Investigating the prevalence of anxiety and depression in people living with patellofemoral pain in the UK: the Dep-Pf Study

Wride, James; Bannigan, Katrina

Published in:
Scandinavian Journal of Pain

DOI:
10.1515/sjpain-2018-0347

Publication date:
2019

Document Version
Author accepted manuscript

Investigating the prevalence of anxiety and depression in people living with patellofemoral pain in the UK: The Dep-Pf Study

ABSTRACT

Background and Aims

Patellofemoral pain (PFP) is a common knee condition causing pain around or behind the kneecap which is exacerbated by certain activities. Traditionally it has been viewed as a self-limiting condition. Recent research proves this is not the case and the evidence for poor long-term outcomes is growing. Whilst the evidence base for PFP treatment and the understanding of its aetiology is improving, it remains a complex and difficult to treat condition. In many physical conditions, it has been shown that anxiety and depression negatively affect both their management and duration. It is unclear how prevalent anxiety and depression are in PFP. This study aimed to identify the prevalence of anxiety and depression in people living with PFP in the UK.

Methods

In order to investigate this, a cross-sectional online survey was undertaken. Four hundred participants with self-reported symptoms of PFP were recruited through a tailored social media campaign, using modified snowball sampling. Eligibility criteria were i) aged between 18 and 44, ii) self-reported symptoms of PFP (using accepted criteria) iii) resident in the UK. Exclusion criteria were previous history of patella dislocation or previous surgery to affected knee. The survey recorded demographic information, previous treatment for both PFP and anxiety and depression, the Hospital

Anxiety and Depression Scale and the Anterior Knee Pain Scale. Ethical approval was gained from a University of Plymouth Ethics Committee.

Results

Half (49.5%; n=198) of respondents were classified as experiencing anxiety and 20.8% (n=83) as experiencing depression. The levels of anxiety and depression identified in this study are higher than those found in the general population (5.9-7.8% and 3.3-7.8% respectively). This mirrors results which have been reported in other studies into PFP in different settings and with other musculoskeletal conditions, such as osteoarthritis and contracted shoulder.

Conclusions

Anxiety and depression are more common in people living with PFP than in the general population. These findings support the need for greater research into the effects of psychological factors, such as anxiety and depression, in PFP. A key area of future research will be to determine whether these psychological factors affect treatment outcomes in people living with PFP.

Implications

This is the first study to investigate the prevalence of anxiety and depression in people living with patellofemoral pain in the UK. This study shows that anxiety and depression are very common in people living with patellofemoral pain. The need for further work into the effects of psychological factors in patellofemoral pain is indicated.

Keywords

Patellofemoral; Knee; Anxiety; Depression; Prevalence; Mental Health

Introduction

Patellofemoral pain (PFP) is a common knee condition (1) generally affecting younger and more active people (2). It is characterised by pain around or behind the patella aggravated by weight bearing activity with the knee in a flexed position (3). It has traditionally been viewed as a self-limiting condition, however more recent research has shown that over 40% of those receiving treatment for PFP will still have symptoms after a year (4) with one in four reporting ongoing pain after 20 years (5). The impact of living with PFP is becoming clear, affecting activity levels (6), social participation (7,8) and Health related Quality of Life (8). Historically, research has focussed on the anatomical and biomechanical causes of PFP (9–11), however this is starting to change. Recently best practice guidelines have been published (12,13) which provide guidance as to the optimal management of PFP. Despite this PFP remains a complex and challenging condition to treat (14,15) and many people still continue to experience symptoms even with optimal management (4).

In other musculoskeletal conditions it has been shown that anxiety and depression are more common in these populations than the general population, with figures ranging from 16-30% in those living with musculoskeletal conditions (16–18) compared with 3.3-7.8% in the general UK population (19). This has led to further work to investigate the effects of psychological changes on the management and treatment of these conditions (20–22). It has been shown that increased levels of anxiety and depression are associated with greater persistence of the condition (22), increased acute pain (21), slower recovery (20) and greater risk of re-occurrence (23). Despite this there has been little work to investigate anxiety and depression in PFP (24).

A recent systematic review of psychological features in PFP (24) identified few studies investigating the prevalence of anxiety and depression with more extensive literature on the effects of kinesiophopbia and catastrophizing behaviour. Those studies which do exist reporting anxiety and depression were generally conducted with small sample sizes and using a variety of disparate outcome measures (24). This limited the ability to perform any meta-analyses to identify the true picture of anxiety and depression in PFP with only a single study (25) reporting clear prevalence figures for anxiety and depression. Domenech et al (25) investigated the prevalence of anxiety and depression in Spanish tertiary care PFP patients. This study reported the prevalence of anxiety (30%) and depression (16%) in 97 consecutive patients attending an orthopaedic clinic. However, this is not representative of the majority of PFP patients in the UK who are managed in a primary care setting. Attendance at an orthopaedic clinic would suggest increased severity and chronicity of the condition and, as such, these results cannot be considered representative of the general PFP population. To the best of our knowledge, there had been no UK based studies investigating anxiety and depression in people living with PFP.

