	☐
C. Providing information you need (e.g. explaining osteoarthritis and treatment)	☐	☐	☐	☐	☐
D. Ease of understanding (e.g. used words/language you can understand)	☐	☐	☐	☐	☐
E. You were able to ask questions	☐	☐	☐	☐	☐
F. Your questions were answered	☐	☐	☐	☐	☐
G. Duration of each session	☐	☐	☐	☐	☐
H. Frequency of education sessions	☐	☐	☐	☐	☐
I. Being able to apply what you have learnt into your everyday life	☐	☐	☐	☐	☐
	Very dissatisfied	Dissatisfied	Unsure	Satisfied	Very satisfied
Physiotherapist					
J. Listening to you	☐	☐	☐	☐	☐
K. Providing teaching and training	☐	☐	☐	☐	☐
L. Understanding you	☐	☐	☐	☐	☐
M. Giving you time	☐	☐	☐	☐	☐
N. Involving you in decisions about exercise choices (e.g. individual or group sessions)	☐	☐	☐	☐	☐

Neuromuscular training sessions	Very dissatisfied	Dissatisfied	Unsure	Satisfied	Very satisfied
O. Training instructions provided by the physiotherapist	☐	☐	☐	☐	☐
P. Ease of understanding (e.g. used words/language you can understand)	☐	☐	☐	☐	☐
Q. Duration of each session	☐	☐	☐	☐	☐
R.10-minute warm-up	☐	☐	☐	☐	☐
S. Circuit training program	☐	☐	☐	☐	☐
T. Difficulty of each exercise	☐	☐	☐	☐	☐
U. Individualised care during sessions	☐	☐	☐	☐	☐
V. 10-minute cool down	☐	☐	☐	☐	☐
W. Frequency of exercise sessions	☐	☐	☐	☐	☐
X. Being able to apply what you have learnt into your everyday life (i.e. continue with GLA:D training in the long-term)	☐	☐	☐	☐	☐

Y. Have you attended additional exercise classes after your 12 exercise sessions?

☐ No ☐ Yes

If **yes**, how often do you go?

Monthly ☐ Weekly ☐ Daily ☐

Z. How often do you use what you have learned?

Never ☐ Monthly ☐ Weekly ☐ Daily ☐

2. YOUR PHYSICAL ACTIVITY

Please think of the **last 7 days** when answering *Questions 2 A-G*. These questions are about the time you spent being physically active in the last 7 days that lasted at least 10 minutes at a time and was 'moderate' or 'vigorous' in nature (see definitions below).

- **MODERATE** physical activity: any activity that gets you mildly sweaty and out of breath, (e.g. brisk walking, carrying loads, digging, climbing ladders)
- **VIGOROUS** physical activity: any activity that involves hard physical effort and makes you breath much harder than normal (e.g. heavy lifting, aerobics, or fast bicycling)

A. During the last 7 days, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

Think about *only* those physical activities that you did for at least 10 minutes at a time.

_____ **days per week** ➔ B. How much time in total did you usually spend on one of those days doing vigorous physical activities?

or

☐ **None** _____ **hours** _____ **minutes**

C. Again, think *only* about those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week** ➔ D. How much time in total did you usually spend on one of those days doing moderate physical activities?

or

☐ **None** _____ **hours** _____ **minutes**

E. During the last 7 days, on how many days did you **walk** for at least 10 minutes at a time? This includes walking at work and at home, walking to travel from place to place, and any other walking that you did solely for recreation, sport, exercise or leisure.

_____ **days per week** ➔ F. How much time in total did you usually spend walking on one of those days?

or

☐ **None** _____ **hours** _____ **minutes**

The next question is about the time you spent **sitting** on weekdays while at work, at home, while doing course work and during leisure time. This includes time spent sitting at a desk, visiting friends, reading traveling on a bus or sitting or lying down to watch television.

G. During the last 7 days, how much time in total did you usually spend *sitting* on a **weekday**? _____ **hours** _____ **minutes**

3. YOUR CONFIDENCE WITH EXERCISE

Questions 3 A-H are designed to assess your beliefs in your ability to continue exercising on a three time per week basis at moderate intensities (upper end of your perceived exertion range; see page 6 for definition of 'moderate'), for **40+** minutes per session in the future. Using the scales listed below please indicate how confident you are that you will be able to continue to exercise in the future.

