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Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

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Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

ABSTRACT

Introduction

Patient beliefs regarding evidence-based treatments for osteoarthritis can be influenced by messaging from healthcare professionals. The objective of this study was to determine differences in beliefs regarding exercise for osteoarthritis among general practitioners (GPs), physiotherapists (PTs) and people with hip and knee osteoarthritis (PwOA). A secondary objective was to explore how referral patterns may influence beliefs.

Methods

Three online cross-sectional surveys for GPs, PTs and PwOA were advertised in Ireland via social media and healthcare networks. Nine beliefs statements related to exercise effectiveness, safety and delivery were rated on a 5-point Likert scale. Chi-square tests assessed differences in agreement between groups. Multivariable linear regression models tested associations between beliefs in PwOA and referral to/attendance at physiotherapy.

Results

There were 421 valid responses (n=161 GPs, n=163 PTs, n=97 PwOA). Positive consensus (>75% agreement) was reached for most statements (7/9 GPs, 6/9 PTs, 5/9 PwOA). Beliefs of PwOA were significantly less positive compared to healthcare professionals for six statements. All stakeholders disagreed that exercise is effective regardless of the level of pain. Attendance at physiotherapy (49% of PwOA), rather than referral to physiotherapy from a GP only, was associated with positive exercise beliefs for PwOA [β=0.287 (95% CI 0.299, 1.821)].

Discussion

Beliefs about exercise therapy for osteoarthritis are predominantly positive across all stakeholders, albeit less positive in PwOA. PwOA are more likely to have positive beliefs if they have seen a physiotherapist for their osteoarthritis. Knowledge translation should highlight the effectiveness of exercise for all levels of pain and osteoarthritis disease.

Strengths and Limitations

- Differences in beliefs about exercise between healthcare professionals and patients with osteoarthritis has not previously been examined.
- This study also explored how healthcare professional visits may influence belief about effectiveness of evidence-based care.
- This was a cross-sectional study so no inferences can be made.
- Different results with respect to beliefs and influencers may have been found with an older group of people with osteoarthritis (i.e., 70+ years of age).

INTRODUCTION

The management of hip and knee osteoarthritis (OA), as for other chronic conditions, should be determined by best available evidence, incorporating randomised controlled trials (RCTs), systematic reviews and clinical guidelines. Although there is no cure for this burdensome disease, healthcare professionals in this field have for a long time had a wealth of high-quality evidence to draw from, all pointing to optimal core clinical management that consists of land-based exercise, education and weight loss if appropriate[1,2]. Despite this, implementation of these guidelines in practice is not optimal, often resulting in care that is fragmented in nature or considered low-value [3]. A global meta-analysis involving 16,103 people with OA (PwOA) in community care, revealed that only 39% received a referral or recommendation to exercise,[4] while a UK-based survey in 2018 revealed that only 3.9% of the 502 respondents with an OA diagnosis, were using exercise as part of their management[5]. Some similarities in shortcomings to implementation of guidelines for musculoskeletal health have been identified globally[6].

Alongside use of best evidence, the provision of patient-centred care is a pillar of high-quality care that should help guide treatment for PwOA[7]. It is defined as “providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions”[8]. Literature and expert opinion recommendations state that it is important to assess patient ideas and concerns regarding the cause and management of their pain, and to take into account their expectations and preferences for treatment[7]. Regarding exercise, researchers have identified a considerable amount of uncertainty among PwOA regarding the benefits of exercise for their pain. Results from cross-sectional surveys and semi-structured interviews have indicated that a lack of knowledge on the condition may result in patients believing that surgery is their only option[9,10]. Furthermore, a view of OA as a “wear and tear” condition was associated with the perspective that exercise was a counterintuitive treatment[9–11]. Since it is widely understood that beliefs influence health-related behaviours [12,13], and because stronger recommendations for exercise have been made since previous publications[2,5,10], an updated understanding of how PwOA view exercise is required.

Healthcare professionals’ perceptions and beliefs will affect the advice and management they offer patients, and researchers have suggested that those with biomedical or biomechanical beliefs about OA may transfer these beliefs to their patients, thus affecting their treatment choices[14,15]. Currently, general practitioners (GPs) and physiotherapists (PTs) are considered among the core care providers for PwOA[16]. While PT’s have the knowledge and skills to adopt a key role in the management of hip and knee OA, GPs

remain the most frequently accessed source of formal medical advice and treatment[16,17]. The language used by healthcare professionals, especially GPs, can have a profound influence on patients' beliefs[18,19]. A systematic review from Cottrell et al [20] in 2010, found that the attitudes and beliefs of GPs concerning exercise and chronic knee pain varied widely. An updated UK-based survey of GPs in 2017 found that perspectives were positive, with 87% reporting the use of exercise in their practice [17]. However, only 11% reported using exercise in ways that aligned with evidence-based guidelines [17]. This demonstrates the need for a better understanding of how GPs interact with up-to-date resources for care advancements for OA, in a time-demanding profession.

A scoping review of qualitative research exploring attitudes and beliefs, shows that PTs generally have a positive attitude to activity and exercise in OA management, despite indications that some PTs may also be lacking up-to-date knowledge about best practice or may not be adhering to evidence-based treatments[21]. In contrast, a recent mixed-methods evaluation by Barton et al [22] in 2021 reported that awareness regarding evidence supporting exercise for knee OA was good (89–96%) amongst PTs in Australia and Canada.

Some implementation strategies to improve uptake or delivery of exercise for PwOA may be in the form of education interventions to address negative beliefs or myths associated with exercise and joint pain. Greater knowledge around beliefs and belief influencers are first needed in order to target delivery of these education interventions. The primary objective of this study was to identify differences in beliefs in relation to statements on exercise for management of hip and knee OA in PwOA and healthcare professionals (GPs and PTs). Secondary objectives were to explore any associations between beliefs of PwOA and whether they had ever received a GP referral to physiotherapy or had seen a PT for their painful joint. Based on previous work [10,14,17], it was hypothesised that exercise beliefs of PTs would be more positive, and in line with clinical guidelines and latest evidence, compared to GPs and PwOA. It was also hypothesised that PwOA who had received a physiotherapy referral from their GP, or who had seen a PT for their condition would have more positive beliefs about exercise compared to those who had not.

METHODS

Design and Recruitment

This study incorporates an analysis of three cross-sectional online surveys administered to three stakeholder groups - GPs, PTs and PwOA – in Ireland between March and September 2021. This cross-sectional study is embedded in a larger study (IMPACT – Implementation of osteoarthritis clinical guidelines together)[23], that aims to co-design and evaluate implementation strategies for an exercise and education programme for PwOA in Ireland.

Surveys were adapted from previous studies in this field [10,14,17] and reviewed by co-researchers of a public and patient involvement (PPI) steering committee of representative stakeholders prior to distribution. Qualtrics© software (Qualtrics, Provo, UT) was used to administer the online surveys and all procedures were approved by the University of Limerick Faculty of Education & Health Sciences Research Ethics Committee (REC) (2020_12_13_EHS) and the Irish College of General Practitioners REC (ICGP_REC_21_0006). Surveys were completed anonymously after participants were provided with a participant information sheet and consent was implied by completion of the survey. Reporting is consistent with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies.

The PT survey was distributed via email invite to all members of the Irish Society of Chartered Physiotherapists (n=2022), working across all fields. The survey was also advertised via social media (Twitter, LinkedIn) and amongst networks of researchers and PPI steering committee members. Physiotherapists were eligible for inclusion if they: (1) were practicing in Ireland, and (2) treated a patient with hip or knee OA in the past six months. The GP survey was distributed to the Irish College of General Practitioners network (n=3152), the University of Limerick Education and Research Network for General Practice (ULEARN-GP) network[24] (n=140) and via social media (Twitter, LinkedIn). GPs were eligible to take part if they were currently treating patients with hip and/or knee pain in Ireland. The survey for PwOA was advertised via social media (Twitter, LinkedIn), Arthritis Ireland social media, News Rheum patient newsletter and colleagues and networks of project steering committee and research team members. PwOA were eligible to take part if they (1) were living on the island of Ireland, (2) at least 30 years of age, (3) had chronic hip or knee pain for at least 6 months or more, and (4) did not have joint replacement surgery on at least one of the painful hips or knees. Strategies to increase recruitment via social media across all three surveys were adopted including tagging specific advocacy groups, patient or professional organisations and influencers, providing visual infographics alongside social media posts and aligning posts with events e.g. National Arthritis Day.

Outcomes

Each survey (Supplementary file 1) included an initial set of questions related to participant demographics. For healthcare professionals, these included questions on sex [are you: (1) Male, (2) Female, (3) Prefer not to say], length of time qualified, work setting, details of specific post-qualification training related to OA/chronic pain, confidence in treating hip and knee OA, percentage of typical caseload with hip or knee OA and where they prefer to access knowledge of management for persons with hip or knee OA. For PwOA,

demographic information related to sex [are you: (1) Male, (2) Female, (3) Prefer not to say], age category, geographical area and health conditions were asked. In relation to joint pain, questions regarding location, duration, severity, referrals to exercise, and use of clinical guideline specific treatments (muscle strengthening, aerobic exercise, education, weight loss) were asked. Additional questions were provided for PwOA to understand healthcare utilisation and previous experiences with exercise.

In each survey, a list of statements on exercise beliefs for hip and knee OA were provided and were rated on a 5-point Likert scale from strongly agree to strongly disagree. The belief statements were intended to align with current evidence-based guidelines[1,2] for exercise and OA. Healthcare professionals were given a more extensive list of statements that were related to exercise type or referral decisions. A final section related to barriers and enablers to exercise delivery, referral or uptake was included in each survey. Results of that analysis are presented elsewhere.

Statistical Analysis

Demographic outcomes were summarised as counts/proportions as appropriate. Belief statements were grouped and summarised descriptively by theme i.e., exercise type and effectiveness, exercise safety and exercise delivery. Although some statements had slightly different wording to facilitate understanding and relevance to each group, there were nine statements that were deemed to be comparable across groups and used to analyse differences in beliefs. Responses for the 5-point Likert scale statements were collapsed to a binary scale to label positive beliefs (“strongly agree” or “somewhat agree”) vs. negative beliefs (“strongly disagree”, “somewhat disagree” or “neither”). A commonly defined cut-off for consensus (>75%)[25] between stakeholders was used. Chi-square (2 x 3) tests of independence were used to assess differences in agreement with statements between three groups, and Bonferroni adjustment for between-group differences ($p<0.05$). Multivariable linear regression was used to explore associations between exercise beliefs (number of statements agreed with (range 0-9)) in PwOA and (1) physiotherapy referral from their GP *(Has your GP ever referred you to a physiotherapist for your painful joint? Yes/No)*, and (2) physiotherapy attendance *(Have you seen a physiotherapist for your painful joint? Yes/No).* Histograms, Kolmogorov-Smirnov tests and scatter plots of residuals vs. fitted values were used to test assumptions of Poisson and linear regression and linear regression was deemed more appropriate. Pearson correlation coefficients ($r>0.5$) and variance inflation factor (>5) were used to determine presence of collinearity between variables. The following covariates were included using an enter method in each model: sex, average pain rating (none/mild/moderate/severe), pain duration (6 months-1 year /1-2 years /2-3 years /3-4

years /4+ years) and number of comorbidities. The most parsimonious models were reported checking for a 10% difference in beta coefficients upon removal of covariates (p>0.05). Data were analysed using IBM-SPSS version 26.0.0 and Microsoft Excel365.

RESULTS

There was a total of 421 valid responses from the three distributed surveys, comprising 161 GPs, 163 PTs and 97 PwOA. An additional 26 GP, 33 PT and 15 PwOA surveys were collected but were not fully completed or did not contain sufficient data for analysis so were excluded. Demographic data for each stakeholder are presented in **Table 1**.

Experiences with Exercise for People with Osteoarthritis

Of the 97 PwOA, 78.4% had spoken to their GP regarding their joint pain, 63.9% had an X-ray of their joint and 48.5% had either been referred to physiotherapy or chosen to self-refer privately. Additionally, 50.5% reported having been given specific exercises for their joint by any healthcare professional. All but 5 respondents reported that this healthcare professional was a physiotherapist. Others included orthopaedic surgeon (n=2), rheumatologist (n=1) and GP (n=1). **Figure 1** shows answers to questions regarding the types of treatments tried by PwOA, as per clinical guideline recommendations (aerobic exercise, strengthening exercise, education and weight management).

Stakeholder Beliefs about Exercise Type and Effectiveness, Exercise Safety and Delivery

Figure 2 (a-d) shows the Likert scale results in each stakeholder group for statements related to the effectiveness of different types of exercise and for different levels of pain or perceived severity. **Figure 2 (e-i)** shows the Likert scale results in each stakeholder group for statements related to the safety and delivery of different types of exercise for people with OA. Beliefs were predominantly positive amongst GP's [positive consensus (>75% agreement) on 7/9 statements], PTs (6/9 statements) and PwOA (5/9 statements). Results of chi-square tests for differences in agreement between stakeholders across beliefs statements are presented in **Table 2**. There were differences in stakeholder responses across all statements, except for statement (d): *"Exercise works just as well for everybody, regardless of the amount of pain they have"* (X^2 = 5.14, p=0.076). All three stakeholder groups reached a negative consensus regarding this statement. In six of the eight statements where differences were observed, patient beliefs were significantly different to healthcare professional beliefs. There were two statements with a medium effect size for differences between PwOA and service providers: statements *(b) "Hip and knee problems can be improved by specific muscle strengthening exercises"* (V=0.309) and *(h) "Most*

patients with hip or knee OA would benefit from a supervised group exercise programme" (*V*=0.384). All other differences had a small effect size.

Table 1. Descriptive statistics using count (proportions) for healthcare professionals and people with osteoarthritis demographics

Healthcare Professionals Demographics	GP (n=161) Count (%)	PT (n=163) Count (%)	People with Hip or Knee Osteoarthritis Demographics	PwOA N=97 Count (%)
Sex:			**Sex:**	
Female	88 (54.7)	128 (78.5)	Female	76 (78.4)
Male	72 (44.7)	34 (20.9)	Male	20 (20.6)
Prefer not to say	1 (0.6)	1 (0.6)	Prefer not to say	1 (1.0)
How long have you been qualified?			**Most bothersome joint:**	
Less than 5 years	33 (20.5)	19 (11.7)	Knee	52 (53.8)
5-10 years	25 (15.5)	21 (12.9)	Hip	45 (46.4)
More than 10 years	103 (64.0)	123 (75.5)	**Age Category:**	
Work practice setting (GPs)			30-39 years	12 (12.4)
Urban	60 (37.3)	-	40-49 years	24 (24.7)
Rural	34 (21.1)	-	50-59 years	30 (30.9)
Mixed	67 (41.6)	-	60-69 years	25 (25.8)
Work practice setting (PTs)			70-79 years	6 (6.2)
Public hospital	-	38 (23.3)	**Living Location:**	
Private hospital	-	7 (4.3)	Inner city or suburb	46 (47.4)
Primary care	-	41 (25.2)	Town	16 (16.5)
Private practice clinic	-	70 (42.9)	Village	15 (15.5)
Other	-	7 (4.3)	Open country	20 (20.6)
Post-qualification training on OA / chronic pain			**No. of other comorbidities:**	
No	72 (44.7)	37 (22.7)	0	31 (32.0)
Inservice/webinars/reading	32 (19.9)	17 (10.4)	1-2	45 (47.9)
Course or conference	28 (17.4)	72 (44.2)	3+	18 (19.1)
Diploma/APP or certification	15 (9.3)	3 (1.8)	**Multi-joint pain(>1):**	
MSc in related field	14 (8.7)	32 (19.6)	No	6 (6.2)
PhD in related field	0	2 (1.2)	Yes	91 (93.8)
Confidence in treating hip and knee OA			**Rating of pain /symptoms on an average day**	
Not confident	2 (1.2)	0	No pain/symptoms	1 (1.0)
Slightly confident	33 (20.5)	5 (3.1)	Mild	30 (30.9)
Confident	80 (49.7)	41 (25.2)	Moderate	49 (50.5)
Very confident	36 (22.4)	86 (52.8)	Severe	17 (17.5)
Extremely confident	10 (6.2)	31 (19.0)		
% of typical caseload with hip/knee OA			**Duration of pain**	
1-5%	19 (11.8)	19 (11.7)	6 mon – 1 year	24 (24.7)
6-25%	117 (72.7)	83 (50.9)	1-2 years	13 (13.4)
26-50%	24 (14.9)	36 (22.1)	2-3 years	15 (15.5)
51-75%	1 (0.6)	18 (11.0)	3-4 years	11 (11.3)
>75%	0	5 (3.1)	More than 4 years	34 (35.1)

APP, Advanced Practice Physiotherapist; GP, General Practitioner; OA, Osteoarthritis; PT, Physiotherapist; PwOA, People with Osteoarthritis.