The aim of this study was to identify the prevalence of anxiety and depression in people living with PFP in the UK and whether there are any links between the severity of PFP and anxiety and depression.

METHOD

Study Design

A cross-sectional online study design was used to gain a snap-shot of the prevalence of anxiety and depression in people living with PFP in the UK population. An online approach, using Bristol Online Surveys (now Online Surveys), was used to reach a wide-ranging and diverse population which may not have been available from a more traditional outpatient centred recruitment strategy. The study was opened on 01st March 2017 and closed on 09th May 2017 as the required sample size had been achieved. Participants were provided with a detailed information sheet and could withdraw at any time during or up until two weeks after completion of the survey. Ethical approval was gained from University of Plymouth Faculty of Health & Human Sciences, Schools of Medicine and Dentistry Research Ethics Committee (Reference 16/17-257)

Participants

A sample size of 330 was calculated, using Raosoft Sample Size calculator, based on an estimated UK population of 675,000 people living with PFP in our age range [based upon a minimum 3% prevalence (3,26), the UK population aged 15-44 (27)] and a prevalence of anxiety and depression of 30% based on the figures found by Domenech in PFP and reported in other conditions (16–18,25). The higher figure of 30% was chosen based on the figures for anxiety (25) to reduce the risk of underpowering the study. As there is no pre-existing sampling frame participants were recruited from a variety of online sources (Facebook, Twitter, Forums, Special Interest groups, such as parkrun) who identified as having PFP based on accepted criteria (3). Recruitment was capped at 400 completed surveys. Whilst this allowed for the potential of over recruitment, this enabled people who had begun completing the survey the opportunity to complete it

once the calculated sample size was completed and to allow for any withdrawals following the closing of recruitment. Eligibility criteria were i) adults aged between 18 and 44, ii) self-reported symptoms of PFP of pain when loading the knee in a flexed position, such as running, jumping, squatting, hopping (3) iii) resident in the UK. Exclusion criteria were previous history of patella dislocation or previous surgery to affected knee (3).

Outcome measures

A questionnaire was developed to address our research question. The data collected is summarised in Table 1.

Statistical analysis

Data was analysed with IBM SPSS Statistics (version 23.0). The sociodemographic characteristics of the respondents are reported as percentages and numbers. Prevalence of anxiety and depression were calculated as percentages of total sample. Independent samples t-tests were used to compare continuous variables such as age and HADS and AKPS scores. Chi-squared tests was used to compare categorical variables such as gender, previous history of anxiety and depression and duration of symptoms (categorical as grouped) with current HADS and AKPS scores. Correlation between severity of PFP symptoms (NRS and AKPS) and severity of anxiety and depression was assessed using Pearsons correlation co-efficient. Tests for normality were not run as the sample size was in excess of that required for Central Limit

Theorem assumptions of normality (28). Levels of statistical significance were set at $p<0.05$.

RESULTS

The survey was accessed 2,386 times, with 1,894 not progressing beyond the consent page and 162 people being excluded as they did not meet the inclusion criteria. The demographics of the participants are summarised in table 2, as those excluded did not complete the demographic information this is not available. Scores for the HADS-A, HADS-D, AKPS and NRS are presented in table 3.

Prevalence of anxiety and depression

Almost half (49.5%; n = 198) of respondents scored ≥8 on the HADS-A (29) indicating the presence of anxiety. One in five respondents (20.8%; n = 83) scored ≥8 (29) on the HADS-D indicating depressive symptoms. When combined this showed that 53% (n = 215) of respondents were living with anxiety and/or depression.

Age

Respondents with a HADS-A score suggesting anxiety were shown to be younger than those who were not (mean age = 33.55 v 35.3) following an independent samples t-test ($p= 0.015$). In those with scores suggesting depressive symptoms no significant difference was identified (mean age = 34.55 v 34.4; $p = 0.86$) (Table 4).

Gender

A chi-squared test for independence (with Yates' Continuity Correction) indicated a significant association between gender and anxiety ($p = 0.001$). Adjusted residual scores (4.6) indicated a greater than expected number of females with anxiety. No significant association was seen between depressive symptoms and gender ($p = 0.628$).

History of anxiety and depression

A significant association between a previous diagnosis of anxiety and/or depression and a current score indicating anxiety or depressive symptoms was found using chi-squared. This was found to be stronger for anxiety (phi = -0.33; $p = 0.001$) than depression (phi = -0.22; $p = 0.001$).

Association with knee symptoms

A significant association between AKPS score and both anxiety and depressive symptoms was identified using an independent samples t-test (Table 4). Pearson product-moment correlations showed a small negative correlation between lower scores on the AKPS and higher levels of anxiety ($r = -0.15$; $p < 0.001$), and a small to medium negative correlation between lower AKPS and higher levels of depressive symptoms ($r = -0.26$; $p < 0.001$).