For example, if you have complete confidence that you could exercise three times per week at moderate intensity for **40+** minutes for the next four weeks without quitting, you would **circle 100%**. However, if you had no confidence at all that you could exercise at your exercise prescription for the next four weeks without quitting, (that is, confident you would not exercise), you would **circle 0%**.

Please remember to answer honestly and accurately. There are no right or wrong answers.

Mark your answer by circling a percentage (%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

NOT AT ALL CONFIDENT — MODERATELY CONFIDENT — HIGHLY CONFIDENT

A. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT WEEK.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

B. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT TWO WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

C. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT THREE WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

D. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT FOUR WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

E. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT FIVE WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

F. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT SIX WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

G. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT SEVEN WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

H. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes, without quitting for the NEXT EIGHT WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. YOUR EXPECTATIONS ABOUT THE BENEFITS OF REGULAR EXERCISE OR PHYSICAL ACTIVITY

Please respond to *Questions 4 A-O* by ticking one box for each statement.

A. Exercise will improve my ability to perform daily activities

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

B. Exercise will improve my social standing

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

C. Exercise will improve my overall body functioning

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

D. Exercise will help manage stress

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

E. Exercise will strengthen my bones

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

F. Exercise will improve my mood

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

G. Exercise will increase my muscle strength

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

H. Exercise will make me more at ease with people

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

I. Exercise will aid in weight control

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

J. Exercise will improve my psychological state

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

K. Exercise will provide companionship

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

L. Exercise will improve the functioning of my cardiovascular system

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

M. Exercise will increase my mental alertness

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

N. Exercise will increase my acceptance by others

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

O. Exercise will give me a sense of personal accomplishment

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

5. YOUR KNEES

Answer every question by **ticking the appropriate box, only <u>one</u> box for each question**. If you are unsure about how to answer a question, please give the best answer you can.

5.1 Symptoms

Questions 5.1 A-E should be answered thinking of your knee symptoms during the **last week**.

A. Do you have swelling in your knee?

Never	Rarely	Sometimes	Often	Always
☐	☐	☐	☐	☐

B. Do you feel grinding, hear clicking or any other type of noise when your knee moves?

Never	Rarely	Sometimes	Often	Always
☐	☐	☐	☐	☐

C. Does your knee catch or hang up when moving?

Never	Rarely	Sometimes	Often	Always
☐	☐	☐	☐	☐

D. Can you straighten your knee fully?

Always	Often	Sometimes	Rarely	Never
☐	☐	☐	☐	☐

E. Can you bend your knee fully?

Always	Often	Sometimes	Rarely	Never
☐	☐	☐	☐	☐

5.2 Stiffness

Questions 5.2 A-B concern the amount of joint stiffness you have experienced during the **last week** in your knee. Stiffness is a sensation of restriction or slowness in the ease with which you move your knee joint.

A. How severe is your knee joint stiffness after first wakening in the morning?

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

B. How severe is your knee stiffness after sitting, lying or resting **later in the day**?

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

5.3 Pain *(Questions 5.3 A-I)*

A. How often do you experience knee pain?

Never	Monthly	Weekly	Daily	Always
☐	☐	☐	☐	☐

What amount of knee pain have you experienced the **last week** during the following activities?

B. Twisting/pivoting on your knee

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

C. Straightening knee fully

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

D. Bending knee fully

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

E. Walking on flat surface

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

F. Going up or down stairs

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

G. At night while in bed

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

H. Sitting or lying

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

I. Standing upright

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

5.4 Function, daily living

Questions 5.4 A-Q concern your physical function. By this we mean your ability to move around and to look after yourself. For each of the following activities please indicate the degree of difficulty you have experienced in the **last week** due to your knee.

A. Descending stairs

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

B. Ascending stairs

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

For each of the following activities please indicate the degree of difficulty you have experienced in the **last week** due to your knee.

C. Rising from sitting

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

D. Standing

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

E. Bending to floor/pick up an object

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

F. Walking on flat surface

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

G. Getting in/out of car

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

H. Going shopping

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

I. Putting on socks/stockings

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

J. Rising from bed

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

K. Taking off socks/stockings

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

L. Lying in bed (turning over, maintaining knee position)

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

M. Getting in/out of bath

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

N. Sitting

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

O. Getting on/off toilet

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

P. Heavy domestic duties (moving heavy boxes, scrubbing floors, etc.)

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

Q. Light domestic duties (cooking, dusting, etc.)

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

5.5 Function, sports and recreational activities

Questions 5.5 A-E concern your physical function when being active on a higher level. The questions should be answered thinking of what degree of difficulty you have experienced during the **last week** due to your knee.