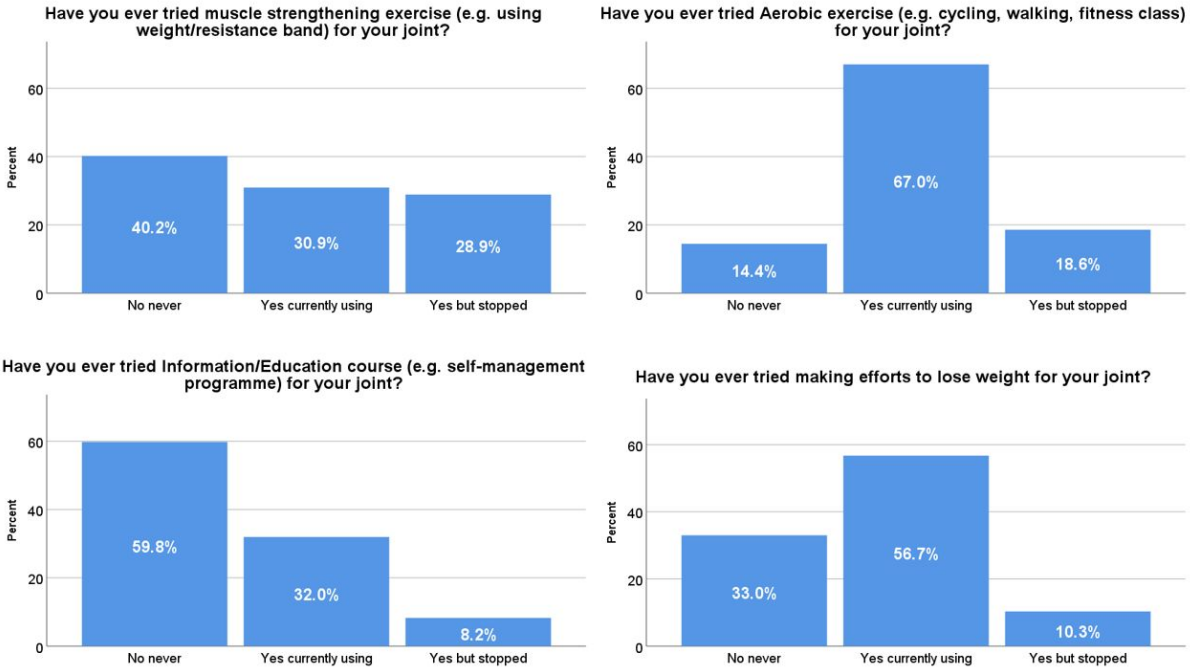

Figure 1. Proportion of responses to guideline-based treatments people with osteoarthritis (n=97) have tried

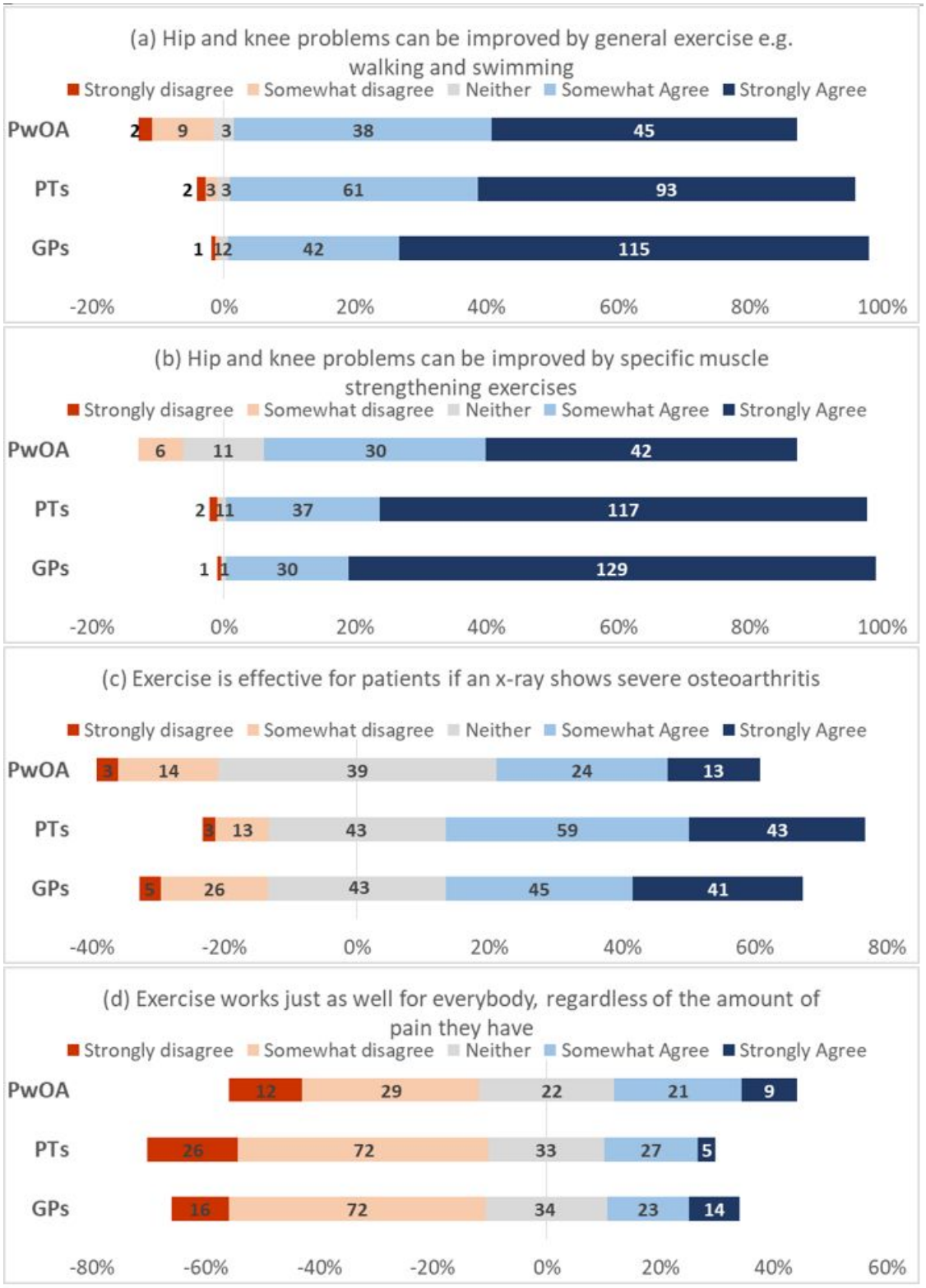

Figure 2 (a-d). 100% stacked bar chart showing Likert scale results with count for each stakeholder on belief statements related to exercise effectiveness. GP, general practitioner; PT, physiotherapist; PwOA, people with osteoarthritis.

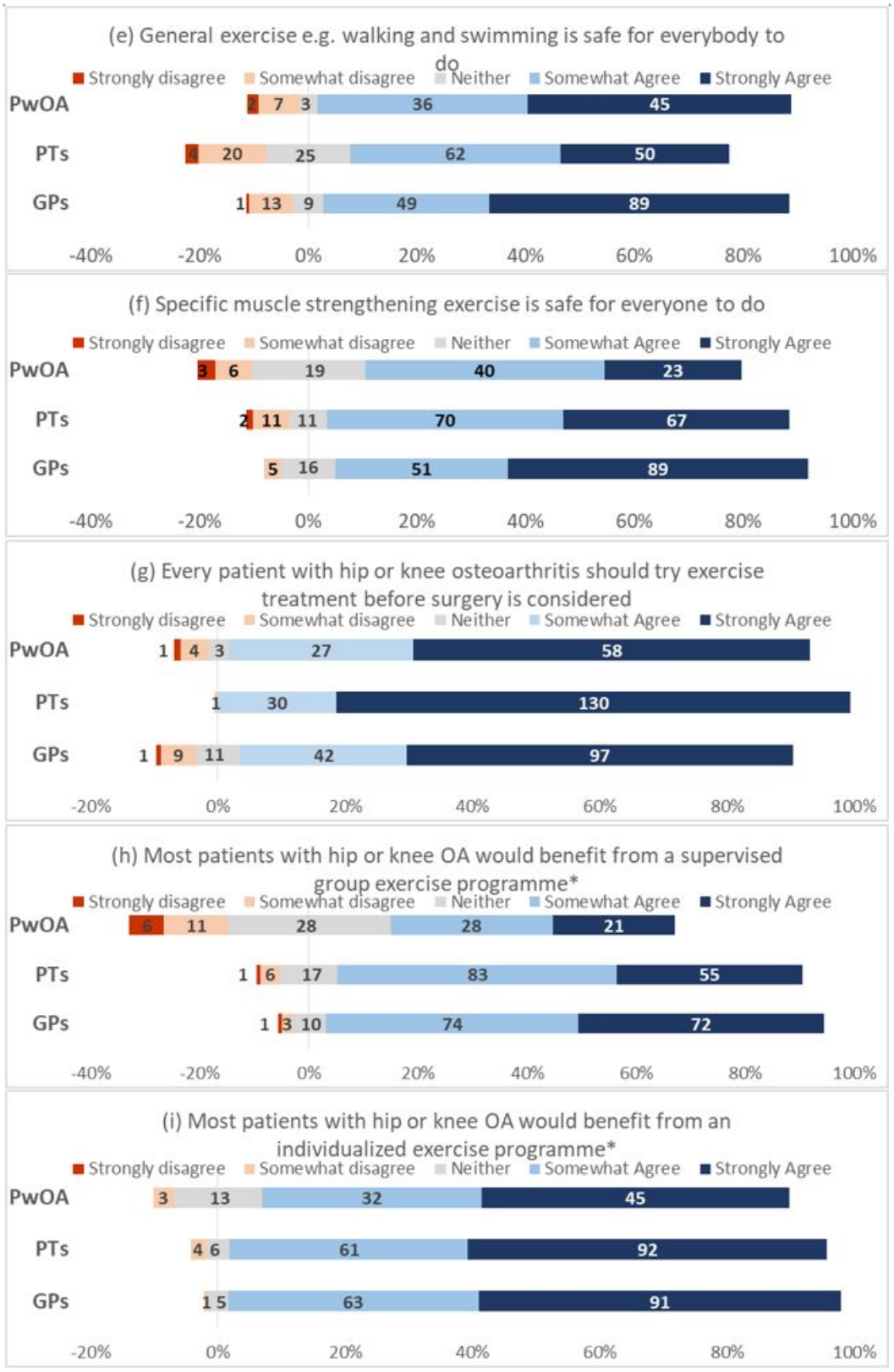

Figure 2 (e-i). 100% stacked bar chart showing Likert scale results with count for each stakeholder on belief statements related to exercise safety and delivery. *Questions for PwOA phrased slightly differently: "The best way to learn about exercise is in a supervised group setting with people who have similar pain" and "The best way to learn about exercise is in a one-on-one setting with a health professional". GP, general practitioner; PT, physiotherapist; PwOA, people with osteoarthritis.

Table 2. Differences in agreement with statements between general practitioner (GP; n=161), physiotherapist (PT; n=163) and people with hip and knee osteoarthritis (PwOA; n=97). Agreement was defined as those who selected "strongly agree" or "somewhat agree" on Likert scales. Proportions that reached "consensus", defined as >75% majority, are in bold.

Statement	Proportion in agreement			Chi-Square	Significance	Cramer's V
	GP	PT	PwOA			
(a) Hip and knee problems can be improved by general exercise e.g. walking and swimming	**97.5%**	**95.1%**	**85.6%[a]**	15.59	<0.0001	0.193
(b) Hip and knee problems can be improved by specific muscle strengthening exercises	**98.8%**	**97.5%**	**80.9%[a]**	39.04	<0.0001	0.309
(c) Exercise is effective for patients if an x-ray shows severe osteoarthritis	53.8%	63.4%	39.8%[c]	13.24	0.001	0.179
(d) Exercise works just as well for everybody, regardless of the amount of pain they have	**24.2%**	**19.6%**	32.3%	5.14	0.076	n/a
(e) General exercise e.g., walking and swimming is safe for everybody to do	**85.7%**	68.9%[b]	**87.1%**	18.13	<0.0001	0.209
(f) Specific muscle strengthening exercise is safe for everyone to do	**85.6%**	**84.5%**	69.2%[a]	11.86	0.003	0.170
(g) Every patient with hip or knee OA should try exercise treatment before surgery is considered	**86.9%**	**99.4%[b]**	**91.4%**	19.0	<0.0001	0.214
(h) Most patients with hip or knee OA would benefit from a supervised group exercise programme*	**91.3%**	**85.3%**	52.1%[a]	61.35	<0.0001	0.384
(i) Most patients with hip or knee OA would benefit from an individualized exercise programme*	**96.3%**	**93.9%**	**82.8%[a]**	15.91	<0.0001	0.196

[a]Significantly different compared to GP and PT, [b]significantly different to GP and PwOA, [c]significantly different to PT, using Bonferroni at .05 level. *Questions for PwOA phrased as: "The best way to learn about exercise is in a supervised group setting with people who have similar pain" and "The best way to learn about exercise is in a one-on-one setting with a health professional". Cramer's V =0.1 small, 0.3 medium, 0.5 large effect size. GP, general practitioner; OA, osteoarthritis; PT, physiotherapist; PwOA, people with osteoarthritis.

Predictors of Patient Beliefs

There was no association between beliefs of PwOA about exercise and the question: "has your GP ever referred you to a physiotherapist for your painful joint?" (**Supplemental File 2**) [B=0.46 (95% CI -0.35, 1.27)]. In this model, sex (male) [B=-1.01 (95% CI -2.01, -0.01)] and a higher number of comorbidities [B=-0.36 (95% CI -0.62, -0.11)] were negatively associated with beliefs about exercise. In model 2, there was a positive association between beliefs of PwOA about exercise and the question: "Have you seen a physiotherapist for your painful joint?" [B=1.06 (95% CI 0.30, 1.82)]. Sex (male) [B=-0.72 (95% CI -1.44, -0.00)], a longer duration of pain and symptoms [B=-0.20 (95% CI -0.40, -0.01)] and a higher number of

comorbidities [B=-0.29 (95% CI -0.53, -0.06)] were negatively associated with beliefs about exercise in this model.

Healthcare Professional Sources of Education

For the question, “Where do you get your knowledge of care advancements for persons with knee or hip osteoarthritis?”; the top five selected responses for GPs were continuous medical education (CME) or GP training networks (78%), published guidelines or recommendations (61%), reading medical journals (47%), conference attendance (47%) and course attendance (31%). For the question, “Where do you access your knowledge of management for persons with knee or hip osteoarthritis?”; the top five selected responses for PTs were published guidelines or recommendations (85%), reading research articles (75%), clinic protocols and discussion with peers or in-services (70%), course attendance (61%) and conference attendance (47%).

DISCUSSION

This research identified differences in beliefs about exercise effectiveness, safety and delivery between healthcare professionals and PwOA. While predominantly positive beliefs were observed across stakeholders, there was less consensus regarding the effectiveness of exercise when an X-ray shows “severe” OA. With regards to exercise referral, 48.5% of PwOA had either been referred to or self-referred to a physiotherapist for their joint pain. Referral to a physiotherapist by their GP was not associated with positive exercise beliefs. However, attendance at a physiotherapist for joint pain was associated with positive exercise beliefs in PwOA.

If OA management guidelines do not align with the personal beliefs of service providers or users, PwOA may not receive high quality care. This study has found that GPs (7/9 statements), PTs (6/9 statements) and PwOA (5/9 statements) have largely positive beliefs regarding exercise for OA. However, there is less certainty about exercise when an X-ray shows “severe osteoarthritis” across all stakeholders, and service providers do not agree that “*exercise works just as well for everybody, regardless of the level of pain they have*”. These results highlight that beliefs are generally in line with best evidence and clinical guidelines. However, there may still be some misconceptions about the effectiveness of exercise for higher levels of pain and disease. Evidence suggests that the pain-relieving qualities of exercise are effective for even moderate to severe OA disease[26–28], and a more recent meta-analysis has shown that individuals with higher pain severity at baseline

benefit more from therapeutic exercise than those with lower pain[29]. This evidence should be a focus of future efforts of knowledge translation to clinicians and PwOA.

Some of the beliefs identified in this study are reflective of the traditional view of OA as a "wear and tear" disease, synonymous with a desire to protect a "damaged" joint on X-ray from further damage, as found previously[9,21]. However, an encouraging finding from this research are the overwhelmingly more positive views towards exercise observed compared to similar studies published on a cohort of UK-based PTs in 2009[14], older adults with knee pain in 2012[10] and GPs in 2017[17]. Using the comparator of statements with at least majority view (>50% agreement), in the 2009 study[14], PTs agreed on the benefit of exercise for knee pain on 4/12 statements (33%), compared to 8/9 similar statements (89%) in the current study. For older adults with knee pain, there was no agreement for any statement in the 2012 study[10], compared to 7/9 statements (78%) in the current study. In the 2017 study[17], GPs agreed on 9/12 statements (75%), compared to 8/9 statements (89%) in the current study. While some statements varied slightly, stronger exercise recommendations in clinical guidelines and greater efforts in implementation and translation to practice in the last 10 years are likely the rationale for these changes, particularly since clinical guideline updates in 2014[1,2]. However, there is still much space to enact recommendations from a 2018 Cochrane review to provide better information and advice about the safety and value of exercise for patients[30]. In particular, providing reassurance on the role of exercise in managing symptoms, and discussion of opportunities to participate in activities regarded as enjoyable and relevant, may encourage greater exercise participation[30].

Beliefs of PwOA about exercise were significantly less positive compared to healthcare professional beliefs for 6/9 statements. The greatest differences were observed for statements in relation to the benefits of strengthening exercises and group-based exercise. Given 40% had never tried weight or strength-based training for their joint, and an additional 28% tried, but since stopped this type of exercise, healthcare professionals should be cognisant of ensuring patients understand the benefit of muscle strengthening and support patients to find enjoyable and sustainable ways to build these exercises into weekly routines. While strength-based training is not deemed superior to aerobic type exercise for pain relief in OA[26,31], knock-on benefits for improvements in physical function, longevity, bone health, and frailty[32] during ageing are important to highlight. Results for aerobic type exercise, however, were much more promising as only 14% had not tried this type of exercise for their joint and 67% were actively using. Further exploration on reasons for stopping exercise would be of benefit to determine if low adherence is related to barriers to exercise participation or a lack of perceived improvement in symptoms. While there is no

strong evidence to indicate a difference in effectiveness regarding exercise setting, PwOA were less likely to agree with the benefits of a supervised group setting compared to service providers. Additional benefits of group exercise for older adults, such as social support, improvements in mental health and loneliness, and cost-effectiveness should, however, be considered and encouraged[33–35].

In this study, referral to physiotherapy by a GP was not associated with more positive exercise beliefs in PwOA, in contrast to what was hypothesised. Although GPs had the most positive beliefs in comparison with other stakeholders, this finding may reflect the lack of time in a GP consultation to educate about exercise therapy and influence patient beliefs. A referral to exercise therapy alone may not be enough. However, seeing a PT for osteoarthritis was associated with more positive exercise beliefs. This may suggest that PTs impart important knowledge and education regarding the benefits of exercise to their patients, that, in turn, changes patient beliefs. Equally, this finding may suggest that PwOA with more positive exercise beliefs are more likely to attend a PT appointment. Tracking of changes in beliefs over time is recommended to further explore this association. Compared to GPs, PTs have more time in a consultation to discuss the effectiveness, mechanism, and safety of exercise for joint pain, which may help to influence beliefs and maximise the potential effect of exercise programs by improving adherence[36]. It is known that the provision of education for OA is superior for patient outcomes when combined with exercise therapy[37]. Almost 60% of PwOA reported having not tried self-management/education, despite some programme availability in Ireland[38]. PwOA were not asked specifically if their GP referred them to a self-management programme, which is a required area of further exploration. Additional efforts are required to support clinicians with resources to deliver trustworthy educational content for PwOA (cite Bhardwaj et al PT facilitator if published on time), or increase knowledge of available self-management programmes, to ensure clinical recommendations are fully implemented.

In the current study, 78% of PwOA had spoken to their GP about their joint pain, while under 50% had been referred to, or self-referred to a PT. Despite OA being amongst the leading causes of years lived with disability[39], the decision to seek care can be deterred by negative or dismissive attitudes from healthcare professionals about their non-urgent condition, or the perception that pain is part of ageing[40]. Healthcare professionals should take care regarding attitudes and language use during consultations[41] to help promote the effectiveness of first-line treatment strategies. From the regression analysis, it is also apparent that men with OA, and people with multiple comorbidities, may require additional supports to improve positive beliefs about exercise for their condition. Men are at times considered ‘hard to reach’ in terms of meaningful engagement with exercise programmes

[42]. For men who do not engage with healthcare services, a suggested route for information may instead be community support groups or sport organisations, where messaging is provided by someone who recipients can relate to and get along with[42]. For people living with the burden of multiple conditions, additional barriers to exercise may require thorough training of facilitators[43].

This study has shown that the most used education sources for healthcare professionals on management of OA are: published guidelines or recommendations (85% of PTs, 61% of GPs), use of training networks, in-clinic protocols, discussion and in-services (70% of PTs, 78% of GPs) and reading medical journals or research articles (75% of PTs, 47% of GPs). Even where clinicians report using clinical guidelines and research to guide practice, this is no guarantee that the most up-to-date recommendations are being used with confidence, or that they are being interpreted, recalled or implemented appropriately[44]. In contrast to this study, previous international investigations have shown that only a small proportion of sport and musculoskeletal PTs use research articles to change their clinical practice (10.4%)[45]. Over half of PTs instead cited “interactions with colleagues” and “attending private education short courses” as the source for change[45]. Given the high proportion of GPs that use CME small groups and training networks, peer-learning opportunities may be a viable source of intervention to ensure practice guidelines are being met[46]. The evidence to practice gap could be filled with clinical guideline supplements that address contextual barriers and time needed to treat[47], and courses/training that include opportunities to discuss real-world implementation of evidence with experienced colleagues and experts, with input from patients on delivery needs.

While efforts were made to recruit participants for this research from multiple diverse sources, this study was not a representative sample. Most PwOA were in the 50–59-year age category with moderate joint pain. While prevalence of OA is higher in older age categories, the sample recruited is likely reflective of the online nature of participation, wide inclusion criteria (age 30+ years) and exclusion criteria for previous joint replacement surgery. Due to the timing of survey administration (during COVID-19 pandemic lockdown), traditional survey advertising methods such as GP and health clinic waiting rooms were not utilised. Completion of an anonymous survey has benefits as results cannot be influenced, however if there was any confusion related to phrasing of a certain question or statement, then this could not be clarified. The selection of other belief statements about exercise may have yielded different results. Future research should also investigate similar beliefs using qualitative approach to allow for more context to these answers.