No significant association was identified between the NRS scores and either anxiety and depressive symptoms.

Duration of Symptoms

A chi-squared test identified no significant association between the duration of PFP and the presence of anxiety ($p = 0.73$) or depressive symptoms ($p = 0.39$).

DISCUSSION

Until recently the role of psychological factors in PFP has received little attention. The recent publication of a systematic review (24), has emphasised the paucity of evidence in this area. The current study has suggested that over half of people living with PFP are experiencing anxiety and/or depressive symptoms. There seems to be a small correlation between increased severity of PFP symptoms (AKPS) and increased levels of anxiety and depressive symptoms. This is more marked with depressive symptoms. To the best of our knowledge this is the first study to investigate the prevalence of anxiety and depression in people living with PFP in the UK population.

Anxiety and depression prevalence in PFP

The levels of anxiety and depressive symptoms shown in this study are much higher than those found in the general population (anxiety: 49.5% v 5.9-7.8%; depressive symptoms 20.8 v 3.3-7.8% (19)). Whilst some caution must be exercised with these figures due to the potential for the HADS to overestimate anxiety and depression (30), and the broad inclusion criteria of the study, this suggests a significant proportion of the study population are experiencing anxiety and depression in addition to the known physical effects of PFP.

Despite these concerns, the results echo those reported in other studies. Domenech et al (25) identified similar rates of anxiety (30%) and depression (16%) in people with

PFP (n=97) in a tertiary setting. They also reported similar mean scores for HADS-A (7.9) and HADS-D (5.3). Direct comparisons with this study should be made with caution as it is not clear as to the threshold used to identify anxiety and depression. Axford et al. (18) suggested a rate of depression in excess of 40% in osteoarthritis, however this has recently been superseded by the systematic review by Stubbs et al. (16), which suggested figures of around 20% may be more accurate for both anxiety and depression in osteoarthritis. Similar figures have also been reported in contracted shoulder (17) and low back pain (31). This suggests that the findings in this study are realistic, despite concerns regarding the accuracy of the HADS as a measurement tool. The growing evidence from these studies suggest that higher levels of anxiety and depression are found across a number of MSK conditions.

The figures for anxiety in this study suggest a high prevalence in people living with PFP. However, this must be viewed in the context of the study population. The study population was predominately female (67.6%) and relatively young (mean age 34.4). Previous studies have shown that anxiety is more common in younger women than in the general population (32). It must be considered whether the results found reflect the demographics of the study. Whilst there was a significant difference in the prevalence of anxiety between men and women, this alone does not explain the prevalence of anxiety in this study.

Relationship between symptom severity and anxiety and depression

The results of this study identified a correlation between greater severity of PFP symptoms (as measured on the AKPS) and higher scores recorded on the two elements

of the HADS. The magnitude of correlation was small for anxiety ($r = -0.15$; $p < 0.001$) and small to medium for depressive symptoms ($r = -0.26$; $p < 0.001$). However the large numbers involved in this study suggest that this statistical significance may be due to the sample size (33). When we consider the strength of the relationship between the two sets of variables (-0.15 and -0.26), and the co-efficient of determination (2.25% and 6.76% respectively), the low levels of these figures suggest that there is only a weak influence of the level of PFP symptoms on the level of anxiety and depressive symptoms (33). When the figures are examined the mean difference in AKPS between those with and without anxiety and depressive symptoms (Table 4), whilst statistically significant, fall well below the minimal clinically important difference for the AKPS (34).

Domenech et al. (25) reported correlations of -0.61 and 0.57 for depression and anxiety (measured with the HADS) with the Lysholm score. Piva et al (35) reported a correlation of -0.45 between the KOS-ADLS and Beck Anxiety Index. This reinforces the concerns raised by Maclachlan et al. (24) regarding the heterogeneity of outcome measures used in PFP research. It could be argued that had the current study taken a different approach to data analysis, such as a binary approach to anxiety and depression, then a stronger relationship may have been found between these factors, as suggested by previous studies.

Irrespective of the magnitude of the relationships identified by Piva et al. (36), Domenech et al. (25) and the current study, all agree that there is a relationship between severity of PFP symptoms and anxiety and depression. A previous meta-analysis investigating chronic pain has suggested that increased levels of depression are associated with the duration of symptoms, severity of symptoms and number of

joints affected (37). Interestingly this current study has suggested that neither the duration of symptoms nor level of pain (measured by NRS) affect the levels of anxiety and depression in PFP. This may reflect the nature of the population targeted in this study. Previous studies have concentrated on people attending a variety of secondary and tertiary healthcare settings, whereas this study has recruited people whether they were receiving formal treatment or not. PFP is not considered to be a degenerative condition, with many people having symptoms over a long time period (4,5). This may suggest that some of the respondents included in this study with long term symptoms have been managing their condition well, with pain at a low level.