A. Squatting

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

B. Running

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

C. Jumping

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

D. Twisting/pivoting on your injured knee

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

E. Kneeling

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

5.6 Quality of Life *(Questions 5.6 A-D)*

A. How often are you aware of your knee problem?

Never	Monthly	Weekly	Daily	Constantly
☐	☐	☐	☐	☐

B. Have you modified your life style to avoid potentially damaging activities to your knee?

Not at all	Mildly	Moderately	Severely	Totally
☐	☐	☐	☐	☐

C. How much are you troubled with lack of confidence in your knee?

Not at all	Mildly	Moderately	Severely	Extremely
☐	☐	☐	☐	☐

D. In general, how much difficulty do you have with your knee?

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

6. YOUR HEALTH IN THE LAST 2 WEEKS *(Questions 6 A-I)*

Over the **last 2 weeks**, how often have you been bothered by any of the following problems? (tick the appropriate answer).

How often during the past 2 weeks were you bothered by...	Not at all	Several days	More than half the days	Nearly every day
A. Little interest or pleasure in doing things	☐	☐	☐	☐
B. Feeling down, depressed, or hopeless	☐	☐	☐	☐
C. Trouble falling or staying asleep, or sleeping too much	☐	☐	☐	☐
D. Feeling tired or having little energy	☐	☐	☐	☐
E. Poor appetite or overeating	☐	☐	☐	☐
F. Feeling bad about yourself, or that you are a failure, or have let yourself or your family down	☐	☐	☐	☐
G. Trouble concentrating on things, such as reading the newspaper or watching television	☐	☐	☐	☐
H. Moving or speaking slowly that other people could have noticed. Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	☐	☐	☐	☐

I. If you checked off **any** problems, how **difficult** have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

7. YOUR GENERAL HEALTH TODAY (*Questions 7 A-F*)

Under each heading, please tick the ONE box that best describes your health TODAY.

A. MOBILITY

I have no problems in walking about ☐
I have slight problems in walking about ☐
I have moderate problems in walking about ☐
I have severe problems in walking about ☐
I am unable to walk about ☐

B. SELF-CARE

I have no problems washing or dressing myself ☐
I have slight problems washing or dressing myself ☐
I have moderate problems washing or dressing myself ☐
I have severe problems washing or dressing myself ☐
I am unable to wash or dress myself ☐

C. USUAL ACTIVITIES *(e.g. work, study, housework, family or leisure activities)*

I have no problems doing my usual activities ☐
I have slight problems doing my usual activities ☐
I have moderate problems doing my usual activities ☐
I have severe problems doing my usual activities ☐
I am unable to do my usual activities ☐

D. PAIN / DISCOMFORT

I have no pain or discomfort ☐
I have slight pain or discomfort ☐
I have moderate pain or discomfort ☐
I have severe pain or discomfort ☐
I have extreme pain or discomfort ☐

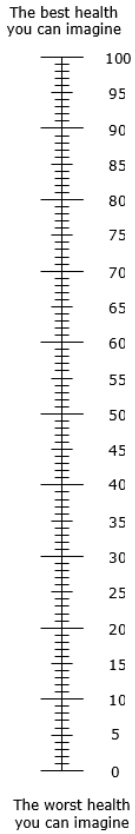
E. ANXIETY / DEPRESSION

I am not anxious or depressed ☐
I am slightly anxious or depressed ☐
I am moderately anxious or depressed ☐
I am severely anxious or depressed ☐
I am extremely anxious or depressed ☐