Conclusion

Beliefs of healthcare professionals and PwOA regarding exercise as a treatment for hip and knee OA have likely become more positive in recent years. However, there is still much scope for service improvement, with less than 50% of PwOA having seen a PT for their joint pain and all stakeholders in disagreement with statements relating to effectiveness of exercise for severe joint pain. Knowledge translation activities should be aimed at increasing knowledge and improving access to evidence-based exercise therapies, using stakeholder co-design to provide context on barriers and facilitators.

Author roles

Toomey CM: Conceptualization, Methodology, Formal Analysis, Supervision, Writing – Original Draft. Higgins N: Methodology, Formal Analysis, Writing – Reviewing & Editing; Wood-Thornsbury A: Methodology, Formal Analysis, Writing – Reviewing & Editing; Rector J: Methodology, Formal Analysis, Writing – Reviewing & Editing; Bhardwaj A: Methodology, Writing – Review & Editing; Hayes P: Methodology, Writing – Review & Editing; Browne J: Methodology, Writing – Review & Editing; Grealis S: Methodology, Writing – Review & Editing; Maguire D: Methodology, Writing – Review & Editing; O'Hora J: Methodology, Writing – Review & Editing; Dowling I: Methodology, Writing – Review & Editing; Kennedy N: Conceptualization, Supervision, Writing – Review & Editing.

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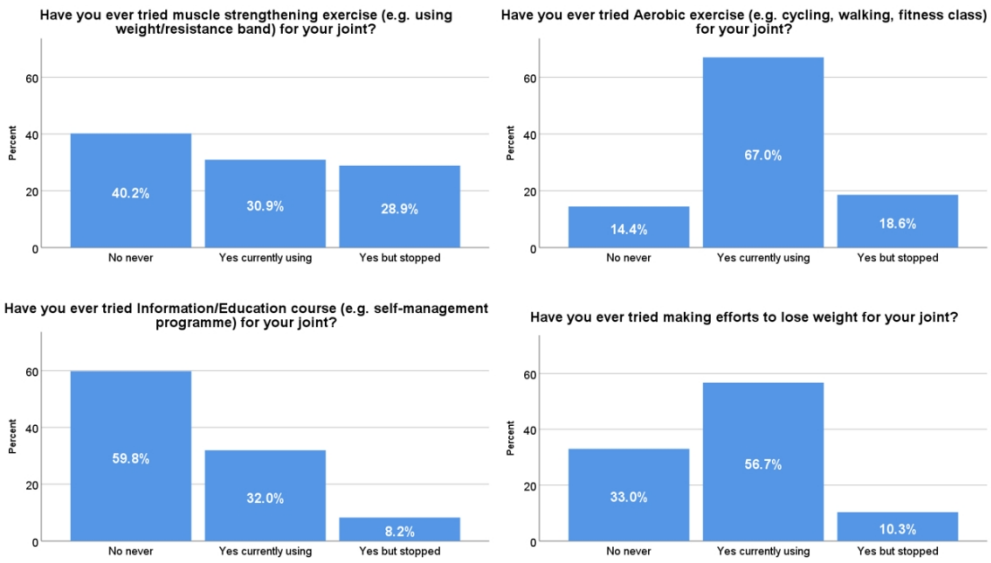

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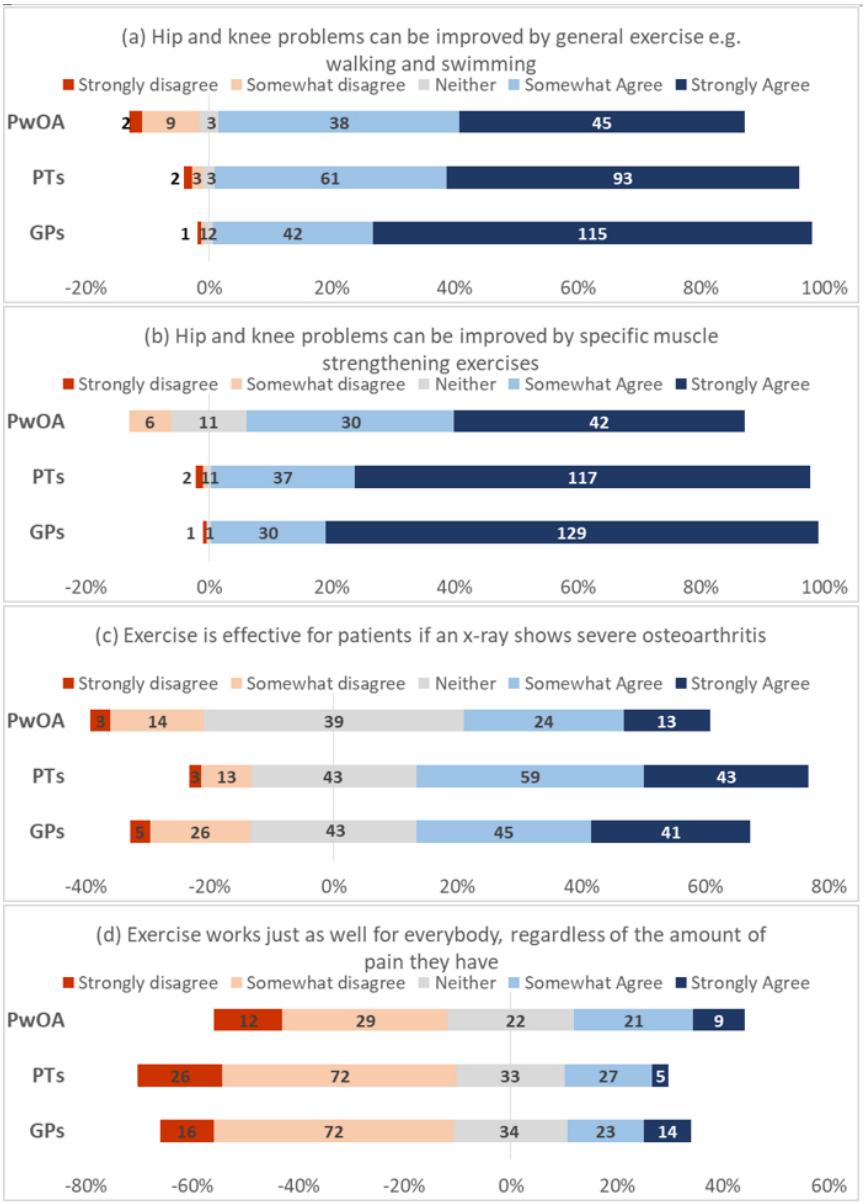

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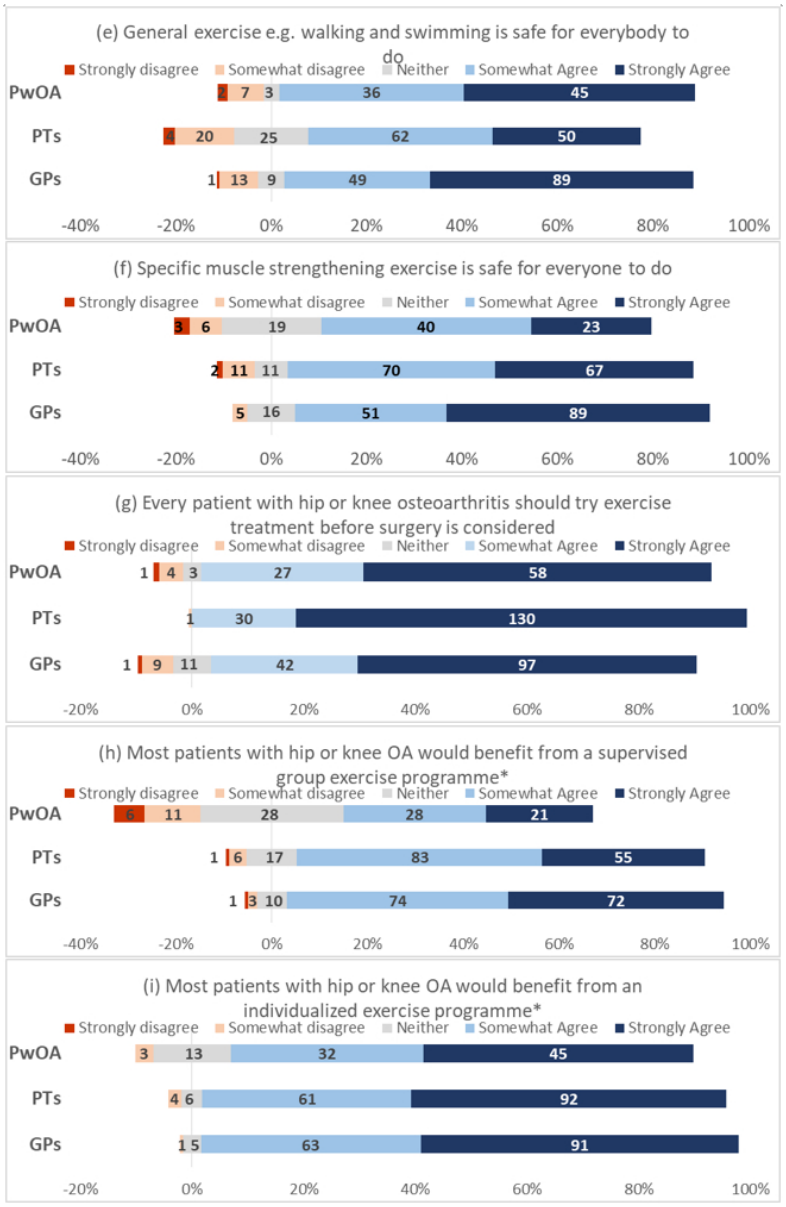

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Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Survey 1: Beliefs, Barriers and Enablers to Exercise Prescription for Hip and Knee Osteoarthritis in General Practice in Ireland

Instructions for completing this questionnaire

- When completing the questionnaire, please try and provide answers that most accurately reflect your usual clinical practice. There are no 'correct' or 'incorrect' answers.
- Please do not consult any literature while completing this questionnaire.

Section 1. Information about you

1. How long have you been qualified as a General Practitioner?
   ☐ Less than 5 years experience
   ☐ 5-10 years experience
   ☐ Greater than 10 years experience
2. How many GP's work in your practice (including yourself)
3. Are you: ☐ Female ☐ Male ☐Other ☐Prefer not to disclose
4. Is your primary practice: ☐ urban ☐ rural ☐ mixed
5. Is your practice:
   ☐ Primary care reimbursement scheme only
   ☐ Private practice only
   ☐ Mixed
6. Since graduating from University, do you remember receiving any specific postgraduate training in musculoskeletal (MSK) which contained education about hip or knee osteoarthritis or chronic pain? (By this we do not mean clinical placements or jobs in rheumatology or orthopaedics)
   ☐ Yes ☐ No
   If yes, what type of training?
   ☐ CME small groups (or guest speaker)
   ☐ Diploma in MSK
   ☐ M.Sc. in Sports & Exercise Medicine
   ☐ Sports Medicine Faculty conferences
   ☐ Private Hospital Day Course
   ☐ Therapeutic Intra Articular and Soft Tissue Injection and Assessment Course
   ☐ Specific Modules on MSK on your GP training Scheme
   ☐ Other _____
7. How would you rate your confidence in treating hip and knee osteoarthritis?
   ☐ Not confident
   ☐ Slightly confident
   ☐ Confident
   ☐ Very confident
   ☐ Extremely confident
8. Do you have, or have you ever suffered from chronic knee or hip pain yourself?
   ☐ Yes ☐ No
9. What percentage of your typical caseload is made up of patients with hip and/or knee pain?
   ☐1-5% ☐ 6-25% ☐ 26-50% ☐ 51-75% ☐ >75%

Section 2. Exercise beliefs for hip and knee osteoarthritis

2.1 Where do you get your knowledge of care advancements for persons with knee or hip osteoarthritis? (Tick all that apply)

☐ Published guidelines or recommendations (e.g. NICE, EULAR, OARSI)
☐ Reading medical journals
☐ Twitter or other social media
☐ Podcasts
☐ CME networks or other GP networks
☐ Conference attendance
☐ Course attendance

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Other _____

We are interested in your views about the role of exercise in the treatment of hip and knee osteoarthritis. Please indicate the extent to which you agree or disagree with the statements given by ticking or placing an 'X' in one box per row.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.2 Hip and knee problems are improved by general exercise e.g. walking and swimming					
2.3 Hip and knee problems are improved by specific muscle strengthening exercises					
2.4 General exercise e.g. walking and swimming is safe for everybody to do					
2.5 Specific muscle strengthening exercise is safe for everyone to do					
2.6 Every patient with hip or knee OA should try conservative exercise treatment before more invasive procedures are recommended					
2.7 Exercise for hip or knee OA is most beneficial when it is tailored to meet individual patient needs					
2.8 A standard set of exercises is sufficient for every patient with hip or knee OA					
2.9 Education on lifestyle change is important for patients with OA					
2.10 Education on strategies for self-management of pain are important for patients with OA					
2.11 It is important that people with OA increase their overall activity levels					
2.12 Exercise is effective for patients if an x-ray shows severe knee osteoarthritis					
2.13 Exercise for OA is more effectively provided by physiotherapists than GPs					
2.14 Time constraints prevent the provision of advice on individual exercises for OA					
2.15 Exercise for OA should preferably be used after drug treatment has been tried					
2.16 Exercise for chronic knee pain would be used more frequently if access to physiotherapy was easier					

Section 3. Clinical scenario of a patient with osteoarthritis

Presented below is a clinical scenario of a patient with suspected knee osteoarthritis who presents to you with this problem for the first time. All questions in this section relate to the care you would give this particular patient.

Patient:	Mrs. Murphy, 60-year old shop owner, no health insurance
Complaint:	Right sided knee pain
History:	Gradually worsening over 3 years
	No history of trauma
	Pain when walking and at rest, worst when climbing stairs.
	No night pain.
	Activities of daily living are manageable. Difficulty gardening.
	Finding work increasingly difficult due to the stairs
	Tried going to gym but stopped – thinks was making pain worse.
	Otherwise well – mild hypertension
	Has tried ibuprofen with no effect
Medication:	Amlodipine
Examination:	Mild Obesity with Body Mass Index of 33
	Knees – bilaterally no effusions.
	Joint line tenderness on palpation.
	No pain or reduced mobility around knee cap
	Slightly reduced flexion of the right knee.
	Hips – no abnormality detected

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

3.1 Select some **key words** you would use to describe their diagnosis **to the patient**. (Select all that apply)

☐ Mild	☐ Cartilage thinning	☐ Fear avoidance
☐ Moderate	☐ Overloading	☐ Pain sensitivity
☐ Severe	☐ Overweight	☐ Bone on bone
☐ Degeneration	☐ Deterioration	☐ Weakness
☐ Wear and tear	☐ Normal ageing	☐ Joint swelling
☐ Arthritis	☐ Joint damage	Other _____

3.2 What investigation(s)/assessment(s), if any, would you do/order for this patient at this point

☐ None ☐ Knee x-ray ☐ Blood tests ☐ Other _____

3.3 At this consultation, what approaches would you use, or suggest, to manage this patient? (please tick all that apply)

☐ None	☐ Advice on footwear	☐ Exercise
☐ Ice	☐ General activity	☐ Injection of steroids
☐ Heat	☐ Provision of walking aid	☐ Oral NSAID
☐ Rest	☐ Weight Loss	☐ Topical NSAID
☐ Weak opioids	☐ Paracetemol	☐ Glucosamine/Chondroitin

☐ Other, please state _____

3.4 If you selected exercise above, what form would this take? (Select all that apply)

☐ Suggest general exercise and activity
☐ Suggest specific exercises
☐ Give a leaflet or online resource
☐ Refer to physiotherapy or other exercise specialist
☐ Other (please state) _____

3.5 In an ideal world without barriers, would you refer the patient to physiotherapy or orthopaedic consultant or neither, at this stage?

☐ Physiotherapy
☐ Orthopaedic consultant
☐ Neither

3.6 In your current practice, would you refer this patient to physiotherapy at this stage?

☐ Yes
☐ No

If yes, why? (Select all that apply)

☐ Deemed an appropriate candidate for supervised conservative treatment
☐ Ease of access to physiotherapy
☐ Lack of time to appropriately address exercise needs in practice
☐ Lack of response to NSAIDS
☐ Other _____

If no, why not? (Select all that apply)

☐ Not an appropriate candidate for conservative treatment
☐ Long waiting lists and poor access to physiotherapy
☐ Other interventions are a priority
☐ Exercise will make the pain worse
☐ Patient has tried exercise
☐ I would prefer to examine further therapeutic options first (e.g., develop a pain management plan or give an intra articular steroid injection)
☐ Other _____

3.7 In your current practice, would you refer this patient to an orthopaedic consultant at this stage?

☐ Yes
☐ No

If yes, why? (Select all that apply)

☐ Deemed an appropriate candidate for surgery right now

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Will likely need a joint replacement in a few years so put on waiting list now
☐ Need a specialist opinion
☐ Other _____

If no, why not? (Select all that apply)
☐ More conservative treatmenta have not been exhausted
☐ Symptoms not severe enough to warrant joint replacement
☐ Waiting list too long
☐ Other _____

3.8 Would you refer the patient to see someone else, either in the primary or community team or into secondary care, at this point?
☐ Yes
☐ No
If yes, who? _____

Section 4. Barriers and enablers to exercise prescription and referral in general practice

In your practice and experience of treating patients with osteoarthritis, what are the main barriers to exercise prescription or referral? (Please select all that apply)
☐ Insufficient time in consultation
☐ Insufficient expertise
☐ Uncertainty about the effects of exercise
☐ Uncertainty about the most appropriate exercise type
☐ Uncertainty about the safety of exercise
☐ Cost and accessibility of physiotherapy for patient
☐ Physiotherapy waiting lists are too long
☐ Lack of a standardized physiotherapy programme for OA in the region
☐ Patients prefer other management options
☐ Patients want an orthopaedic consultant referral
☐ English language barrier for patients
☐ Severity of disease (symptoms too mild)
☐ Severity of disease (symptoms too severe)
☐ Older age of patient
☐ Presence of many comorbidities
☐ Other _____

What enablers would help you to prescribe or refer a patient with osteoarthritis to exercise in your practice?

☐ Increased formal post-qualification education e.g. diploma or masters
☐ Increased post-qualification training e.g. workshops, videos
☐ Increased exercise education during GP training
☐ More consultation time to provide exercise prescription
☐ Shorter waiting lists and improved access to physiotherapy
☐ Presence of an evidence-based physiotherapy-supervised group exercise programme for osteoarthritis in the locality
☐ Patients who recognize the importance of strategies for self-management of pain using appropriate exercise recommendations
☐ Low cost community-based exercise programmes
☐ Renumeration for exercise prescription and follow up consultations
☐ Other _____

Thank you for taking the time to complete this questionnaire. Your time and participation is greatly appreciated.

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Survey 2: Beliefs, Barriers and Enablers to Group Exercise Programme Delivery for Hip and Knee Osteoarthritis in Physiotherapy Practice in Ireland

The questionnaire is divided into 3 sections and should take approximately **7 minutes** to complete.

Instructions for completing this questionnaire

- When completing the questionnaire, please try and provide answers that most accurately reflect your usual clinical practice. There are no 'correct' or 'incorrect' answers.
- Please do not consult any literature while completing this questionnaire.