Future Research

Further research would be beneficial to identify the effects, if any, of anxiety and depression on treatment outcomes in PFP. Should this show that anxiety and depression does have a negative impact on treatment outcomes then further studies investigating the treatment of anxiety and depression in PFP would be warranted.

Whilst this study has shown that there are high levels of anxiety and depression evident in people living with PFP we are unable to draw any inferences as to why this is. Further qualitative work could identify any common themes about what contributes to the development of anxiety and depression. This could then be progressed to investigate whether there is a causative relationship between PFP and anxiety and depression and in which direction it exists.

Strengths and Limitations

This study benefits from the fact we were able to over-recruit (target 330, actual 400) ensuring that we were able to adequately power all the calculations for the statistical analysis. Underpowered studies are more prone to both type I and type II errors (38) with the risk of both false positive results and 'true' results not reaching statistical significance. This is a weakness seen in many studies across all fields (39). The number of respondents in this study was larger than any previous study looking at mental health in PFP (24,25).

The study also benefitted from using robust outcome measures (AKPS, HADS and NRS) to determine our primary outcomes (PFP severity and anxiety and depression) with good reliability and validity. These measures have been identified as the most commonly used outcome tools in PFP (24), meaning that the results of this study can be easily incorporated into any future meta-analyses.

There were a number of clear limitations identified within this study. Foremost among these was the lack of clinical diagnosis for PFP amongst the respondents. Clinical assessment by an experienced clinician is considered the gold standard for diagnosis of PFP (3,12). This was not a practical option for this study due to its online nature. Instead, the criteria developed by Crossley et al. (2016) were used to classify someone as living with PFP. This raises the likelihood that other knee conditions were included in this study. The use of established inclusion and exclusion criteria should have mitigated this risk.

The online nature of the study also contributed to another significant weakness within the study design. Anxiety and depression are complex, multifactorial conditions unlikely to be directly attributable to a single cause (40,41). Recent studies have also shown that

PFP is highly associated with multi-site musculoskeletal pain (42). As we were unable to collect extensive medical history for each participant we are unable to account for the effects of other musculoskeletal or chronic health conditions in this study. This limits our ability to truly say that PFP is associated with higher levels of anxiety and depression. This is shown by the high number of respondents identifying as having a history of anxiety or depression.

Another limitation identified in this study is the risk of self-selection bias. Since our respondents were able to choose whether to participate in the study, it is not possible to say that this was a representative sample of the population as a whole (43). It is well established that ethnic minorities are generally under-represented in research participation (44) and that educated white females are disproportionally represented in research studies (45). This is shown in this study with an over-representation of those identifying as white (94.8%; n= 379) compared with that expected from the latest Office for National Statistics figures (86%) (46). Whilst this is a common finding across many fields of research, it raises the question about what information may be being missed in these groups. This is an area which would benefit from greater attention in future research in order to ensure a wider, and more representative, study population.

CONCLUSION

Anxiety and depression in people living with PFP is more common than in the general UK population. In this study almost half of people meeting the inclusion criteria for PFP had a score on the HADS-A indicating anxiety and one in five were identified as experiencing depressive symptoms on the HADS-D. To the best of our knowledge this

is the first study to investigate the prevalence of anxiety and depression of people living with PFP in the general population rather than those who are engaged in healthcare services. This study cannot draw any causal links between anxiety and depression and PFP, but it does highlight the strong association between the two conditions. The results of this study add further strength to the need for additional work into the effects of mental well-being in PFP. This is an area which has previously received little attention.

Research Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. JW is funded by the NIHR as part of the NIHR Clinical Academic Pathway.

***Conflict of Interest declaration*:** None declared

Informed Consent: Informed consent has been obtained from all individuals included in this study.

Ethical Approval: Ethical approval was gained from University of Plymouth Faculty of Health & Human Sciences, Schools of Medicine and Dentistry Research Ethics Committee (Reference 16/17-257)

318 *Table 1: Summary of data collected in the survey*

Demographics	• Age • Gender • Educational level, • Employment status • Ethnicity.
History	• Duration of knee pain symptoms. • Any previous treatment for this. • Previous diagnosis of either anxiety and/or depression • Any current treatment for anxiety and/or depression
Anxiety and Depression	• Hospital Anxiety and Depression Scale (HADS) (47) • This scale gives scores for both anxiety (HADS-A) and depression (HADS-D) with a maximum score of 21 on each scale. • A cut-off point of ≥8 was chosen for each scale (29) . • Shown to have the greatest sensitivity for case detection (48). • The HADS has been shown to be valid and reliable for use in primary care, community and musculoskeletal populations (29,30,49,50).
Knee symptoms	• Two measures used to assess severity of PFP symptoms. • A numerical rating scale (NRS) for pain over the previous 24 hours was used to assess current pain. • Shown to be valid and reliable in both general musculoskeletal conditions (51) and PFP (34). • Anterior Knee Pain Scale (AKPS) (52) was used to assess level of function. • Shown to be both valid and reliable in PFP patients (53) and requires little guidance in completion (54).