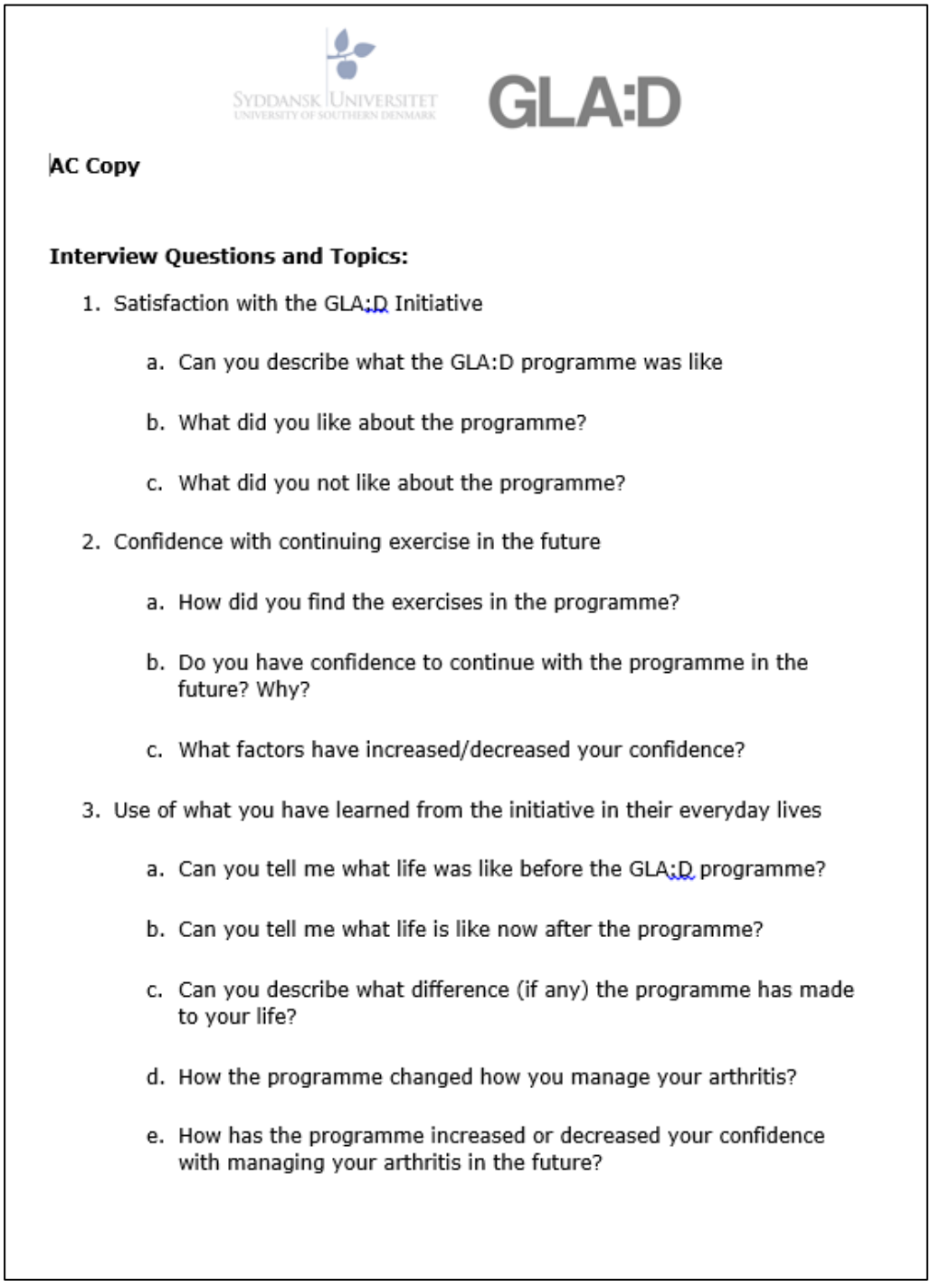
- We would like to know how good or bad your health is TODAY.
- This scale is numbered from 0 to 100.
- 100 means the best health you can imagine. 0 means the worst health you can imagine.
- Mark an X on the scale to indicate how your health is TODAY.
- Now, please write the number you marked on the scale in the box below.

F. YOUR HEALTH TODAY = ☐

This is the end of the questionnaire. Thank you very much for taking part.



Appendix 9 Study 2 interview guide



SYDDANSK UNIVERSITET
UNIVERSITY OF SOUTHERN DENMARK

GLA:D

AC Copy

Interview Questions and Topics:

1. Satisfaction with the GLA:D Initiative
    a. Can you describe what the GLA:D programme was like
    b. What did you like about the programme?
    c. What did you not like about the programme?
2. Confidence with continuing exercise in the future
    a. How did you find the exercises in the programme?
    b. Do you have confidence to continue with the programme in the future? Why?
    c. What factors have increased/decreased your confidence?
3. Use of what you have learned from the initiative in their everyday lives
    a. Can you tell me what life was like before the GLA:D programme?
    b. Can you tell me what life is like now after the programme?
    c. Can you describe what difference (if any) the programme has made to your life?
    d. How the programme changed how you manage your arthritis?
    e. How has the programme increased or decreased your confidence with managing your arthritis in the future?