Section 1. Information about you

1. How long have you been qualified as a Physiotherapist?
   - ☐ Less than 5 years experience
   - ☐ 5-10 years experience
   - ☐ Greater than 10 years experience
2. How many Physiotherapists work in your clinic (including yourself) _____
3. Are you: ☐ Female ☐ Male ☐ Other ☐ Prefer not to disclose
4. Is your primary work setting:
   - ☐ Public hospital
   - ☐ Private hospital
   - ☐ Primary, community and continuing care
   - ☐ Private practice clinic
   - ☐ Education
   - ☐ Other (please state) _____
5. Have you undertaken any specific post-qualification training, which involved education about hip or knee osteoarthritis or chronic pain? (By this we do not mean clinical placements or jobs in rheumatology or orthopaedics) ☐ Yes ☐ No

If yes, what type of training? (Provide additional details if you wish to expand)

- ☐ In-service training Additional details _____
- ☐ M.Sc. (taught) in this/similar field Additional details _____
- ☐ M.Sc. (research) in this/similar field Additional details _____
- ☐ PhD in this/similar field Additional details _____
- ☐ Day, weekend or online course (please name most relevant) _____
- ☐ Other _____

6. How would you rate your confidence in treating hip and knee osteoarthritis?
   - ☐ Not confident
   - ☐ Slightly confident
   - ☐ Confident
   - ☐ Very confident
   - ☐ Extremely confident
7. Do you have, or have you ever suffered from chronic knee or hip pain yourself? ☐ Yes ☐ No
8. What percentage of your typical caseload is made up of patients with hip and/or knee osteoarthritis?
   ☐ 1-5% ☐ 6-25% ☐ 26-50% ☐ 51-75% ☐ >75%

Section 2. Exercise beliefs for hip and knee osteoarthritis

2.1 Where do you access your knowledge of management for persons with knee or hip osteoarthritis? (Tick all that apply)

☐ Published guidelines or recommendations (e.g. NICE, EULAR, OARSI)
☐ Clinic protocols, discussion with peers or in-services
☐ Reading published research articles
☐ Twitter or other social media
☐ Podcasts
☐Blogs
☐Infographics
☐Videos
☐ ISCP specialist groups and other network events
☐ Conference attendance
☐ Course attendance

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Other _____

Please now rank in order your preferred resources to learn from

We are interested in your views about the role of exercise in the treatment of hip and knee osteoarthritis. Please indicate the extent to which you agree or disagree with the statements given by ticking one box per row.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.2 Hip and knee problems are improved by general exercise e.g. walking and swimming					
2.3 Hip and knee problems are improved by specific muscle strengthening exercises					
2.4 Hip and knee problems are improved by focusing on motor or neuromuscular control of the joints during exercise					
2.5 General exercise e.g. walking and swimming is safe for most patients to do					
2.6 Specific muscle strengthening exercise is safe for most patients to do					
2.7 Neuromuscular control exercises are safe for most patients to do					
2.8 Every patient with hip or knee OA should try conservative exercise treatment before surgery is considered					
2.9 Exercise for hip or knee OA is most beneficial when it is tailored to meet individual patient needs					
2.10 A standard set of exercises with individual progression is sufficient for every patient with hip or knee OA					
2.11 Education on lifestyle change is important for patients with OA					
2.12 Education on strategies for self-management of pain are important for patients with OA					
2.13 It is important that people with OA increase their overall activity levels					
2.14 Exercise is effective for patients if an x-ray shows severe knee osteoarthritis					
2.15 Most patients with hip or knee OA would benefit from a supervised group exercise programme					
2.16 Most patients with hip or knee OA would benefit from an individualized exercise programme					

Section 3. Barriers and enablers to exercise programme delivery in physiotherapy practice

3.1 Please select the current level of government COVID19 restrictions in place as you are completing this survey

☐ Level 1 ☐ Level 2 ☐ Level ☐ Level 4 ☐ Level 5

3.2 **Pre-COVID19** restrictions in March 2020, were you or your clinic providing **group exercise classes** for patients with hip or knee osteoarthritis? ☐ Yes ☐ No

If Yes, what was the average number of classes per week? _____

If No, were you interested in offering group exercise classes for osteoarthritis in an ideal world and **if no barriers** existed?

☐ Yes

☐ No

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

3.3 **Pre-COVID19** restrictions in March 2020, **what** were the main **barriers** to providing group exercise programmes for patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Insufficient space and equipment resources
☐ Insufficient personnel (staff) resources
☐ Insufficient referrals or low OA caseload
☐ Patients want individualized programmes
☐ Patients prefer other management options e.g. manual therapy
☐ Insufficient expertise
☐ Uncertainty about the effects of exercise
☐ Uncertainty about the most appropriate exercise type
☐ Uncertainty about the safety of exercise
☐ Cost for patient
☐ Access for patient (e.g. travel, parking, time)
☐ Scheduling conflict related to patient working hours and clinic hours
☐ Lack of a standardised programme or protocol for exercise for OA
☐ English language barrier for patients
☐ Lack of support from colleagues or managers
☐ Other _____

3.4 Are you currently offering **group exercise classes** for patients with hip or knee osteoarthritis and **to what capacity**?

☐ Yes, face to face at full capacity
☐ Yes, face to face at reduced capacity compared to Pre-COVID19 restrictions
☐ Yes, online classes only
☐ Yes, combination of face-to-face and online
☐ No

3.5 **Under current restrictions**, are there any **additional barriers** to providing **face-to-face** group exercise programmes for patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Government restrictions currently do not allow for group classes
☐ Hospital or clinic protocols currently do not allow for group classes
☐ Patients do not want to attend clinic
☐ Not enough resources for adequate distancing for class members
☐ Sanitization procedures are too time consuming
☐ Own COVID-related safety concerns
☐ Other _____

3.6 **Under current restrictions**, are there any **additional barriers** to providing **online** group exercise programmes for patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Lack of IT resources in clinic (e.g. online platform, webcams, high speed Wi-Fi)
☐ Lack of personnel (staff) with IT knowledge
☐ Patients lack IT resources or knowledge
☐ Patients prefer to wait until they can access face-to-face treatment
☐ Uncertainty about the effectiveness of online group exercise
☐ Own personal preference
☐ Other _____

3.7 What **enablers** would help you to provide **face to face group exercise** classes to patients with osteoarthritis in your practice if COVID restrictions were not a factor? (Please select all that apply)

☐ None
☐ More university post-qualification education e.g. diploma or masters
☐ More other post-qualification training e.g. short courses, workshops, videos
☐ More education on group exercise delivery during physiotherapy training
☐ Appropriate referrals from GP or other sources
☐ GPs who impart knowledge regarding benefits of exercise to patients upon referral

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Resources to deliver quality educational material regarding self-management alongside exercise
☐ More support from colleagues or managers
☐ Other_____

3.8 What **enablers** would help you to provide an option of **online** group exercise classes to patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Improved IT infrastructure in clinic (e.g. laptops, webcams)
☐ IT skills resources for delivering online programmes (e.g. tutorials, do's and don'ts)
☐ Access to IT resources (e.g. tutorials) to provide patients with
☐ Improved Wi-Fi and bandwidth nationwide
☐ Strong evidence for effectiveness of existing online programmes
☐ An online registry allowing collection of patient outcomes pre- and post- programme
☐ Other _____

3.9 Would you be interested in receiving **training** (1.5 day workshop) to effectively implement and deliver a standardized, international, evidence-based group exercise and education programme with online and face-to-face options for patients with osteoarthritis in your clinic?

☐ Extremely interested
☐ Very interested
☐ Moderately interested
☐ Slightly interested
☐ Not at all interested
If not interested, why? _____

3.10 If interested, how much would you be willing to pay for this continuous professional development training?

☐ €100-150
☐ €151-200
☐ €201-250
☐ €251-300
☐ €301-350
☐ More than €350
☐ N/A

Thank you for taking the time to complete this questionnaire. Your time and participation is greatly appreciated.

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Survey 3: Survey on the Role of Exercise for Hip and Knee Osteoarthritis in Adults in Ireland

The questions below are divided into 3 sections. Please complete the questions to the best of your ability.

Section 1. Information about you

1. Are you: ☐ Female ☐ Male ☐ Other ☐ Prefer not to disclose
2. Which age category do you fall into?
   - ☐ 30 to 39 years
   - ☐ 40 to 49 years
   - ☐ 50 to 59 years
   - ☐ 60 to 69 years
   - ☐ 70 to 79 years
   - ☐ 80 to 89 years
   - ☐ 90 years or older
3. Which province in Ireland do you reside in? ☐ Munster ☐ Ulster ☐ Connacht ☐ Leinster

****If "Ulster" is selected, question 3(b) will appear.**

3(b) Do you access your healthcare in:
- ☐Northern Ireland (NHS)
- ☐Republic of Ireland (HSE)
- ☐A combination of both

4. Which of the following best describes where you live?
   - ☐ Inner city
   - ☐ Suburb of a city
   - ☐ Town
   - ☐ Village
   - ☐ Open country
   - ☐ Island off Ireland
5. Have you ever been told by a health professional that you have a diagnosis of the following?(Select all that apply)

☐ Arthritis	☐ Diabetes Mellitus (type 1 or 2)
☐ Osteoarthritis	☐ Kidney or liver disease
☐ Wear and tear	☐ Anemia (reduced number of red blood cells)
☐ Degenerative changes	☐ Other blood disease
☐ Rheumatoid arthritis	☐ Cancer
☐ Hypertension	☐ Depression
☐ Heart Disease	☐ Anxiety
☐ Ulcer or other bowel diseases	☐ Other mental health disorder
☐ Neurological disease e.g. Parkinson's/MS	
☐ Respiratory diseases e.g. COPD	☐ Thyroid Disease
☐ Hemochromatosis	☐ Fibromyalgia
☐ Other health condition _____	

6. Have you had pain and joint symptoms in any of the following joints for **6 months or more** (select all that apply)

☐Right Knee	☐Left Knee
☐Right Hip	☐Left Hip
☐Right Ankle	☐Left Ankle
☐Right Shoulder	☐Left Shoulder
☐Right Elbow	☐Left Elbow
☐Right Wrist	☐Left Wrist
☐Right Hand/Fingers	☐Left Hand/Fingers
☐Lower Back	☐Other, please describe_____
☐Mid Back	
☐Neck	

7. Have you ever had joint replacement surgery for any of your painful joints? Please select below the joints that have been replaced.

☐Right Knee	☐Left Knee
☐Right Hip	☐Left Hip
☐Right Ankle	☐Left Ankle
☐Right Shoulder	☐Left Shoulder

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐Right Elbow ☐Left Elbow
☐Right Wrist ☐Left Wrist
☐Right Hand/Fingers ☐Left Hand/Fingers
☐Other, please describe_____

8. Of your hip and/or knee joints that have **NOT** been replaced, which joint are you most bothered by? (select one)

☐Right Knee ☐Left Knee
☐Right Hip ☐Left Hip

All remaining questions will now be related to the joint that you have chosen.

9. How long have you been experiencing pain in your [insert chosen joint]?
   - ☐ 6 months – 1 year
   - ☐ 1 – 2 years
   - ☐ 2 – 3 years
   - ☐ 3 – 4 years
   - ☐ 4 – 5 years
   - ☐ More than 5 years
10. Have you seen or spoken to your GP about your painful [insert chosen joint]? ☐Yes ☐No
11. Have you ever had an x-ray of your [insert chosen joint]? ☐ Yes ☐ No
12. Has your GP ever referred you to an **orthopaedic consultant** for your [insert chosen joint]?
    - ☐ Yes
    - ☐ No
    - ☐ Currently on a waiting list (private consultant referral)
    - ☐ Currently on a waiting list (public consultant referral)

** If on a waiting list, how long have you been waiting?

- ☐ Less than 6 months
- ☐ 6 months – 1 year
- ☐ 1 year – 1.5 years
- ☐ 1.5 years – 2 years
- ☐ More than 2 years

13. Has your GP ever referred you to a **physiotherapist** for your [insert chosen joint]?
    - ☐ Yes
    - ☐ No
    - ☐ Currently on a waiting list (private consultant referral)
    - ☐ Currently on a waiting list (public consultant referral)

    * If on a waiting list, how long have you been waiting?

    - ☐ Less than 6 months
    - ☐ 6 months – 1 year
    - ☐ 1 year – 1.5 years
    - ☐ 1.5 years – 2 years
    - ☐ More than 2 years
14. How would you rate the pain and symptoms you are experiencing in your hip and/or knee on an average day?
    - ☐ No pain or symptoms
    - ☐ Mild pain and symptoms
    - ☐ Moderate pain and symptoms
    - ☐ Severe pain and symptoms
15. Have you EVER tried any of the following specifically for your [insert chosen joint]?

Muscle strengthening exercise (e.g. using weight/resistance band)	☐No, never	☐Yes, currently using	☐Yes, stopped using
Aerobic exercise (e.g. cycling, walking, fitness class)	☐No, never	☐Yes, currently using	☐Yes, stopped using
Information/Education course (e.g. self-management programme)	☐No, never	☐Yes, currently using	☐Yes, stopped using
Making efforts to lose weight	☐No, never	☐Yes, currently using	☐Yes, stopped using

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Section 2. Exercise beliefs for hip and knee osteoarthritis

We are interested in your views about the role of exercise in the treatment of hip and knee osteoarthritis. Please indicate how much you agree or disagree with the statements given by selecting one option per question.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.1 Hip and knee problems can be improved by general exercise e.g. walking and swimming					
2.2 Hip and knee problems can be improved by specific muscle strengthening exercises					
2.3 General exercise e.g. walking and swimming is safe for everybody to do					
2.4 Specific muscle strengthening exercise is safe for everyone to do					
2.5 Every patient with hip or knee osteoarthritis should try exercise treatment before surgery is considered					
2.6 Patients should learn more about how to self-manage their pain and symptoms using exercise and physical activity					
2.7 The best way to learn about exercise is in a supervised group setting with people who have similar pain (Pre-COVID-19 restrictions)					
2.8 The best way to learn about exercise is in a one-on-one setting with a health professional (Pre-COVID-19 restrictions)					
2.9 Exercise is effective for patients if an x-ray shows severe knee osteoarthritis					
2.10 Exercise works just as well for everybody, regardless of the amount of pain they have					

Section 3. Barriers and enablers to exercise for hip and knee osteoarthritis

In this section we want to know more about your exercise experience and what kinds of things would prevent you or help you do more exercise

3.1 How many times a week do you exercise (e.g. 30 minute walk)?

☐ 3 or more days per week
☐ Less than 3 days per week
☐ I don't exercise

3.2 Has a health professional ever given you specific exercises for your [insert chosen joint]?

☐ Yes
☐ No
☐ Not sure

*If Yes, what type of health professional? (select all that apply)

☐ Physiotherapist
☐ GP
☐ Orthopaedic surgeon
☐ Nurse
☐ Personal trainer
☐ Other, please name _____

*If Yes, what type of exercise?

☐ Home-based individual exercises
☐ Group exercise class for osteoarthritis
☐ Other, please state _____

*If Yes, did you find the exercise beneficial?

☐ Yes
☐ No
☐ Not sure

3.3 Please select the current level of government COVID19 restrictions in place as you are completing this survey

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Level 1 ☐ Level 2 ☐ Level ☐ Level 4 ☐ Level 5 (strictest restrictions)

3.4 Thinking about life **without COVID19** restrictions, **what** are the main **barriers** that would prevent you from exercising? (Please select all that apply)

☐ Pain or other joint symptoms
☐ I need assistance for mobility e.g. walking stick, wheelchair
☐ Finding time to exercise
☐ Lack of enjoyment from exercise
☐ Lack of exercise buddy or support network
☐ Wet or cold weather
☐ Other health problems
☐ Other disability e.g. visual impairment
☐ Cost of a gym membership or physiotherapy visit
☐ Cost of active wear or equipment
☐ I don't know the best types of exercise to do
☐ I don't know who to contact to learn more or do more exercise
☐ Uncertainty about the safety of exercise for joint pain
☐ Uncertainty about the benefit of exercise for joint pain
☐ Negative body image
☐ Access to facilities (e.g. availability, travel, parking)
☐ Work commitments
☐ Family commitments or other responsibilities
☐ Age
☐ Fear of injury
☐ Tiredness and fatigue
☐ Depression
☐ Other _____

3.5 Thinking about life **without COVID19** restrictions, what types of things would **help you to exercise more**? (Please select all that apply)

☐ Better knowledge of the best type of exercise to do
☐ Access to exercise that is supervised by a health professional
☐ Social aspect e.g. group exercise with other people with hip or knee pain
☐ More confidence in your joint
☐ Exercise recommendations from a GP
☐ Exercise recommendations from a physiotherapist
☐ More support from family or friends
☐ Warm and dry weather for outdoor exercise
☐ Low cost community exercise programmes
☐ Safe exercise environment (e.g. well-lit pathways)
☐ Other_____

3.6 Thinking about life **without COVID-19,** how interested would you be in attending a 6-week, twice per week, physiotherapy-supervised group exercise and education class for your hip or knee pain **at a clinic or community centre**?

☐ Extremely interested
☐ Very interested
☐ Moderately interested
☐ Slightly interested
☐ Not at all interested

If not interested, why? _____

3.7 Thinking about **current restrictions**, how interested would you be in taking part in a 6-week, twice per week, **ONLINE** physiotherapy-supervised group exercise and education class for you hip or knee pain?

☐ Extremely interested
☐ Very interested
☐ Moderately interested
☐ Slightly interested

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Not at all interested

If not interested, why? _____

3.8 Do you have any experience with online-delivered healthcare or telerehabilitation from a GP or other health professional?

☐Yes

☐ No

3.9 What are the **barriers** that would prevent you taking part in an **online exercise** class? (Please select all that apply)

☐ Lack of technology equipment (e.g. laptop, smartphone or tablet, webcams)

☐ Lack of confidence in using computers, laptops etc.

☐ Wi-Fi / Broadband connection is not good enough

☐ Preference to wait until I can access face-to-face treatment

☐ Uncertain about how online group exercise would work

☐ Lack of space in home environment to perform exercises

☐ English language barriers

☐ Lack of time to take part

☐ Other _____

3.10 What would **help you** to take part in an **online** group exercise class with other people with osteoarthritis? (Please select all that apply)

☐ An initial one-to-one session with a physiotherapist to get familiar with the process

☐ Resources (e.g. videos) with explanations of how to get started

☐ Improved Wi-Fi and bandwidth

☐ Examples and testimonials from patients who have finished the classes

☐ Opportunities to chat online with other patients before and after the class

☐ Support from family members to get set up in your home

☐ A laptop or tablet

☐ Other _____

3.11 If interested, how much would you be willing to pay to take part in these exercise classes (price in euros for entire 14-15 session programme)?

☐ €0-25

☐ €26-50

☐ €51-100

☐ €101-150

☐ €151-200

☐ > €200

Thank you for taking the time to complete this questionnaire. Your time and participation is greatly appreciated.

Supplemental File 2

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Supplemental Table: Multivariable linear regression models to determine if positive beliefs about exercise in PwOA are associated with (1) referral to physiotherapist by a GP and (2) if they have seen a physiotherapist for their joint pain.