319

320 *Table 2: Demographic data for study participants*

			n
Age, mean (SD)	34.4	(7.18)	400
Gender - female, n (%)	268	(67.3)	397
Ethnicity, n (%)			
White	379	(94.8)	
Asian or Asian British	9	(2.3)	
Black or Black British	3	(0.8)	398
Mixed / Multiple ethnic groups	5	(1.3)	
Other ethnic background	2	(0.5)	
Education, n (%)			
GCSE / O Level	26	(6.5)	
AS Level	5	(1.3)	
A Level	36	(9.0)	
NVQ or other vocational	39	(9.8)	398
First Degree (including foundation degree)	177	(44.3)	
University Higher Degree (Msc or PhD)	111	(27.8)	
None of the above	4	(1.0)	
Employment Status, n (%)			
Employed / Self employed	352	(88.0)	
Unemployed	7	(1.8)	
Looking after home/ family	13	(3.3)	399
Student / Full time education	25	(6.3)	
Unable to work	2	(0.5)	
Pain Duration, n (%)			
<3 Months	55	(13.8)	
3-6 months	54	(13.5)	
6-12 months	42	(10.5)	
12-18 months	40	(10)	400
18-24 months	27	(6.8)	
2-5 years	84	(21.0)	
>5 years	98	(24.5)	
Affected Knee, n (%)			
Right	111	(27.8)	
Left	126	(31.5)	400
Both	163	(40.8)	
Previous treatment for PFP - Yes, n (%)	187	(46.8)	400
Previous Diagnosis of anxiety or depression - Yes, n (%)	136	(34.8)	400
Receiving Treatment for anxiety or depression - Yes, n (%)	45	(11.3)	400

321 *Table 3: Mean values of key outcome measure for study participants. (SD = Standard deviation)*

Outcome Measure	Mean	SD
Numerical Rating Scale - Pain 0-10,	3.45	(2.2)
Hospital Anxiety and Depression Scale – Anxiety 0-21,	7.75	(4.2)
Hospital Anxiety and Depression Scale - Depression 0-21,)	4.65	(3.5)
Anterior Knee Pain Scale 0-100,	76.7	(10.4)

322

323

Table 4: Associations between anxiety and depression and key outcome measures. (NRS = Numerical Rating Scale; AKPS = Anterior Knee Pain Scale)

Variable	Depression			Anxiety		
	<8	**≥8**		**<8**	**≥8**	
	(n=317)	**(n = 83)**	***p***	**(n= 202)**	**(n = 198)**	***p***
Age	34.40 (7.15)	34.55 (7.35)	0.86	35.30 (7.13)	33.55 (7.14)	0.015
NRS	3.45 (2.18)	3.45 (2.35)	0.994	3.32 (2.23)	3.58 (2.19)	0.25
AKPS	77.61 (10.23)	73.24 (10.15)	0.001	78.37 (9.96)	75 (10.49)	0.001

References

1. van Middelkoop M, van Linschoten R, Berger MY, Koes BW, Bierma-Zeinstra SM. Knee complaints seen in general practice: active sport participants versus non-sport participants. BMC Musculoskelet Disord [Internet]. 2008 Dec 19;9(1):36. Available from: http://bmcmusculoskeletdisord.biomedcentral.com/articles/10.1186/1471-2474-9-36

2. Rathleff MS, Roos EM, Olesen JL, Rasmussen S. Early intervention for adolescents with patellofemoral pain syndrome--a pragmatic cluster randomised controlled trial. BMC Musculoskelet Disord. 2012;13:9.

3. Crossley KM, Stefanik JJ, Selfe J, Collins NJ, Davis IS, Powers CM, McConnell J, Vicenzino B, Bazett-Jones DM, Esculier J-F, Morrissey D, Callaghan MJ. 2016 Patellofemoral pain consensus statement from the 4th International Patellofemoral Pain Research Retreat, Manchester. Part 1: Terminology, definitions, clinical examination, natural history, patellofemoral osteoarthritis and patient-reported outcome. Br J Sports Med [Internet]. 2016 Jul;50(14):839–43. Available from: http://bjsm.bmj.com/lookup/doi/10.1136/bjsports-2016-096384

4. Collins NJ, Bierma-Zeinstra SMA, Crossley KM, van Linschoten RL, Vicenzino B, van Middelkoop M. Prognostic factors for patellofemoral pain: a multicentre observational analysis. Br J Sports Med [Internet]. 2013 Mar;47(4):227–33. Available from:

http://bjsm.bmj.com/lookup/doi/10.1136/bjsports-2012-091696

5. Nimon G, Murray D, Sandow M, Goodfellow J. Natural history of anterior knee pain: a 14- to 20-year follow-up of nonoperative management. J Pediatr Orthop [Internet]. 1998 Jan 1;18(1):118–22. Available from: http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=00004694-199801000-00021

6. Glaviano NR, Baellow A, Saliba S, Al. E, Tatman M, Olesen JL. Physical activity levels in individuals with and without patellofemoral pain. Phys Ther Sport [Internet]. 2017;25(0):2432–9. Available from: http://linkinghub.elsevier.com/retrieve/pii/S1466853X17301530

7. Smith BE, Moffatt F, Hendrick P, Bateman M, Rathleff MS, Selfe J, Smith TO, Logan P. The experience of living with patellofemoral pain—loss, confusion and fear-avoidance: a UK qualitative study. BMJ Open [Internet]. 2018;8(1):e018624. Available from: http://bmjopen.bmj.com/lookup/doi/10.1136/bmjopen-2017-018624

8. Coburn SL, Barton CJ, Filbay SR, Hart HF, Rathleff MS, Crossley KM. Quality of life in individuals with patellofemoral pain: A systematic review including meta-analysis. Phys Ther Sport [Internet]. 2018;33(2018):96–108. Available from: https://doi.org/10.1016/j.ptsp.2018.06.006

9. Myer GD, Ford KR, Barber Foss KD, Goodman A, Ceasar A, Rauh MJ, Divine JG, Hewett TE. The incidence and potential pathomechanics of patellofemoral pain in female athletes. Clin Biomech. 2010;25(7):700–7.

10. Powers CM, Bolgla L a, Callaghan MJ, Collins N, Sheehan FT. Patellofemoral pain: proximal, distal, and local factors, 2nd International Research Retreat. J Orthop Sports Phys Ther [Internet]. 2012;42(6):A1-54. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22660660

11. Noehren B, Scholz J, Davis I. The effect of real-time gait retraining on hip kinematics, pain and function in subjects with patellofemoral pain syndrome. Br J Sports Med [Internet]. 2011 Jul 1;45(9):691–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20584755

12. Barton CJ, Lack S, Hemmings S, Tufail S, Morrissey D. The 'Best Practice Guide to Conservative Management of Patellofemoral Pain': incorporating level 1 evidence with expert clinical reasoning. Br J Sports Med [Internet]. 2015 Jul;49(14):923–34. Available from: http://bjsm.bmj.com/lookup/doi/10.1136/bjsports-2014-093637

13. Lack S, Neal B, De Oliveira Silva D, Barton CJ. How to manage patellofemoral pain – Understanding the multifactorial nature and treatment options. Phys Ther Sport [Internet]. 2018;32:155–66. Available from: https://doi.org/10.1016/j.ptsp.2018.04.010

14. Smith BE, Hendrick P, Bateman M, Moffatt F, Rathleff MS, Selfe J, Smith TO, Logan P. Current management strategies for patellofemoral pain: an online survey of 99 practising UK physiotherapists. BMC Musculoskelet Disord [Internet]. 2017 Dec 8;18(1):181. Available from: http://bmcmusculoskeletdisord.biomedcentral.com/articles/10.1186/s12891-017-1539-8

15. Papadopoulos KD, Noyes J, Barnes M, Jones JG, Thom JM. How do

physiotherapists assess and treat patellofemoral pain syndrome in North Wales? A mixed method study. Int J Ther Rehabil. 2012;19(5):261–72.

16. Stubbs B, Aluko Y, Myint PK, Smith TO. Prevalence of depressive symptoms and anxiety in osteoarthritis: A systematic review and meta-analysis. Age Ageing. 2016;45(2):228–35.

17. Ding H, Tang Y, Xue Y, Yang Z, Li Z, He D, Zhao Y, Zong Y. A report on the prevalence of depression and anxiety in patients with frozen shoulder and their relations to disease status. Psychol Health Med. 2014;19(6):730–7.

18. Axford J, Butt A, Heron C, Hammond J, Morgan J, Alavi A, Bolton J, Bland M. Prevalence of anxiety and depression in osteoarthritis: use of the Hospital Anxiety and Depression Scale as a screening tool. Clin Rheumatol. 2010;29(11):1277–83.

19. McManus S, P B, Jenkins R, Brugha T. Mental health and well-being in England: Adult Psychiatric Morbidity Survey 2014. Leeds; 2016.