Dependent Variable: Number of exercise belief statements agreed with								
Variables Model 1 [a]	**B**	**S.E.**	**Partial Correlation**	**VIF**	**Sig.**	**Exp(B)**	**95% CI for EXP(B) Lower**	**Upper**
Has your GP ever referred you to a physiotherapist for your painful joint?	0.457	0.406	0.129	1.01	0.264	0.120	-0.352	1.267
Sex	-1.011	0.502	-0.227	1.009	0.048	-0.215	-2.011	-0.011
Number of comorbidities	-0.361	0.128	0.309	1.009	0.006	-0.300	-0.616	-0.106
Constant	7.772	0.686	-	-	0.000	-	6.405	9.138
Model 2 [b]								
Have you seen a physiotherapist for your painful joint?	1.060	0.383	0.288	1.138	0.007	0.287	0.299	1.821
Sex	-0.723	0.362	-0.212	1.003	0.049	-0.194	-1.444	-0.003
How long have you been experiencing pain in your joint?	-0.204	0.099	-0.219	1.163	0.042	-0.216	-0.400	-0.008
Number of comorbidities	-0.293	0.119	-0.257	1.026	0.016	-0.241	-0.530	-0.055
Constant	7.680	0.585	-	-	0.000	-	6.034	9.653

[a]Model variables removed due to non-significance (1): *How long have you been experiencing pain in your joint?*, *How would you rate the pain and symptoms you are experiencing in your hip and/or knee on an average day?*.
[b]Model variables removed due to non-significance (2): *How would you rate the pain and symptoms you are experiencing in your hip and/or knee on an average day?*. B, beta coefficient; GP, general practitioner; OA, osteoarthritis; PT, physiotherapist; PwOA, people with osteoarthritis; S.E., standard error; VIF, variance inflation factor.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4-5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4-5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*5-7*
Bias	9	Describe any efforts to address potential sources of bias	n/a
Study size	10	Explain how the study size was arrived at	n/a
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	6-7
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6-7
		(*e*) Describe any sensitivity analyses	n/a
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1

Outcome data	15*	Report numbers of outcome events or summary measures	Page 7, Figure 1-3
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 3
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	14-15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16,17
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Guideline-based exercise management for hip and knee osteoarthritis: a cross-sectional comparison of healthcare professional and patient beliefs in Ireland.

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Guideline-based exercise management for hip and knee osteoarthritis: a cross-sectional comparison of healthcare professional and patient beliefs in Ireland.

ABSTRACT

Objectives: To identify within-stakeholder agreement and between-stakeholder differences in beliefs regarding exercise for osteoarthritis among general practitioners (GPs), physiotherapists (PTs) and people with hip and knee osteoarthritis (PwOA). A secondary objective was to explore how referral patterns may influence beliefs.

Design: Cross-sectional

Setting: Online surveys administered to GPs, PTs and PwOA in Ireland via social media and healthcare networks.

Participants: 421 valid responses (n=161 GPs, n=163 PTs, n=97 PwOA).

Primary and secondary outcome measures: Nine beliefs statements related to exercise effectiveness, safety and delivery were rated on a 5-point Likert scale and analysed for within-stakeholder consensus. Chi-square tests assessed differences in agreement between groups. Multivariable linear regression models tested associations between beliefs in PwOA and referral to/attendance at physiotherapy.

Results: Positive within-stakeholder consensus (>75% agreement) was reached for most statements (7/9 GPs, 6/9 PTs, 5/9 PwOA). However, beliefs of PwOA were significantly less positive compared to healthcare professionals for six statements. All stakeholders disagreed that exercise is effective regardless of the level of pain. Attendance at physiotherapy (49% of PwOA), rather than referral to physiotherapy from a GP only, was associated with positive exercise beliefs for PwOA [β=0.287 (95% CI 0.299, 1.821)].

Conclusions: Beliefs about exercise therapy for osteoarthritis are predominantly positive across all stakeholders, albeit less positive in PwOA. PwOA are more likely to have positive beliefs if they have seen a physiotherapist for their osteoarthritis. Knowledge translation should highlight the effectiveness of exercise for all levels of pain and osteoarthritis disease.

Strengths and Limitations

- Differences in beliefs about exercise between healthcare professionals and patients with osteoarthritis has not previously been examined.

- This study also explored how healthcare professional visits may influence beliefs about effectiveness of evidence-based care.
- This was a cross-sectional study so no inferences can be made.
- Different results with respect to beliefs and influences may have been found if non-online recruitment methods were available (e.g. paper surveys in healthcare settings).

INTRODUCTION

The management of hip and knee osteoarthritis (OA), as for other chronic conditions, should be determined by best available evidence. Although there is no cure for this burdensome disease, healthcare professionals in this field have for a long time had a wealth of high-quality evidence to draw from, all pointing to optimal core clinical management that consists of land-based exercise, education and weight loss if appropriate[1,2]. Despite this, implementation of these guidelines in practice is not optimal, often resulting in care that is fragmented in nature or considered low-value [3]. A global meta-analysis involving 16,103 people with OA (PwOA) in community care, revealed that only 39% received a referral or recommendation to exercise,[4] while a UK-based survey in 2018 revealed that only 3.9% of the 502 respondents with an OA diagnosis, were using exercise as part of their management[5]. Some similarities in shortcomings to implementation of guidelines for musculoskeletal health have been identified globally[6].

Alongside use of best evidence, the provision of patient-centred care is a pillar of high-quality care that should help guide treatment for PwOA[7]. Literature and expert opinion recommendations state that it is important to assess patient ideas and concerns regarding the cause and management of their pain, and to take into account their expectations and preferences for treatment[7]. Regarding exercise, researchers have identified a considerable amount of uncertainty among PwOA regarding the benefits of exercise for their pain. Results from cross-sectional surveys and semi-structured interviews have indicated that a lack of knowledge on the condition may result in patients believing that surgery is their only option[9,10]. Furthermore, a view of OA as a “wear and tear” condition was associated with the perspective that exercise was a counterintuitive treatment[9–11]. Since it is widely understood that beliefs influence health-related behaviours [12,13], and because stronger recommendations for exercise have been made since previous publications[2,5,10], an updated understanding of how PwOA view exercise is required.

Healthcare professionals’ perceptions and beliefs will affect the advice and management they offer patients, and researchers have suggested that those with biomedical or biomechanical beliefs about OA may transfer these beliefs to their patients, thus affecting their treatment choices[14,15]. Currently, general practitioners (GPs) and physiotherapists (PTs) are considered among the core care providers for PwOA[16]. While PT’s have the knowledge and skills to adopt a key role in the management of hip and knee OA, GPs remain the most frequently accessed source of formal medical advice and treatment[16,17]. The language used by healthcare professionals, especially GPs, can have a profound influence on patients’ beliefs[18,19]. A systematic review from Cottrell et al [20] in 2010,

found that the attitudes and beliefs of GPs concerning exercise and chronic knee pain varied widely. An updated UK-based survey of GPs in 2017 found that perspectives were positive, with 87% reporting the use of exercise in their practice [17]. However, only 11% reported using exercise in ways that aligned with evidence-based guidelines [17]. This demonstrates the need for a better understanding of how GPs interact with up-to-date resources for care advancements for OA, in a time-demanding profession.

A scoping review of qualitative research exploring attitudes and beliefs, shows that PTs generally have a positive attitude to activity and exercise in OA management, despite indications that some PTs may also be lacking up-to-date knowledge about best practice or may not be adhering to evidence-based treatments[21]. In contrast, a recent mixed-methods evaluation by Barton et al [22] in 2021 reported that awareness regarding evidence supporting exercise for knee OA was good (89–96%) amongst PTs in Australia and Canada.

Greater knowledge around beliefs and belief influencers are needed in order to address negative beliefs or myths associated with exercise and joint pain. The objective of this study was to identify within-stakeholder agreement and between-stakeholder differences in beliefs in relation to statements on exercise for management of hip and knee OA in PwOA, GPs and PTs. Secondary objectives were to explore any associations between beliefs of PwOA and whether they had ever received a GP referral to physiotherapy or had seen a PT for their painful joint. Based on previous work [10,14,17], it was hypothesised that exercise beliefs of PTs would be more positive, and in line with clinical guidelines and latest evidence, compared to GPs and PwOA. It was also hypothesised that PwOA who had received a physiotherapy referral from their GP, or who had seen a PT for their condition would have more positive beliefs about exercise compared to those who had not.

METHODS

Design and Recruitment

This study incorporates an analysis of three cross-sectional online surveys administered to three stakeholder groups - GPs, PTs and PwOA – in Ireland between March and September 2021. This cross-sectional study is embedded in a larger study (IMPACT – Implementation of osteoarthritis clinical guidelines together)[23], that aims to co-design and evaluate implementation strategies for an exercise and education programme for PwOA in Ireland. Surveys were adapted from previous studies in this field [10,14,17] and reviewed by co-researchers of a public and patient involvement (PPI) steering committee of representative stakeholders prior to distribution. Validation consisted of a round of pre-testing with a convenience sample of three of each GPs, PTs and PwOA with feedback provided on readability, acceptability and appropriateness that was incorporated before distribution.

Qualtrics© software (Qualtrics, Provo, UT) was used to administer the online surveys and all procedures were approved by the University of Limerick Faculty of Education & Health Sciences Research Ethics Committee (REC) (2020_12_13_EHS) and the Irish College of General Practitioners REC (ICGP_REC_21_0006). Surveys were completed anonymously after participants were provided with a participant information sheet and consent was implied by completion of the survey. Reporting is consistent with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies.

The PT survey was distributed via email invite to all members of the Irish Society of Chartered Physiotherapists (n=2022), working across all fields. The survey was also advertised via social media (Twitter, LinkedIn) and amongst networks of researchers and PPI steering committee members. Physiotherapists were eligible for inclusion if they: (1) were practicing in Ireland, and (2) treated a patient with hip or knee OA in the past six months. The GP survey was distributed to the Irish College of General Practitioners network (n=3152), the University of Limerick Education and Research Network for General Practice (ULEARN-GP) network[24] (n=140) and via social media (Twitter, LinkedIn). GPs were eligible to take part if they were currently treating patients with hip and/or knee pain in Ireland. The survey for PwOA was advertised via social media (Twitter, LinkedIn), Arthritis Ireland social media, News Rheum patient newsletter and colleagues and networks of project steering committee and research team members. PwOA were eligible to take part if they (1) were living on the island of Ireland, (2) at least 30 years of age, (3) had chronic hip or knee pain for at least 6 months or more, and (4) did not have joint replacement surgery on at least one of the painful hips or knees. Strategies to increase recruitment via social media across all three surveys were adopted including tagging specific advocacy groups, patient or professional organisations and influencers, providing visual infographics alongside social media posts and aligning posts with events e.g. National Arthritis Day.

Outcomes

Each survey (Supplementary file 1) included an initial set of questions related to participant demographics. For healthcare professionals, these included questions on sex [are you: (1) Male, (2) Female, (3) Prefer not to say], length of time qualified, work setting, details of specific post-qualification training related to OA/chronic pain, confidence in treating hip and knee OA, percentage of typical caseload with hip or knee OA and where they prefer to access knowledge of management for persons with hip or knee OA. For PwOA, demographic information related to sex [are you: (1) Male, (2) Female, (3) Prefer not to say], age category, geographical area and health conditions were asked. In relation to joint pain, questions regarding location, duration, severity, referrals to exercise, and use of clinical

guideline specific treatments (muscle strengthening, aerobic exercise, education, weight loss) were asked. Additional questions were provided for PwOA to understand healthcare utilisation and previous experiences with exercise.

In each survey, a list of statements on exercise beliefs for hip and knee OA were provided and were rated on a 5-point Likert scale from strongly agree to strongly disagree. The belief statements were intended to align with current evidence-based guidelines[1,2] and best practice for exercise and OA. Healthcare professionals were given a more extensive list of statements that were related to exercise type or referral decisions. A final section related to barriers and enablers to exercise delivery, referral or uptake was included in each survey. Results of that analysis are presented elsewhere.

Statistical Analysis

Demographic outcomes were summarised as counts/proportions as appropriate. Belief statements were grouped and summarised descriptively by theme i.e., exercise type and effectiveness, exercise safety and exercise delivery. Although some statements had slightly different wording to facilitate understanding and relevance to each group, there were nine statements that were deemed to be comparable across groups and used to analyse differences in beliefs. Responses for the 5-point Likert scale statements were collapsed to a binary scale to label positive beliefs (“strongly agree” or “somewhat agree”) vs. negative beliefs (“strongly disagree”, “somewhat disagree” or “neither”). “Neither” was included with negative beliefs since statements were deemed to align somewhat with best practice and anything short of agreement may be considered unsatisfactory knowledge translation or personal experience. A commonly defined cut-off for consensus (>75%)[25] between stakeholders was used. Chi-square (2 x 3) tests of independence were used to assess differences in agreement with statements between three groups, and Bonferroni adjustment for between-group differences ($p<0.05$). Multivariable linear regression was used to explore associations between exercise beliefs (number of statements agreed with (range 0-9)) in PwOA and (1) physiotherapy referral from their GP *(Has your GP ever referred you to a physiotherapist for your painful joint? Yes/No)*, and (2) physiotherapy attendance *(Have you seen a physiotherapist for your painful joint? Yes/No).* Histograms, Kolmogorov-Smirnov tests and scatter plots of residuals vs. fitted values were used to test assumptions of Poisson and linear regression and linear regression was deemed more appropriate. Pearson correlation coefficients ($r>0.5$) and variance inflation factor (>5) were used to determine presence of collinearity between variables. Based on correlates of physical activity for hip and knee OA from previous literature, the following covariates were included using an enter method in each model: sex[26], average pain rating (none/mild/moderate/severe)[26], pain

duration (6 months-1 year /1-2 years /2-3 years /3-4 years /4+ years)[27] and number of comorbidities[26]. The most parsimonious models were reported checking for a 10% difference in beta coefficients upon removal of covariates ($p>0.05$). Data were analysed using IBM-SPSS version 26.0.0 and Microsoft Excel365.

Patient and public involvement

This research was conducted as part of a larger project (IMPACT) that uses a participatory health research approach. A steering committee of key stakeholders with relevant research, clinical/system expertise or lived experience (academics, people with arthritis, patient advocacy group members, physiotherapists, GPs, orthopaedic surgeon) have oversight of the project from inception to dissemination. Members of the committee were involved in designing the research question and outcome measures for these surveys, recruitment of participants, interpretation of analyses and dissemination as co-authors of the publication.

RESULTS

There was a total of 421 valid responses from the three distributed surveys, comprising 161 GPs, 163 PTs and 97 PwOA. An additional 26 GP, 33 PT and 15 PwOA surveys were collected but were not fully completed or did not contain sufficient data for analysis so were excluded. Demographic data for each stakeholder are presented in **Table 1**.

Experiences with Exercise for People with Osteoarthritis

Of the 97 PwOA, 78.4% (n=76) had spoken to their GP regarding their joint pain, 63.9% (n=62) had an X-ray of their joint. 44.6% (n=43) had been referred to physiotherapy by their GP and 48.5% (n=47) had seen a physiotherapist for their joint (either through GP- or self-referral). Additionally, 50.5% (n=49) reported having been given specific exercises for their joint by any healthcare professional. All but 5 respondents reported that this healthcare professional was a physiotherapist. Others included orthopaedic surgeon (n=2), rheumatologist (n=1) and GP (n=1). **Figure 1** shows answers to questions regarding the types of treatments tried by PwOA, as per clinical guideline recommendations (aerobic exercise, strengthening exercise, education and weight management).

Within-Stakeholder Agreement in Beliefs about Exercise Type and Effectiveness, Exercise Safety and Delivery

Figure 2 shows the Likert scale results in each stakeholder group for statements (a-d), related to the effectiveness of different types of exercise and for different levels of pain or perceived severity. **Figure 3** shows the Likert scale results in each stakeholder group for statements (e-i), related to the safety and delivery of different types of exercise for people

with OA. Beliefs were predominantly positive amongst GP's [positive consensus (>75% agreement) on 7/9 statements], PTs (6/9 statements) and PwOA (5/9 statements).

Between-Stakeholder Differences in Beliefs about Exercise Type and Effectiveness, Exercise Safety and Delivery

Results of chi-square tests for differences in agreement between stakeholders across beliefs statements are presented in **Table 2**. There were differences in stakeholder responses across all statements, except for statement (d): *"Exercise works just as well for everybody, regardless of the amount of pain they have"* (X^2 = 5.14, p=0.076). All three stakeholder groups reached a negative consensus regarding this statement. In six of the eight statements where differences were observed, patient beliefs were significantly different to healthcare professional beliefs. There were two statements with a medium effect size for differences between PwOA and service providers: statements *(b) "Hip and knee problems can be improved by specific muscle strengthening exercises"* (*V*=0.309) and *(h) "Most patients with hip or knee OA would benefit from a supervised group exercise programme"* (*V*=0.384). All other differences had a small effect size.

Table 1. Descriptive statistics using count (proportions) for healthcare professionals and people with osteoarthritis demographics

Healthcare Professionals Demographics	**GP (n=161)** Count (%)	**PT (n=163)** Count (%)	**People with Hip or Knee Osteoarthritis Demographics**	**PwOA N=97** Count (%)
Sex:			**Sex:**	
Female	88 (54.7)	128 (78.5)	Female	76 (78.4)
Male	72 (44.7)	34 (20.9)	Male	20 (20.6)
Prefer not to say	1 (0.6)	1 (0.6)	Prefer not to say	1 (1.0)
How long have you been qualified?			**Most bothersome joint:**	
Less than 5 years	33 (20.5)	19 (11.7)	Knee	52 (53.8)
5-10 years	25 (15.5)	21 (12.9)	Hip	45 (46.4)
More than 10 years	103 (64.0)	123 (75.5)	**Age Category:**	
Work practice setting (GPs)			30-39 years	12 (12.4)
Urban	60 (37.3)	-	40-49 years	24 (24.7)
Rural	34 (21.1)	-	50-59 years	30 (30.9)
Mixed	67 (41.6)	-	60-69 years	25 (25.8)
Work practice setting (PTs)			70-79 years	6 (6.2)
Public hospital	-	38 (23.3)	**Living Location:**	
Private hospital	-	7 (4.3)	Inner city or suburb	46 (47.4)
Primary care	-	41 (25.2)	Town	16 (16.5)
Private practice clinic	-	70 (42.9)	Village	15 (15.5)
Other	-	7 (4.3)	Open country	20 (20.6)
Post-qualification training on OA / chronic pain			**No. of other comorbidities:**	
No	72 (44.7)	37 (22.7)	0	31 (32.0)
Inservice/webinars/reading	32 (19.9)	17 (10.4)	1-2	45 (47.9)
Course or conference	28 (17.4)	72 (44.2)	3+	18 (19.1)

Diploma/APP or certification	15 (9.3)	3 (1.8)		**Multi-joint pain(>1):**	
MSc in related field	14 (8.7)	32 (19.6)		No	6 (6.2)
PhD in related field	0	2 (1.2)		Yes	91 (93.8)
Confidence in treating hip and knee OA				**Rating of pain /symptoms on an average day**	
Not confident	2 (1.2)	0		No pain/symptoms	1 (1.0)
Slightly confident	33 (20.5)	5 (3.1)		Mild	30 (30.9)
Confident	80 (49.7)	41 (25.2)		Moderate	49 (50.5)
Very confident	36 (22.4)	86 (52.8)		Severe	17 (17.5)
Extremely confident	10 (6.2)	31 (19.0)			
% of typical caseload with hip/knee OA				**Duration of pain**	
1-5%	19 (11.8)	19 (11.7)		6 mon – 1 year	24 (24.7)
6-25%	117 (72.7)	83 (50.9)		1-2 years	13 (13.4)
26-50%	24 (14.9)	36 (22.1)		2-3 years	15 (15.5)
51-75%	1 (0.6)	18 (11.0)		3-4 years	11 (11.3)
>75%	0	5 (3.1)		More than 4 years	34 (35.1)

APP, Advanced Practice Physiotherapist; GP, General Practitioner; OA, Osteoarthritis; PT, Physiotherapist; PwOA, People with Osteoarthritis.

Table 2. Differences in agreement with statements between general practitioner (GP; n=161), physiotherapist (PT; n=163) and people with hip and knee osteoarthritis (PwOA; n=97). Agreement was defined as those who selected "strongly agree" or "somewhat agree" on Likert scales. Proportions that reached within-stakeholder "consensus", defined as >75% majority, are in bold.