20. Melloh M, Elfering A, Käser A, Salathé CR, Barz T, Aghayev E, Röder C, Theis J-C. Depression Impacts the Course of Recovery in Patients with Acute Low-Back Pain. Behav Med [Internet]. 2013 Jul;39(3):80–9. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23930900

21. Elfering A, Käser A, Melloh M. Relationship between depressive symptoms and acute low back pain at first medical consultation, three and six weeks of primary care. Psychol Health Med [Internet]. 2014 Mar 4;19(2):235–46. Available from: http://www.tandfonline.com/doi/abs/10.1080/13548506.2013.780131

22. Rathbun AM, Stuart EA, Shardell M, Yau MS, Baumgarten M, Hochberg MC. Dynamic Effects of Depressive Symptoms on Osteoarthritis Knee Pain. Arthritis Care Res (Hoboken) [Internet]. 2017 Mar;11(5):475–6. Available from: http://doi.wiley.com/10.1002/acr.23239

23. Pinheiro MB, Ferreira ML, Refshauge K, Ordoñana JR, Machado GC, Prado LR, Maher CG, Ferreira PH. Symptoms of Depression and Risk of New Episodes of Low Back Pain: A Systematic Review and Meta-Analysis. Arthritis Care Res (Hoboken) [Internet]. 2015;67(11):1591–603. Available from: http://doi.wiley.com/10.1002/acr.22619

24. Maclachlan LR, Collins NJ, Matthews MLG, Hodges PW, Vicenzino B. The psychological features of patellofemoral pain: a systematic review. Br J Sports Med [Internet]. 2017;51(9):732–42. Available from: http://bjsm.bmj.com/lookup/doi/10.1136/bjsports-2016-096705

25. Domenech J, Sanchis-Alfonso V, López L, Espejo B. Influence of kinesiophobia and catastrophizing on pain and disability in anterior knee pain patients. Knee Surgery, Sport Traumatol Arthrosc [Internet]. 2013 Jul 19;21(7):1562–8. Available from: http://link.springer.com/10.1007/s00167-012-2238-5

26. Lack S, Barton CJ, Sohan O, Crossley K, Morrissey D. Proximal muscle rehabilitation is effective for patellofemoral pain: a systematic review with meta-analysis. Br J Sports Med [Internet]. 2015 Nov;49(21):1365–76. Available from: http://dx.doi.org/10.1136/

27. Office for National Statistics. Population Estimates for UK, England and Wales, Scotland and Northern Ireland, Mid 2015 [Internet]. 2016

452 [cited 2016 Oct 10]. p. 1–9. Available from:
453 http://www.ons.gov.uk/ons/rel/pop-estimate/population-estimates-for-
454 uk--england-and-wales--scotland-and-northern-ireland/mid-
455 2014/index.html

456 28. Daniel WW, Cross CL. Biostatistics. Basic Concepts and Methodology
457 for the Health Sciences. 10th ed. John Wiley & Sons; 2013. 960 p.

458 29. Covic T, Cumming SR, Pallant JF, Manolios N, Emery P, Conaghan
459 PG, Tennant A. Depression and anxiety in patients with rheumatoid
460 arthritis: prevalence rates based on a comparison of the Depression,
461 Anxiety and Stress Scale (DASS) and the hospital, Anxiety and
462 Depression Scale (HADS). BMC Psychiatry [Internet]. 2012;12(1):6.
463 Available from:
464 http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3285517&t
465 ool=pmcentrez&rendertype=abstract

466 30. Cameron IM, Cardy A, Crawford JR, du Toit SW, Hay S, Lawton K,
467 Mitchell K, Sharma S, Shivaprasad S, Winning S, Reid IC. Measuring
468 depression severity in general practice: discriminatory performance of
469 the PHQ-9, HADS-D, and BDI-II. Br J Gen Pract [Internet]. 2011 Jul
470 1;61(588):419–26. Available from:
471 http://bjgp.org/cgi/doi/10.3399/bjgp11X583209

472 31. Currie SR, Wang J. Chronic back pain and major depression in the
473 general Canadian population. Pain. 2004;107(1–2):54–60.

474 32. Remes O, Brayne C, van der Linde R, Lafortune L. A systematic
475 review of reviews on the prevalence of anxiety disorders in adult
476 populations. Brain Behav. 2016;6(7).

33. Pallant J. SPSS survival manual: a step by step guide to data analysis using SPSS. 6th ed. Step by step guide to data analysis using the SPSS program. Maidenhead: Open University Press; 2016.

34. Crossley KM, Bennell KL, Cowan SM, Green S. Analysis of outcome measures for persons with patellofemoral pain: Which are reliable and valid? Arch Phys Med Rehabil. 2004;85(5):815–22.

35. Piva SR, Fitzgerald GK, Irrgang JJ, Fritz JM, Wisniewski S, McGinty GT, Childs JD, Domenec MA, Jones S, Delitto A. Associates of Physical Function and Pain in Patients with Patellofemoral Pain Syndrome. Arch Phys Med Rehabil [Internet]. 2009 Feb 1 [cited 2016 Oct 5];90(2):285–95. Available from: http://linkinghub.elsevier.com/retrieve/pii/S0003999308016328

36. Piva S, Fitzgerald G, Wisniewski S, Delitto A. Predictors of pain and function outcome after rehabilitation in patients with patellofemoral pain syndrome. J Rehabil Med. 2009;41(8):604–12.