Statement	**Proportion in agreement**			**Chi-Square**	**Significance**	**Cramer's V**
	GP	**PT**	**PwOA**			
(a) Hip and knee problems can be improved by general exercise e.g. walking and swimming	**97.5%**	**95.1%**	**85.6%[a]**	15.59	<0.0001	0.193
(b) Hip and knee problems can be improved by specific muscle strengthening exercises	**98.8%**	**97.5%**	**80.9%[a]**	39.04	<0.0001	0.309
(c) Exercise is effective for patients if an x-ray shows severe osteoarthritis	53.8%	63.4%	39.8%[c]	13.24	0.001	0.179
(d) Exercise works just as well for everybody, regardless of the amount of pain they have	**24.2%**	**19.6%**	32.3%	5.14	0.076	n/a
(e) General exercise e.g., walking and swimming is safe for everybody to do	**85.7%**	68.9%[b]	**87.1%**	18.13	<0.0001	0.209
(f) Specific muscle strengthening exercise is safe for everyone to do	**85.6%**	**84.5%**	69.2%[a]	11.86	0.003	0.170
(g) Every patient with hip or knee OA should try exercise treatment before surgery is considered	**86.9%**	**99.4%[b]**	**91.4%**	19.0	<0.0001	0.214
(h) Most patients with hip or knee OA would benefit from a supervised group exercise programme*	**91.3%**	**85.3%**	52.1%[a]	61.35	<0.0001	0.384
(i) Most patients with hip or knee OA would benefit from an individualized exercise programme*	**96.3%**	**93.9%**	**82.8%[a]**	15.91	<0.0001	0.196

[a]Significantly different compared to GP and PT, [b]significantly different to GP and PwOA, [c]significantly different to PT, using Bonferroni at .05 level. *Questions for PwOA phrased as: "The best way to learn about exercise is in a supervised group setting with people who have similar pain" and "The best way to learn about exercise is

in a one-on-one setting with a health professional". Cramer's V =0.1 small, 0.3 medium, 0.5 large effect size. GP, general practitioner; OA, osteoarthritis; PT, physiotherapist; PwOA, people with osteoarthritis.

Predictors of Patient Beliefs

There was no association between beliefs of PwOA about exercise and the question: "has your GP ever referred you to a physiotherapist for your painful joint?" (**Supplemental File 2**) [B=0.46 (95% CI -0.35, 1.27)]. In this model, sex (male) [B=-1.01 (95% CI -2.01, -0.01)] and a higher number of comorbidities [B=-0.36 (95% CI -0.62, -0.11)] were negatively associated with beliefs about exercise. In model 2, there was a positive association between beliefs of PwOA about exercise and the question: "Have you seen a physiotherapist for your painful joint?" [B=1.06 (95% CI 0.30, 1.82)]. Sex (male) [B=-0.72 (95% CI -1.44, -0.00)], a longer duration of pain and symptoms [B=-0.20 (95% CI -0.40, -0.01)] and a higher number of comorbidities [B=-0.29 (95% CI -0.53, -0.06)] were negatively associated with beliefs about exercise in this model.

Healthcare Professional Sources of Education

For the question, "Where do you get your knowledge of care advancements for persons with knee or hip osteoarthritis?"; the top five selected responses for GPs were continuous medical education (CME) or GP training networks (78%), published guidelines or recommendations (61%), reading medical journals (47%), conference attendance (47%) and course attendance (31%). For the question, "Where do you access your knowledge of management for persons with knee or hip osteoarthritis?"; the top five selected responses for PTs were published guidelines or recommendations (85%), reading research articles (75%), clinic protocols and discussion with peers or in-services (70%), course attendance (61%) and conference attendance (47%).

DISCUSSION

This research identified differences in beliefs about exercise effectiveness, safety and delivery between healthcare professionals and PwOA. While predominantly positive beliefs were observed across stakeholders, there was less consensus regarding the effectiveness of exercise when an X-ray shows "severe" OA. With regards to exercise referral, 48.5% of PwOA had either been referred to or self-referred to a physiotherapist for their joint pain. Referral to a physiotherapist by their GP was not associated with positive exercise beliefs.

However, attendance at a physiotherapist for joint pain was associated with positive exercise beliefs in PwOA.

If OA management guidelines do not align with the personal beliefs of service providers or users, PwOA may not receive high quality care. This study has found that GPs (7/9 statements), PTs (6/9 statements) and PwOA (5/9 statements) have largely positive beliefs regarding exercise for OA. However, there is less certainty about exercise when an X-ray shows "severe osteoarthritis" across all stakeholders, and service providers do not agree that "*exercise works just as well for everybody, regardless of the level of pain they have*". These results highlight that beliefs are generally in line with best evidence and clinical guidelines. However, there may still be some misconceptions about the effectiveness of exercise for higher levels of pain and disease. Evidence suggests that the pain-relieving qualities of exercise are effective for even moderate to severe OA disease[28–30], and a more recent meta-analysis has shown that individuals with higher pain severity at baseline benefit more from therapeutic exercise than those with lower pain[31]. This evidence should be a focus of future efforts of knowledge translation to clinicians and PwOA.

Some of the beliefs identified in this study are reflective of the traditional view of OA as a "wear and tear" disease, synonymous with a desire to protect a "damaged" joint on X-ray from further damage, as found previously[9,21]. However, an encouraging finding from this research are the overwhelmingly more positive views towards exercise observed compared to similar studies published on a cohort of UK-based PTs in 2009[14], older adults with knee pain in 2012[10] and GPs in 2017[17]. Using the comparator of statements with at least majority view (>50% agreement), in the 2009 study[14], PTs agreed on the benefit of exercise for knee pain on 4/12 statements (33%), compared to 8/9 similar statements (89%) in the current study. For older adults with knee pain, there was no agreement for any statement in the 2012 study[10], compared to 7/9 statements (78%) in the current study. In the 2017 study[17], GPs agreed on 9/12 statements (75%), compared to 8/9 statements (89%) in the current study. While some statements varied slightly, stronger exercise recommendations in clinical guidelines and greater efforts in implementation and translation to practice in the last 10 years are likely the rationale for these changes, particularly since clinical guideline updates in 2014[1,2]. However, there is still much space to enact recommendations from a 2018 Cochrane review to provide better information and advice about the safety and value of exercise for patients[32]. In particular, providing reassurance on the role of exercise in managing symptoms, and discussion of opportunities to participate in activities regarded as enjoyable and relevant, may encourage greater exercise participation[32].

Beliefs of PwOA about exercise were significantly less positive compared to healthcare professional beliefs for 6/9 statements. The greatest differences were observed for statements in relation to the benefits of strengthening exercises and group-based exercise. Given 40% had never tried weight or strength-based training for their joint, and an additional 28% tried, but since stopped this type of exercise, healthcare professionals should be cognisant of ensuring patients understand the benefit of muscle strengthening and support patients to find enjoyable and sustainable ways to build these exercises into weekly routines. While strength-based training is not deemed superior to aerobic type exercise for pain relief in OA[28,33], knock-on benefits for improvements in physical function, longevity, bone health, and frailty[34] during ageing are important to highlight. Results for aerobic type exercise, however, were much more promising as only 14% had not tried this type of exercise for their joint and 67% were actively using. Further exploration on reasons for stopping exercise would be of benefit to determine if low adherence is related to barriers to exercise participation or a lack of perceived improvement in symptoms. While there is no strong evidence to indicate a difference in effectiveness regarding exercise setting, PwOA were less likely to agree with the benefits of a supervised group setting compared to service providers. Additional benefits of group exercise for older adults, such as social support, peer-learning, improvements in mental health and loneliness, and cost-effectiveness should, however, be considered and encouraged[35–37].

In this study, referral to physiotherapy by a GP was not associated with more positive exercise beliefs in PwOA, in contrast to what was hypothesised. Although GPs had the most positive beliefs in comparison with other stakeholders, this finding may reflect the lack of time in a GP consultation to educate about exercise therapy and influence patient beliefs. A referral to exercise therapy alone may not be enough. However, seeing a PT for osteoarthritis was associated with more positive exercise beliefs. This may suggest that PTs impart important knowledge and education regarding the benefits of exercise to their patients, that, in turn, changes patient beliefs. Equally, this finding may suggest that PwOA with more positive exercise beliefs are more likely to attend a PT appointment. Tracking of changes in beliefs over time is recommended to further explore this association. Compared to GPs, PTs have more time in a consultation to discuss the effectiveness, mechanism, and safety of exercise for joint pain, which may help to influence beliefs and maximise the potential effect of exercise programs by improving adherence[38]. It is known that the provision of education for OA is superior for patient outcomes when combined with exercise therapy[39]. Almost 60% of PwOA reported having not tried self-management/education, despite some programme availability in Ireland[40]. PwOA were not asked specifically if their GP referred them to a self-management programme, which is a required area of further

exploration. Additional efforts are required to support clinicians with resources to deliver trustworthy educational content for PwOA, or increase knowledge of available self-management programmes, to ensure clinical recommendations are fully implemented.

In the current study, 78% of PwOA had spoken to their GP about their joint pain, while under 50% had been referred to, or self-referred to a PT. Despite OA being amongst the leading causes of years lived with disability[41], the decision to seek care can be deterred by negative or dismissive attitudes from healthcare professionals about their non-urgent condition, or the perception that pain is part of ageing[42]. Healthcare professionals should take care regarding attitudes and language use during consultations[43] to help promote the effectiveness of first-line treatment strategies. From the regression analysis, it is also apparent that men with OA, and people with multiple comorbidities, may require additional supports to improve positive beliefs about exercise for their condition. Men are at times considered 'hard to reach' in terms of meaningful engagement with exercise programmes [44]. For men who do not engage with healthcare services, a suggested route for information may instead be community support groups or sport organisations, where messaging is provided by someone who recipients can relate to and get along with[44]. For people living with the burden of multiple conditions, additional barriers to exercise may require thorough training of facilitators[45].

This study has shown that the most used education sources for healthcare professionals on management of OA are: published guidelines or recommendations (85% of PTs, 61% of GPs), use of training networks, in-clinic protocols, discussion and in-services (70% of PTs, 78% of GPs) and reading medical journals or research articles (75% of PTs, 47% of GPs). Even where clinicians report using clinical guidelines and research to guide practice, this is no guarantee that the most up-to-date recommendations are being used with confidence, or that they are being interpreted, recalled or implemented appropriately[46]. In contrast to this study, previous international investigations have shown that only a small proportion of sport and musculoskeletal PTs use research articles to change their clinical practice (10.4%)[47]. Over half of PTs instead cited "interactions with colleagues" and "attending private education short courses" as the source for change[47]. Given the high proportion of GPs that use CME small groups and training networks, peer-learning opportunities may be a viable source of intervention to ensure practice guidelines are being met[48]. The evidence to practice gap could be filled with clinical guideline supplements that address contextual barriers and time needed to treat[49], and courses/training that include opportunities to discuss real-world implementation of evidence with experienced colleagues and experts, with input from patients on delivery needs.

While efforts were made to recruit participants for this research from multiple diverse sources, this study was not a representative sample. Most PwOA were in the 50–59-year age category with moderate joint pain. While prevalence of OA is higher in older age categories, the sample recruited is likely reflective of the online nature of participation, wide inclusion criteria (age 30+ years) and exclusion criteria for previous joint replacement surgery. Due to the timing of survey administration (during COVID-19 pandemic lockdown), traditional survey advertising methods such as GP and health clinic waiting rooms were not utilised. Completion of an anonymous survey has benefits as results cannot be influenced, however if there was any confusion related to phrasing of a certain question or statement, then this could not be clarified. The selection of other belief statements about exercise may have yielded different results. Future research should also investigate similar beliefs using qualitative approach to allow for more context to these answers.

Conclusion

Beliefs of healthcare professionals and PwOA regarding exercise as a treatment for hip and knee OA have likely become more positive in recent years. However, there is still much scope for service improvement, with less than 50% of PwOA having seen a PT for their joint pain and all stakeholders in disagreement with statements relating to effectiveness of exercise for severe joint pain. Knowledge translation activities should be aimed at increasing knowledge and improving access to evidence-based exercise therapies, using stakeholder co-design to provide context on barriers and facilitators.

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Figure 2. 100% stacked bar chart showing Likert scale results with count for each stakeholder on belief statements (a-d) related to exercise effectiveness. GP, general practitioner; PT, physiotherapist; PwOA, people with osteoarthritis.

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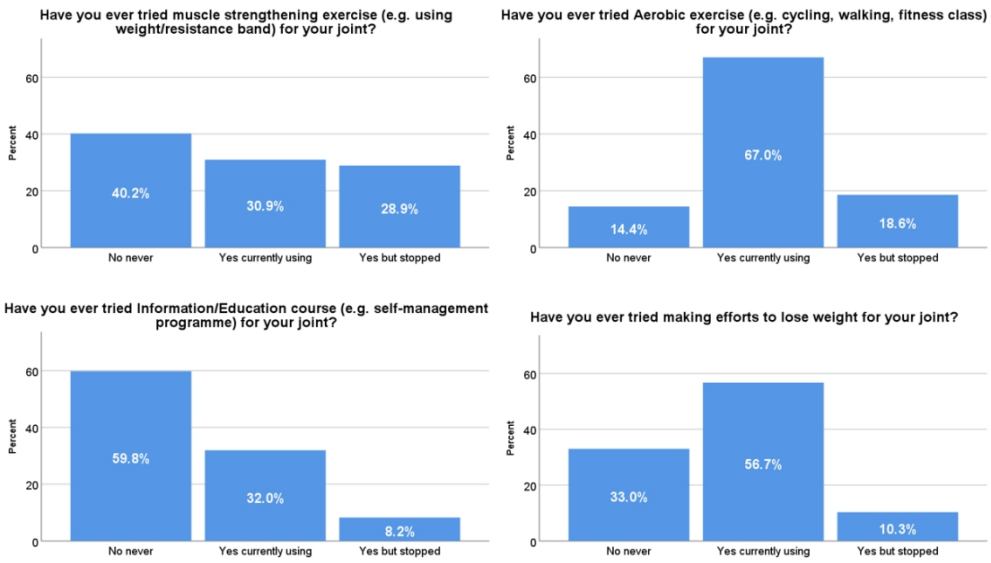


Figure 1. Proportion of responses to guideline-based treatments people with osteoarthritis (n=97) have tried.

680x385mm (47 x 47 DPI)

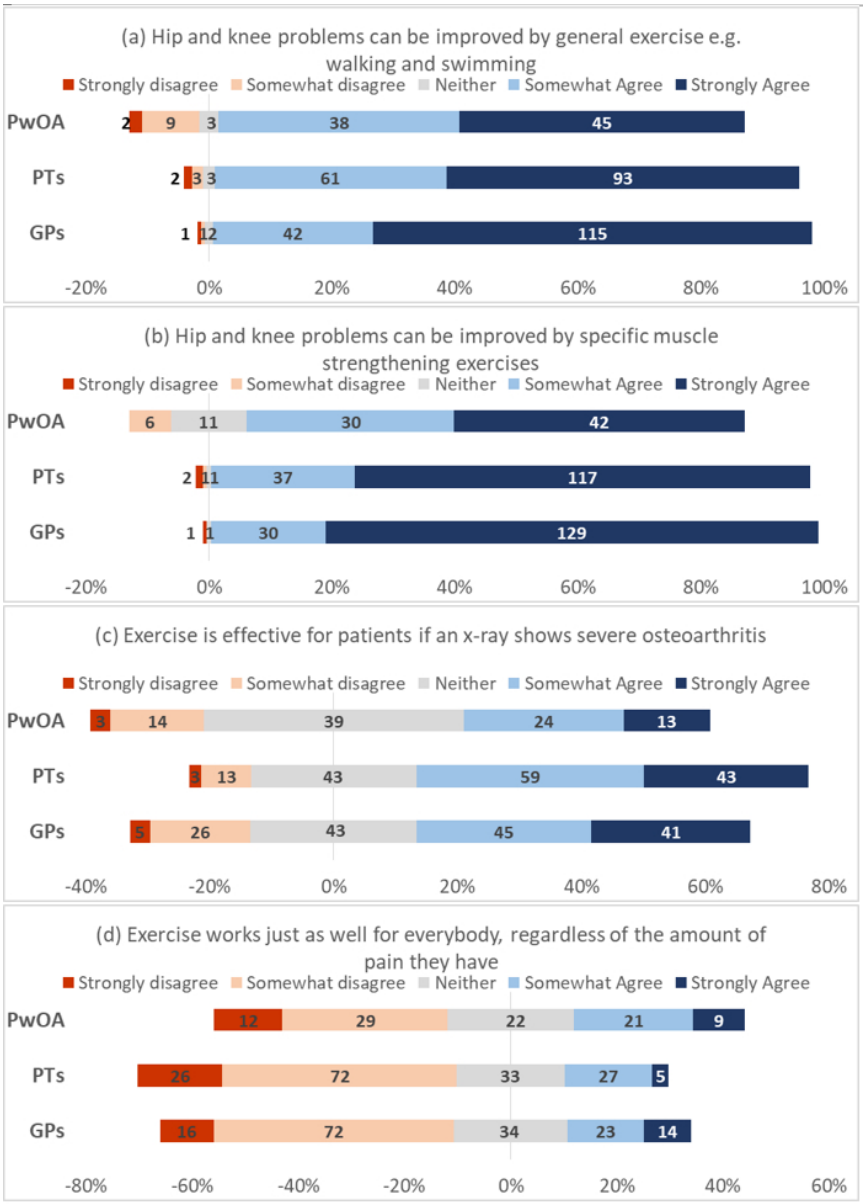
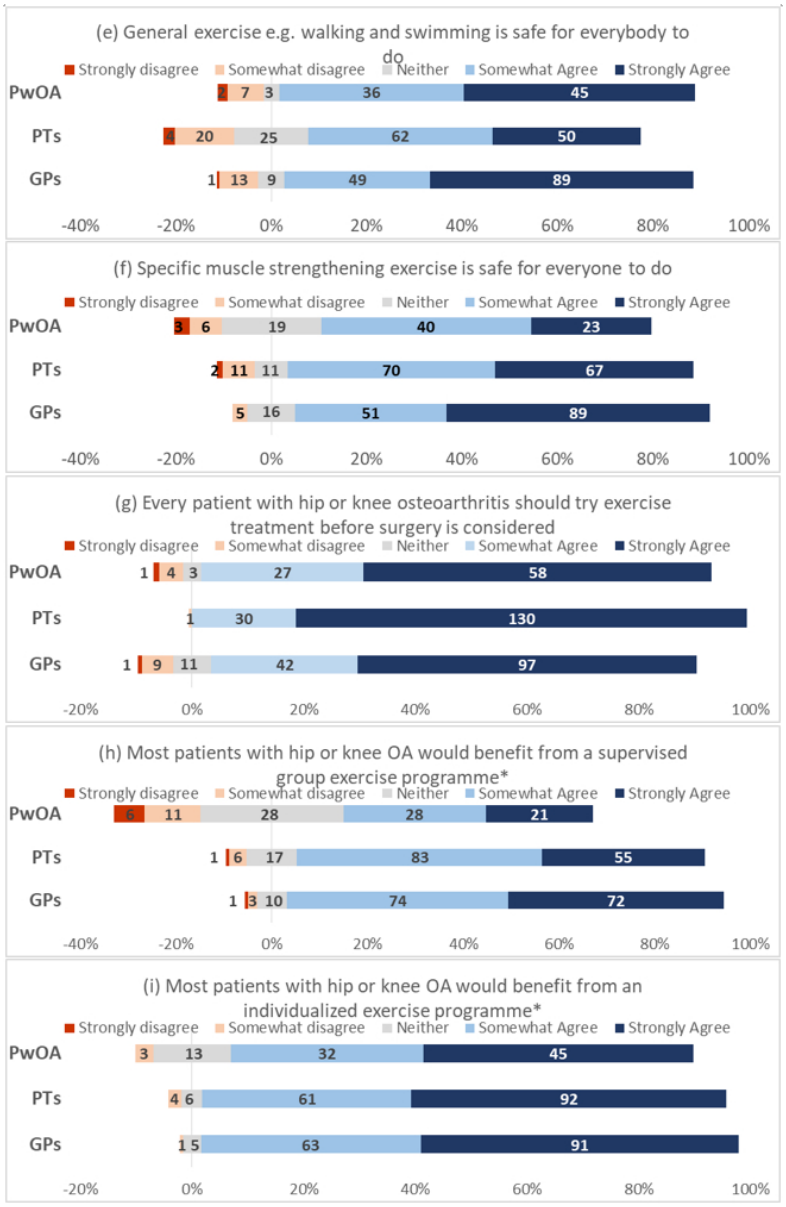


Figure 2. 100% stacked bar chart showing Likert scale results with count for each stakeholder on belief statements (a-d) related to exercise effectiveness. GP, general practitioner; PT, physiotherapist; PwOA, people with osteoarthritis.