37. Gandhi R, Zywiel MG, Mahomed NN, Perruccio A V. Depression and the Overall Burden of Painful Joints: An Examination among Individuals Undergoing Hip and Knee Replacement for Osteoarthritis. Arthritis [Internet]. 2015;2015:1–6. Available from: http://www.hindawi.com/journals/arthritis/2015/327161/

38. Christley RM. Power and Error: Increased Risk of False Positive Results in Underpowered Studies. Open Epidemiol J [Internet]. 2010 Feb 1;3(1):16–9. Available from: http://benthamopen.com/ABSTRACT/TOEPIJ-3-16

39. Turner RM, Bird SM, Higgins JPT. The Impact of Study Size on Meta-

analyses: Examination of Underpowered Studies in Cochrane Reviews. PLoS One [Internet]. 2013 Mar 27;8(3):e59202. Available from: http://dx.plos.org/10.1371/journal.pone.0059202

40. National Institute for Health and Clinical Excellence. Generalised anxiety disorder and panic disorder in adults: Management. Natl Inst Heal Clin Excell. 2011;(January):1–53.

41. National Institute for Health and Clinical Excellence. Depression in Adults: Recognition and Management Clinical Guideline: NICE Guideline [CG90]. Natl Collab Cent Ment Heal [Internet]. 2009;(April). Available from: https://www.nice.org.uk/guidance/cg90/resources/depression-in-adults-recognition-and-management-975742636741

42. Holden S, Rathleff MS, Roos EM, Jensen MB, Pourbordbari N, Graven-Nielsen T. Pain patterns during adolescence can be grouped into four pain classes with distinct profiles: A study on a population based cohort of 2953 adolescents. Eur J Pain [Internet]. 2017 Dec 27; Available from: http://doi.wiley.com/10.1002/ejp.1165

43. Bethlehem J. Selection Bias in Web Surveys. Int Stat Rev [Internet]. 2010 Jun 18;78(2):161–88. Available from: http://dx.doi.org/10.1111/j.1751-5823.2010.00112.x

44. Hood GA, Chowdhury TA, Griffiths CJ, Hood RKE, Mathews C, Hitman GA. The Mela Study: exploring barriers to diabetes research in black and minority ethnic groups. Prim Health Care Res Dev [Internet]. 2015;16(01):53–60. Available from: http://www.journals.cambridge.org/abstract_S1463423614000061

45. Van Lange PAM, Schippers M, Balliet D. Who volunteers in psychology experiments? An empirical review of prosocial motivation in volunteering. Pers Individ Dif [Internet]. 2011 Aug;51(3):279–84. Available from: http://linkinghub.elsevier.com/retrieve/pii/S0191886910002850

46. Office for National Statistics. Ethnicity and National Identity in England and Wales [Internet]. 2012 [cited 2016 Nov 14]. Available from: http://www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/ethnicity/articles/ethnicityandnationalidentityinenglandandwales/2012-12-11

47. Zigmond AS, Snaith RP. The Hospital Anxiety and Depression Scale. Acta Psychiatr Scand. 1983 Jun;67(6):361–70.

48. Brennan C, Worrall-Davies A, McMillan D, Gilbody S, House A. The Hospital Anxiety and Depression Scale: A diagnostic meta-analysis of case-finding ability. J Psychosom Res [Internet]. 2010 Oct;69(4):371–8. Available from: http://dx.doi.org/10.1016/j.jpsychores.2010.04.006

49. Turk DC, Dworkin RH, Trudeau JJ, Benson C, Biondi DM, Katz NP, Kim M. Validation of the Hospital Anxiety and Depression Scale in Patients With Acute Low Back Pain. J Pain. 2015;16(10):1012–21.

50. Cameron IM, Crawford JR, Lawton K, Reid IC. Psychometric comparison of PHQ-9 and HADS for measuring depression severity in primary care. Br J Gen Pract [Internet]. 2008 Jan 1;58(546):32–6. Available from: http://bjgp.org/cgi/doi/10.3399/bjgp08X263794

51. Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale

for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF. Arthritis Care Res (Hoboken) [Internet]. 2011 Nov;63(S11):S240–52. Available from: http://doi.wiley.com/10.1002/acr.20543

52. Kujala UM, Jaakkola LH, Koskinen SK, Taimela S, Hurme M, Nelimarkka O. Scoring of patellofemoral disorders. Arthrosc J Arthrosc Relat Surg [Internet]. 1993;9(2):159–63. Available from: http://linkinghub.elsevier.com/retrieve/pii/S0749806305803664

53. Singer B, Singer K. Anterior Knee Pain Scale. Aust J Physiother [Internet]. 2009;55(2):140. Available from: http://linkinghub.elsevier.com/retrieve/pii/S0004951409700480

54. Bennell K, Bartam S, Crossley K, Green S. Outcome measures in patellofemoral pain syndrome: test retest reliability and inter-relationships. Phys Ther Sport. 2000 May;1(2):32–41.