377x526mm (47 x 47 DPI)



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354x545mm (47 x 47 DPI)

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Survey 1: Beliefs, Barriers and Enablers to Exercise Prescription for Hip and Knee Osteoarthritis in General Practice in Ireland

Instructions for completing this questionnaire

- When completing the questionnaire, please try and provide answers that most accurately reflect your usual clinical practice. There are no 'correct' or 'incorrect' answers.
- Please do not consult any literature while completing this questionnaire.

Section 1. Information about you

1. How long have you been qualified as a General Practitioner?
   ☐ Less than 5 years experience
   ☐ 5-10 years experience
   ☐ Greater than 10 years experience

2. How many GP's work in your practice (including yourself)
3. Are you: ☐ Female ☐ Male ☐Other ☐Prefer not to disclose
4. Is your primary practice: ☐ urban ☐ rural ☐ mixed
5. Is your practice:
   ☐ Primary care reimbursement scheme only
   ☐ Private practice only
   ☐ Mixed
6. Since graduating from University, do you remember receiving any specific postgraduate training in musculoskeletal (MSK) which contained education about hip or knee osteoarthritis or chronic pain? (By this we do not mean clinical placements or jobs in rheumatology or orthopaedics)
   ☐ Yes ☐ No
   If yes, what type of training?
   ☐ CME small groups (or guest speaker)
   ☐ Diploma in MSK
   ☐ M.Sc. in Sports & Exercise Medicine
   ☐ Sports Medicine Faculty conferences
   ☐ Private Hospital Day Course
   ☐ Therapeutic Intra Articular and Soft Tissue Injection and Assessment Course
   ☐ Specific Modules on MSK on your GP training Scheme
   ☐ Other _____

7. How would you rate your confidence in treating hip and knee osteoarthritis?
   ☐ Not confident
   ☐ Slightly confident
   ☐ Confident
   ☐ Very confident
   ☐ Extremely confident
8. Do you have, or have you ever suffered from chronic knee or hip pain yourself?
   ☐ Yes ☐ No
9. What percentage of your typical caseload is made up of patients with hip and/or knee pain?
   ☐1-5% ☐ 6-25% ☐ 26-50% ☐ 51-75% ☐ >75%

Section 2. Exercise beliefs for hip and knee osteoarthritis

2.1 Where do you get your knowledge of care advancements for persons with knee or hip osteoarthritis? (Tick all that apply)

☐ Published guidelines or recommendations (e.g. NICE, EULAR, OARSI)
☐ Reading medical journals
☐ Twitter or other social media
☐ Podcasts
☐ CME networks or other GP networks
☐ Conference attendance
☐ Course attendance

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Other _____

We are interested in your views about the role of exercise in the treatment of hip and knee osteoarthritis. Please indicate the extent to which you agree or disagree with the statements given by ticking or placing an 'X' in one box per row.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.2 Hip and knee problems are improved by general exercise e.g. walking and swimming					
2.3 Hip and knee problems are improved by specific muscle strengthening exercises					
2.4 General exercise e.g. walking and swimming is safe for everybody to do					
2.5 Specific muscle strengthening exercise is safe for everyone to do					
2.6 Every patient with hip or knee OA should try conservative exercise treatment before more invasive procedures are recommended					
2.7 Exercise for hip or knee OA is most beneficial when it is tailored to meet individual patient needs					
2.8 A standard set of exercises is sufficient for every patient with hip or knee OA					
2.9 Education on lifestyle change is important for patients with OA					
2.10 Education on strategies for self-management of pain are important for patients with OA					
2.11 It is important that people with OA increase their overall activity levels					
2.12 Exercise is effective for patients if an x-ray shows severe knee osteoarthritis					
2.13 Exercise for OA is more effectively provided by physiotherapists than GPs					
2.14 Time constraints prevent the provision of advice on individual exercises for OA					
2.15 Exercise for OA should preferably be used after drug treatment has been tried					
2.16 Exercise for chronic knee pain would be used more frequently if access to physiotherapy was easier					

Section 3. Clinical scenario of a patient with osteoarthritis

Presented below is a clinical scenario of a patient with suspected knee osteoarthritis who presents to you with this problem for the first time. All questions in this section relate to the care you would give this particular patient.

Patient:	Mrs. Murphy, 60-year old shop owner, no health insurance
Complaint:	Right sided knee pain
History:	Gradually worsening over 3 years
	No history of trauma
	Pain when walking and at rest, worst when climbing stairs.
	No night pain.
	Activities of daily living are manageable. Difficulty gardening.
	Finding work increasingly difficult due to the stairs
	Tried going to gym but stopped – thinks was making pain worse.
	Otherwise well – mild hypertension
	Has tried ibuprofen with no effect
Medication:	Amlodipine
Examination:	Mild Obesity with Body Mass Index of 33
	Knees – bilaterally no effusions.
	Joint line tenderness on palpation.
	No pain or reduced mobility around knee cap
	Slightly reduced flexion of the right knee.
	Hips – no abnormality detected

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

3.1 Select some **key words** you would use to describe their diagnosis **to the patient**. (Select all that apply)

☐ Mild ☐ Cartilage thinning ☐ Fear avoidance
☐ Moderate ☐ Overloading ☐ Pain sensitivity
☐ Severe ☐ Overweight ☐ Bone on bone
☐ Degeneration ☐ Deterioration ☐ Weakness
☐ Wear and tear ☐ Normal ageing ☐ Joint swelling
☐ Arthritis ☐ Joint damage Other _____

3.2 What investigation(s)/assessment(s), if any, would you do/order for this patient at this point

☐ None ☐ Knee x-ray ☐ Blood tests ☐ Other _____

3.3 At this consultation, what approaches would you use, or suggest, to manage this patient? (please tick all that apply)

☐ None ☐ Advice on footwear ☐ Exercise
☐ Ice ☐ General activity ☐ Injection of steroids
☐ Heat ☐ Provision of walking aid ☐ Oral NSAID
☐ Rest ☐ Weight Loss ☐ Topical NSAID
☐ Weak opioids ☐ Paracetemol ☐ Glucosamine/Chondroitin
☐ Other, please state _____

3.4 If you selected exercise above, what form would this take? (Select all that apply)

☐ Suggest general exercise and activity
☐ Suggest specific exercises
☐ Give a leaflet or online resource
☐ Refer to physiotherapy or other exercise specialist
☐ Other (please state) _____

3.5 In an ideal world without barriers, would you refer the patient to physiotherapy or orthopaedic consultant or neither, at this stage?

☐ Physiotherapy
☐ Orthopaedic consultant
☐ Neither

3.6 In your current practice, would you refer this patient to physiotherapy at this stage?

☐ Yes
☐ No

If yes, why? (Select all that apply)

☐ Deemed an appropriate candidate for supervised conservative treatment
☐ Ease of access to physiotherapy
☐ Lack of time to appropriately address exercise needs in practice
☐ Lack of response to NSAIDS
☐ Other _____

If no, why not? (Select all that apply)

☐ Not an appropriate candidate for conservative treatment
☐ Long waiting lists and poor access to physiotherapy
☐ Other interventions are a priority
☐ Exercise will make the pain worse
☐ Patient has tried exercise
☐ I would prefer to examine further therapeutic options first (e.g., develop a pain management plan or give an intra articular steroid injection)
☐ Other _____

3.7 In your current practice, would you refer this patient to an orthopaedic consultant at this stage?

☐ Yes
☐ No

If yes, why? (Select all that apply)

☐ Deemed an appropriate candidate for surgery right now

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Will likely need a joint replacement in a few years so put on waiting list now
☐ Need a specialist opinion
☐ Other _____

If no, why not? (Select all that apply)
☐ More conservative treatmenta have not been exhausted
☐ Symptoms not severe enough to warrant joint replacement
☐ Waiting list too long
☐ Other _____

3.8 Would you refer the patient to see someone else, either in the primary or community team or into secondary care, at this point?
☐ Yes
☐ No
If yes, who? _____

Section 4. Barriers and enablers to exercise prescription and referral in general practice

In your practice and experience of treating patients with osteoarthritis, what are the main barriers to exercise prescription or referral? (Please select all that apply)
☐ Insufficient time in consultation
☐ Insufficient expertise
☐ Uncertainty about the effects of exercise
☐ Uncertainty about the most appropriate exercise type
☐ Uncertainty about the safety of exercise
☐ Cost and accessibility of physiotherapy for patient
☐ Physiotherapy waiting lists are too long
☐ Lack of a standardized physiotherapy programme for OA in the region
☐ Patients prefer other management options
☐ Patients want an orthopaedic consultant referral
☐ English language barrier for patients
☐ Severity of disease (symptoms too mild)
☐ Severity of disease (symptoms too severe)
☐ Older age of patient
☐ Presence of many comorbidities
☐ Other _____

What enablers would help you to prescribe or refer a patient with osteoarthritis to exercise in your practice?

☐ Increased formal post-qualification education e.g. diploma or masters
☐ Increased post-qualification training e.g. workshops, videos
☐ Increased exercise education during GP training
☐ More consultation time to provide exercise prescription
☐ Shorter waiting lists and improved access to physiotherapy
☐ Presence of an evidence-based physiotherapy-supervised group exercise programme for osteoarthritis in the locality
☐ Patients who recognize the importance of strategies for self-management of pain using appropriate exercise recommendations
☐ Low cost community-based exercise programmes
☐ Renumeration for exercise prescription and follow up consultations
☐ Other _____

Thank you for taking the time to complete this questionnaire. Your time and participation is greatly appreciated.

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Survey 2: Beliefs, Barriers and Enablers to Group Exercise Programme Delivery for Hip and Knee Osteoarthritis in Physiotherapy Practice in Ireland

The questionnaire is divided into 3 sections and should take approximately **7 minutes** to complete.
Instructions for completing this questionnaire

- When completing the questionnaire, please try and provide answers that most accurately reflect your usual clinical practice. There are no 'correct' or 'incorrect' answers.
- Please do not consult any literature while completing this questionnaire.

Section 1. Information about you

1. How long have you been qualified as a Physiotherapist?
   ☐ Less than 5 years experience
   ☐ 5-10 years experience
   ☐ Greater than 10 years experience
2. How many Physiotherapists work in your clinic (including yourself) _____
3. Are you: ☐ Female ☐ Male ☐ Other ☐ Prefer not to disclose
4. Is your primary work setting:
   ☐ Public hospital
   ☐ Private hospital
   ☐ Primary, community and continuing care
   ☐ Private practice clinic
   ☐ Education
   ☐ Other (please state) _____
5. Have you undertaken any specific post-qualification training, which involved education about hip or knee osteoarthritis or chronic pain? (By this we do not mean clinical placements or jobs in rheumatology or orthopaedics) ☐ Yes ☐ No

If yes, what type of training? (Provide additional details if you wish to expand)

☐ In-service training Additional details _____
☐ M.Sc. (taught) in this/similar field Additional details _____
☐ M.Sc. (research) in this/similar field Additional details _____
☐ PhD in this/similar field Additional details _____
☐ Day, weekend or online course (please name most relevant)
_____
☐ Other _____

6. How would you rate your confidence in treating hip and knee osteoarthritis?
   ☐ Not confident
   ☐ Slightly confident
   ☐ Confident
   ☐ Very confident
   ☐ Extremely confident
7. Do you have, or have you ever suffered from chronic knee or hip pain yourself? ☐ Yes ☐ No
8. What percentage of your typical caseload is made up of patients with hip and/or knee osteoarthritis?
   ☐ 1-5% ☐ 6-25% ☐ 26-50% ☐ 51-75% ☐ >75%

Section 2. Exercise beliefs for hip and knee osteoarthritis

2.1 Where do you access your knowledge of management for persons with knee or hip osteoarthritis? (Tick all that apply)

☐ Published guidelines or recommendations (e.g. NICE, EULAR, OARSI)
☐ Clinic protocols, discussion with peers or in-services
☐ Reading published research articles
☐ Twitter or other social media
☐ Podcasts
☐Blogs
☐Infographics
☐Videos
☐ ISCP specialist groups and other network events
☐ Conference attendance
☐ Course attendance

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Other _____

Please now rank in order your preferred resources to learn from

We are interested in your views about the role of exercise in the treatment of hip and knee osteoarthritis. Please indicate the extent to which you agree or disagree with the statements given by ticking one box per row.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.2 Hip and knee problems are improved by general exercise e.g. walking and swimming					
2.3 Hip and knee problems are improved by specific muscle strengthening exercises					
2.4 Hip and knee problems are improved by focusing on motor or neuromuscular control of the joints during exercise					
2.5 General exercise e.g. walking and swimming is safe for most patients to do					
2.6 Specific muscle strengthening exercise is safe for most patients to do					
2.7 Neuromuscular control exercises are safe for most patients to do					
2.8 Every patient with hip or knee OA should try conservative exercise treatment before surgery is considered					
2.9 Exercise for hip or knee OA is most beneficial when it is tailored to meet individual patient needs					
2.10 A standard set of exercises with individual progression is sufficient for every patient with hip or knee OA					
2.11 Education on lifestyle change is important for patients with OA					
2.12 Education on strategies for self-management of pain are important for patients with OA					
2.13 It is important that people with OA increase their overall activity levels					
2.14 Exercise is effective for patients if an x-ray shows severe knee osteoarthritis					
2.15 Most patients with hip or knee OA would benefit from a supervised group exercise programme					
2.16 Most patients with hip or knee OA would benefit from an individualized exercise programme					

Section 3. Barriers and enablers to exercise programme delivery in physiotherapy practice

3.1 Please select the current level of government COVID19 restrictions in place as you are completing this survey

☐ Level 1 ☐ Level 2 ☐ Level ☐ Level 4 ☐ Level 5

3.2 **Pre-COVID19** restrictions in March 2020, were you or your clinic providing **group exercise classes** for patients with hip or knee osteoarthritis? ☐ Yes ☐ No

If Yes, what was the average number of classes per week? _____

If No, were you interested in offering group exercise classes for osteoarthritis in an ideal world and **if no barriers** existed?

☐ Yes

☐ No

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

3.3 **Pre-COVID19** restrictions in March 2020, **what** were the main **barriers** to providing group exercise programmes for patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Insufficient space and equipment resources
☐ Insufficient personnel (staff) resources
☐ Insufficient referrals or low OA caseload
☐ Patients want individualized programmes
☐ Patients prefer other management options e.g. manual therapy
☐ Insufficient expertise
☐ Uncertainty about the effects of exercise
☐ Uncertainty about the most appropriate exercise type
☐ Uncertainty about the safety of exercise
☐ Cost for patient
☐ Access for patient (e.g. travel, parking, time)
☐ Scheduling conflict related to patient working hours and clinic hours
☐ Lack of a standardised programme or protocol for exercise for OA
☐ English language barrier for patients
☐ Lack of support from colleagues or managers
☐ Other _____

3.4 Are you currently offering **group exercise classes** for patients with hip or knee osteoarthritis and **to what capacity**?

☐ Yes, face to face at full capacity
☐ Yes, face to face at reduced capacity compared to Pre-COVID19 restrictions
☐ Yes, online classes only
☐ Yes, combination of face-to-face and online
☐ No

3.5 **Under current restrictions**, are there any **additional barriers** to providing **face-to-face** group exercise programmes for patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Government restrictions currently do not allow for group classes
☐ Hospital or clinic protocols currently do not allow for group classes
☐ Patients do not want to attend clinic
☐ Not enough resources for adequate distancing for class members
☐ Sanitization procedures are too time consuming
☐ Own COVID-related safety concerns
☐ Other _____

3.6 **Under current restrictions**, are there any **additional barriers** to providing **online** group exercise programmes for patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Lack of IT resources in clinic (e.g. online platform, webcams, high speed Wi-Fi)
☐ Lack of personnel (staff) with IT knowledge
☐ Patients lack IT resources or knowledge
☐ Patients prefer to wait until they can access face-to-face treatment
☐ Uncertainty about the effectiveness of online group exercise
☐ Own personal preference
☐ Other _____

3.7 What **enablers** would help you to provide **face to face group exercise** classes to patients with osteoarthritis in your practice if COVID restrictions were not a factor? (Please select all that apply)

☐ None
☐ More university post-qualification education e.g. diploma or masters
☐ More other post-qualification training e.g. short courses, workshops, videos
☐ More education on group exercise delivery during physiotherapy training
☐ Appropriate referrals from GP or other sources
☐ GPs who impart knowledge regarding benefits of exercise to patients upon referral

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Resources to deliver quality educational material regarding self-management alongside exercise
☐ More support from colleagues or managers
☐ Other_____

3.8 What **enablers** would help you to provide an option of **online** group exercise classes to patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Improved IT infrastructure in clinic (e.g. laptops, webcams)
☐ IT skills resources for delivering online programmes (e.g. tutorials, do's and don'ts)
☐ Access to IT resources (e.g. tutorials) to provide patients with
☐ Improved Wi-Fi and bandwidth nationwide
☐ Strong evidence for effectiveness of existing online programmes
☐ An online registry allowing collection of patient outcomes pre- and post- programme
☐ Other _____

3.9 Would you be interested in receiving **training** (1.5 day workshop) to effectively implement and deliver a standardized, international, evidence-based group exercise and education programme with online and face-to-face options for patients with osteoarthritis in your clinic?

☐ Extremely interested
☐ Very interested
☐ Moderately interested
☐ Slightly interested
☐ Not at all interested
If not interested, why? _____

3.10 If interested, how much would you be willing to pay for this continuous professional development training?

☐ €100-150
☐ €151-200
☐ €201-250
☐ €251-300
☐ €301-350
☐ More than €350
☐ N/A

Thank you for taking the time to complete this questionnaire. Your time and participation is greatly appreciated.

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Survey 3: Survey on the Role of Exercise for Hip and Knee Osteoarthritis in Adults in Ireland

The questions below are divided into 3 sections. Please complete the questions to the best of your ability.

Section 1. Information about you

1. Are you: ☐ Female ☐ Male ☐ Other ☐ Prefer not to disclose
2. Which age category do you fall into?
   - ☐ 30 to 39 years
   - ☐ 40 to 49 years
   - ☐ 50 to 59 years
   - ☐ 60 to 69 years
   - ☐ 70 to 79 years
   - ☐ 80 to 89 years
   - ☐ 90 years or older
3. Which province in Ireland do you reside in? ☐ Munster ☐ Ulster ☐ Connacht ☐ Leinster

****If "Ulster" is selected, question 3(b) will appear.**

3(b) Do you access your healthcare in:
- ☐Northern Ireland (NHS)
- ☐Republic of Ireland (HSE)
- ☐A combination of both

4. Which of the following best describes where you live?
   - ☐ Inner city
   - ☐ Suburb of a city
   - ☐ Town
   - ☐ Village
   - ☐ Open country
   - ☐ Island off Ireland
5. Have you ever been told by a health professional that you have a diagnosis of the following?(Select all that apply)

☐ Arthritis	☐ Diabetes Mellitus (type 1 or 2)
☐ Osteoarthritis	☐ Kidney or liver disease
☐ Wear and tear	☐ Anemia (reduced number of red blood cells)
☐ Degenerative changes	☐ Other blood disease
☐ Rheumatoid arthritis	☐ Cancer
☐ Hypertension	☐ Depression
☐ Heart Disease	☐ Anxiety
☐ Ulcer or other bowel diseases	☐ Other mental health disorder
☐ Neurological disease e.g. Parkinson's/MS	
☐ Respiratory diseases e.g. COPD	☐ Thyroid Disease
☐ Hemochromatosis	☐ Fibromyalgia
☐ Other health condition _____	

6. Have you had pain and joint symptoms in any of the following joints for **6 months or more** (select all that apply)

☐Right Knee	☐Left Knee
☐Right Hip	☐Left Hip
☐Right Ankle	☐Left Ankle
☐Right Shoulder	☐Left Shoulder
☐Right Elbow	☐Left Elbow
☐Right Wrist	☐Left Wrist
☐Right Hand/Fingers	☐Left Hand/Fingers
☐Lower Back	☐Other, please describe_____
☐Mid Back	
☐Neck	

7. Have you ever had joint replacement surgery for any of your painful joints? Please select below the joints that have been replaced.

☐Right Knee	☐Left Knee
☐Right Hip	☐Left Hip
☐Right Ankle	☐Left Ankle
☐Right Shoulder	☐Left Shoulder

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐Right Elbow ☐Left Elbow
☐Right Wrist ☐Left Wrist
☐Right Hand/Fingers ☐Left Hand/Fingers
☐Other, please describe_____

8. Of your hip and/or knee joints that have **NOT** been replaced, which joint are you most bothered by? (select one)

☐Right Knee ☐Left Knee
☐Right Hip ☐Left Hip

All remaining questions will now be related to the joint that you have chosen.

9. How long have you been experiencing pain in your [insert chosen joint]?
   - ☐ 6 months – 1 year
   - ☐ 1 – 2 years
   - ☐ 2 – 3 years
   - ☐ 3 – 4 years
   - ☐ 4 – 5 years
   - ☐ More than 5 years
10. Have you seen or spoken to your GP about your painful [insert chosen joint]? ☐Yes ☐No
11. Have you ever had an x-ray of your [insert chosen joint]? ☐ Yes ☐ No
12. Has your GP ever referred you to an **orthopaedic consultant** for your [insert chosen joint]?
    - ☐ Yes
    - ☐ No
    - ☐ Currently on a waiting list (private consultant referral)
    - ☐ Currently on a waiting list (public consultant referral)

** If on a waiting list, how long have you been waiting?

- ☐ Less than 6 months
- ☐ 6 months – 1 year
- ☐ 1 year – 1.5 years
- ☐ 1.5 years – 2 years
- ☐ More than 2 years

13. Has your GP ever referred you to a **physiotherapist** for your [insert chosen joint]?
    - ☐ Yes
    - ☐ No
    - ☐ Currently on a waiting list (private consultant referral)
    - ☐ Currently on a waiting list (public consultant referral)

    * If on a waiting list, how long have you been waiting?

    - ☐ Less than 6 months
    - ☐ 6 months – 1 year
    - ☐ 1 year – 1.5 years
    - ☐ 1.5 years – 2 years
    - ☐ More than 2 years
14. How would you rate the pain and symptoms you are experiencing in your hip and/or knee on an average day?
    - ☐ No pain or symptoms
    - ☐ Mild pain and symptoms
    - ☐ Moderate pain and symptoms
    - ☐ Severe pain and symptoms
15. Have you EVER tried any of the following specifically for your [insert chosen joint]?

Muscle strengthening exercise (e.g. using weight/resistance band)	☐No, never	☐Yes, currently using	☐Yes, stopped using
Aerobic exercise (e.g. cycling, walking, fitness class)	☐No, never	☐Yes, currently using	☐Yes, stopped using
Information/Education course (e.g. self-management programme)	☐No, never	☐Yes, currently using	☐Yes, stopped using
Making efforts to lose weight	☐No, never	☐Yes, currently using	☐Yes, stopped using

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Section 2. Exercise beliefs for hip and knee osteoarthritis

We are interested in your views about the role of exercise in the treatment of hip and knee osteoarthritis. Please indicate how much you agree or disagree with the statements given by selecting one option per question.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.1 Hip and knee problems can be improved by general exercise e.g. walking and swimming					
2.2 Hip and knee problems can be improved by specific muscle strengthening exercises					
2.3 General exercise e.g. walking and swimming is safe for everybody to do					
2.4 Specific muscle strengthening exercise is safe for everyone to do					
2.5 Every patient with hip or knee osteoarthritis should try exercise treatment before surgery is considered					
2.6 Patients should learn more about how to self-manage their pain and symptoms using exercise and physical activity					
2.7 The best way to learn about exercise is in a supervised group setting with people who have similar pain (Pre-COVID-19 restrictions)					
2.8 The best way to learn about exercise is in a one-on-one setting with a health professional (Pre-COVID-19 restrictions)					
2.9 Exercise is effective for patients if an x-ray shows severe knee osteoarthritis					
2.10 Exercise works just as well for everybody, regardless of the amount of pain they have					

Section 3. Barriers and enablers to exercise for hip and knee osteoarthritis

In this section we want to know more about your exercise experience and what kinds of things would prevent you or help you do more exercise

3.1 How many times a week do you exercise (e.g. 30 minute walk)?

☐ 3 or more days per week
☐ Less than 3 days per week
☐ I don't exercise

3.2 Has a health professional ever given you specific exercises for your [insert chosen joint]?

☐ Yes
☐ No
☐ Not sure

*If Yes, what type of health professional? (select all that apply)

☐ Physiotherapist
☐ GP
☐ Orthopaedic surgeon
☐ Nurse
☐ Personal trainer
☐ Other, please name _____

*If Yes, what type of exercise?

☐ Home-based individual exercises
☐ Group exercise class for osteoarthritis
☐ Other, please state _____

*If Yes, did you find the exercise beneficial?

☐ Yes
☐ No
☐ Not sure

3.3 Please select the current level of government COVID19 restrictions in place as you are completing this survey

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Level 1 ☐ Level 2 ☐ Level ☐ Level 4 ☐ Level 5 (strictest restrictions)

3.4 Thinking about life **without COVID19** restrictions, **what** are the main **barriers** that would prevent you from exercising? (Please select all that apply)

☐ Pain or other joint symptoms
☐ I need assistance for mobility e.g. walking stick, wheelchair
☐ Finding time to exercise
☐ Lack of enjoyment from exercise
☐ Lack of exercise buddy or support network
☐ Wet or cold weather
☐ Other health problems
☐ Other disability e.g. visual impairment
☐ Cost of a gym membership or physiotherapy visit
☐ Cost of active wear or equipment
☐ I don't know the best types of exercise to do
☐ I don't know who to contact to learn more or do more exercise
☐ Uncertainty about the safety of exercise for joint pain
☐ Uncertainty about the benefit of exercise for joint pain
☐ Negative body image
☐ Access to facilities (e.g. availability, travel, parking)
☐ Work commitments
☐ Family commitments or other responsibilities
☐ Age
☐ Fear of injury
☐ Tiredness and fatigue
☐ Depression
☐ Other _____

3.5 Thinking about life **without COVID19** restrictions, what types of things would **help you to exercise more**? (Please select all that apply)

☐ Better knowledge of the best type of exercise to do
☐ Access to exercise that is supervised by a health professional
☐ Social aspect e.g. group exercise with other people with hip or knee pain
☐ More confidence in your joint
☐ Exercise recommendations from a GP
☐ Exercise recommendations from a physiotherapist
☐ More support from family or friends
☐ Warm and dry weather for outdoor exercise
☐ Low cost community exercise programmes
☐ Safe exercise environment (e.g. well-lit pathways)
☐ Other_____

3.6 Thinking about life **without COVID-19,** how interested would you be in attending a 6-week, twice per week, physiotherapy-supervised group exercise and education class for your hip or knee pain **at a clinic or community centre**?

☐ Extremely interested
☐ Very interested
☐ Moderately interested
☐ Slightly interested
☐ Not at all interested

If not interested, why? _____

3.7 Thinking about **current restrictions**, how interested would you be in taking part in a 6-week, twice per week, **ONLINE** physiotherapy-supervised group exercise and education class for you hip or knee pain?

☐ Extremely interested
☐ Very interested
☐ Moderately interested
☐ Slightly interested

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Not at all interested

If not interested, why? _____

3.8 Do you have any experience with online-delivered healthcare or telerehabilitation from a GP or other health professional?

☐Yes

☐ No

3.9 What are the **barriers** that would prevent you taking part in an **online exercise** class? (Please select all that apply)

☐ Lack of technology equipment (e.g. laptop, smartphone or tablet, webcams)

☐ Lack of confidence in using computers, laptops etc.

☐ Wi-Fi / Broadband connection is not good enough

☐ Preference to wait until I can access face-to-face treatment

☐ Uncertain about how online group exercise would work

☐ Lack of space in home environment to perform exercises

☐ English language barriers

☐ Lack of time to take part

☐ Other _____

3.10 What would **help you** to take part in an **online** group exercise class with other people with osteoarthritis? (Please select all that apply)

☐ An initial one-to-one session with a physiotherapist to get familiar with the process

☐ Resources (e.g. videos) with explanations of how to get started

☐ Improved Wi-Fi and bandwidth

☐ Examples and testimonials from patients who have finished the classes

☐ Opportunities to chat online with other patients before and after the class

☐ Support from family members to get set up in your home

☐ A laptop or tablet

☐ Other _____

3.11 If interested, how much would you be willing to pay to take part in these exercise classes (price in euros for entire 14-15 session programme)?

☐ €0-25

☐ €26-50

☐ €51-100

☐ €101-150

☐ €151-200

☐ > €200

Thank you for taking the time to complete this questionnaire. Your time and participation is greatly appreciated.

Supplemental File 2

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Supplemental Table: Multivariable linear regression models to determine if positive beliefs about exercise in PwOA are associated with (1) referral to physiotherapist by a GP and (2) if they have seen a physiotherapist for their joint pain.

Dependent Variable: Number of exercise belief statements agreed with								
Variables Model 1 [a]	**B**	**S.E.**	**Partial Correlation**	**VIF**	**Sig.**	**Exp(B)**	**95% CI for EXP(B) Lower**	**Upper**
Has your GP ever referred you to a physiotherapist for your painful joint?	0.457	0.406	0.129	1.01	0.264	0.120	-0.352	1.267
Sex	-1.011	0.502	-0.227	1.009	0.048	-0.215	-2.011	-0.011
Number of comorbidities	-0.361	0.128	0.309	1.009	0.006	-0.300	-0.616	-0.106
Constant	7.772	0.686	-	-	0.000	-	6.405	9.138
Model 2 [b]								
Have you seen a physiotherapist for your painful joint?	1.060	0.383	0.288	1.138	0.007	0.287	0.299	1.821
Sex	-0.723	0.362	-0.212	1.003	0.049	-0.194	-1.444	-0.003
How long have you been experiencing pain in your joint?	-0.204	0.099	-0.219	1.163	0.042	-0.216	-0.400	-0.008
Number of comorbidities	-0.293	0.119	-0.257	1.026	0.016	-0.241	-0.530	-0.055
Constant	7.680	0.585	-	-	0.000	-	6.034	9.653

[a]Model variables removed due to non-significance (1): *How long have you been experiencing pain in your joint?*, *How would you rate the pain and symptoms you are experiencing in your hip and/or knee on an average day?*.
[b]Model variables removed due to non-significance (2): *How would you rate the pain and symptoms you are experiencing in your hip and/or knee on an average day?.* B, beta coefficient; GP, general practitioner; OA, osteoarthritis; PT, physiotherapist; PwOA, people with osteoarthritis; S.E., standard error; VIF, variance inflation factor.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4-5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4-5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*5-7*
Bias	9	Describe any efforts to address potential sources of bias	n/a
Study size	10	Explain how the study size was arrived at	n/a
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	6-7
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6-7
		(*e*) Describe any sensitivity analyses	n/a
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1

Outcome data	15*	Report numbers of outcome events or summary measures	Page 7, Figure 1-3
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 3
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	14-15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16,17
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Guideline-based exercise management for hip and knee osteoarthritis: a cross-sectional comparison of healthcare professional and patient beliefs in Ireland.

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Guideline-based exercise management for hip and knee osteoarthritis: a cross-sectional comparison of healthcare professional and patient beliefs in Ireland.

ABSTRACT

Objectives: To identify within-stakeholder agreement and between-stakeholder differences in beliefs regarding exercise for osteoarthritis among general practitioners (GPs), physiotherapists (PTs) and people with hip and knee osteoarthritis (PwOA). A secondary objective was to explore the association between referral patterns and beliefs of PwOA.

Design: Cross-sectional

Setting: Online surveys administered to GPs, PTs and PwOA in Ireland via social media and healthcare networks.

Participants: 421 valid responses (n=161 GPs, n=163 PTs, n=97 PwOA).

Primary and secondary outcome measures: Nine beliefs statements related to exercise effectiveness, safety and delivery were rated on a 5-point Likert scale and analysed for within-stakeholder consensus. Chi-square tests assessed differences in agreement between groups. Multivariable linear regression models tested associations between beliefs in PwOA and referral to/attendance at physiotherapy.

Results: Positive within-stakeholder consensus (>75% agreement) was reached for most statements (7/9 GPs, 6/9 PTs, 5/9 PwOA). However, beliefs of PwOA were significantly less positive compared to healthcare professionals for six statements. All stakeholders disagreed that exercise is effective regardless of the level of pain. Attendance at physiotherapy (49% of PwOA), rather than referral to physiotherapy from a GP only, was associated with positive exercise beliefs for PwOA [β=0.287 (95% CI 0.299, 1.821)].

Conclusions: Beliefs about exercise therapy for osteoarthritis are predominantly positive across all stakeholders, albeit less positive in PwOA. PwOA are more likely to have positive beliefs if they have seen a physiotherapist for their osteoarthritis. Knowledge translation should highlight the effectiveness of exercise for all levels of pain and osteoarthritis disease.

Strengths and Limitations

- Differences in beliefs about exercise between healthcare professionals and patients with osteoarthritis has not previously been examined.

- This study also explored how healthcare professional visits may influence beliefs about effectiveness of evidence-based care.
- This was a cross-sectional study so no inferences can be made.
- Different results with respect to beliefs and influences may have been found if non-online recruitment methods were available (e.g. paper surveys in healthcare settings).

INTRODUCTION

The management of hip and knee osteoarthritis (OA), as for other chronic conditions, should be determined by best available evidence. Although there is no cure for this burdensome disease, healthcare professionals in this field have for a long time had a wealth of high-quality evidence to draw from, all pointing to optimal core clinical management that consists of land-based exercise, education and weight loss if appropriate[1,2]. Despite this, implementation of these guidelines in practice is not optimal, often resulting in care that is fragmented in nature or considered low-value [3]. A global meta-analysis involving 16,103 people with OA (PwOA) in community care, revealed that only 39% received a referral or recommendation to exercise,[4] while a UK-based survey in 2018 revealed that only 3.9% of the 502 respondents with an OA diagnosis, were using exercise as part of their management[5]. Some similarities in shortcomings to implementation of guidelines for musculoskeletal health have been identified globally[6].

Alongside use of best evidence, the provision of patient-centred care is a pillar of high-quality care that should help guide treatment for PwOA[7]. Literature and expert opinion recommendations state that it is important to assess patient ideas and concerns regarding the cause and management of their pain, and to take into account their expectations and preferences for treatment[7]. Regarding exercise, researchers have identified a considerable amount of uncertainty among PwOA regarding the benefits of exercise for their pain. Results from cross-sectional surveys and semi-structured interviews have indicated that a lack of knowledge on the condition may result in patients believing that surgery is their only option[8,9]. Furthermore, a view of OA as a “wear and tear” condition was associated with the perspective that exercise was a counterintuitive treatment[8–10]. Since it is widely understood that beliefs influence health-related behaviours [11,12], and because stronger recommendations for exercise have been made since previous publications[2,5,9], an updated understanding of how PwOA view exercise is required.

Healthcare professionals’ perceptions and beliefs will affect the advice and management they offer patients, and researchers have suggested that those with biomedical or biomechanical beliefs about OA may transfer these beliefs to their patients, thus affecting their treatment choices[13,14]. Currently, general practitioners (GPs) and physiotherapists (PTs) are considered among the core care providers for PwOA[15]. While PT’s have the knowledge and skills to adopt a key role in the management of hip and knee OA, GPs remain the most frequently accessed source of formal medical advice and treatment[15,16]. The language used by healthcare professionals, especially GPs, can have a profound influence on patients’ beliefs[17,18]. A systematic review from Cottrell et al [19] in 2010,

found that the attitudes and beliefs of GPs concerning exercise and chronic knee pain varied widely. An updated UK-based survey of GPs in 2017 found that perspectives were positive, with 87% reporting the use of exercise in their practice [16]. However, only 11% reported using exercise in ways that aligned with evidence-based guidelines [16]. This demonstrates the need for a better understanding of how GPs interact with up-to-date resources for care advancements for OA, in a time-demanding profession.

A scoping review of qualitative research exploring attitudes and beliefs, shows that PTs generally have a positive attitude to activity and exercise in OA management, despite indications that some PTs may also be lacking up-to-date knowledge about best practice or may not be adhering to evidence-based treatments[20]. In contrast, a recent mixed-methods evaluation by Barton et al [21] in 2021 reported that awareness regarding evidence supporting exercise for knee OA was good (89–96%) amongst PTs in Australia and Canada.

Greater knowledge around beliefs and belief influencers are needed in order to address negative beliefs or myths associated with exercise and joint pain. The objective of this study was to identify within-stakeholder agreement and between-stakeholder differences in beliefs in relation to statements on exercise for management of hip and knee OA in PwOA, GPs and PTs. Secondary objectives were to explore any associations between beliefs of PwOA and whether they had ever received a GP referral to physiotherapy or had seen a PT for their painful joint. Based on previous work [9,13,16], it was hypothesised that exercise beliefs of PTs would be more positive, and in line with clinical guidelines and latest evidence, compared to GPs and PwOA. It was also hypothesised that PwOA who had received a physiotherapy referral from their GP, or who had seen a PT for their condition would have more positive beliefs about exercise compared to those who had not. Finally, an exploration of common sources of education for GPs and PTs was included to understand how beliefs regarding evidence are influenced.

METHODS

Design and Recruitment

This study incorporates an analysis of three cross-sectional online surveys administered to three stakeholder groups - GPs, PTs and PwOA – in Ireland between March and September 2021. This cross-sectional study is embedded in a larger study (IMPACT – Implementation of osteoarthritis clinical guidelines together)[22], that aims to co-design and evaluate implementation strategies for an exercise and education programme for PwOA in Ireland. Surveys were adapted from previous studies in this field [9,13,16] and reviewed by co-researchers of a public and patient involvement (PPI) steering committee of representative stakeholders prior to distribution. Validation consisted of a round of pre-testing with a

convenience sample of three of each GPs, PTs and PwOA with feedback provided on readability, acceptability and appropriateness that was incorporated before distribution. Qualtrics© software (Qualtrics, Provo, UT) was used to administer the online surveys and all procedures were approved by the University of Limerick Faculty of Education & Health Sciences Research Ethics Committee (REC) (2020_12_13_EHS) and the Irish College of General Practitioners REC (ICGP_REC_21_0006). Surveys were completed anonymously after participants were provided with a participant information sheet and consent was implied by completion of the survey. Reporting is consistent with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies.

The PT survey was distributed via email invite to all members of the Irish Society of Chartered Physiotherapists (n=2022), working across all fields. The survey was also advertised via social media (Twitter, LinkedIn) and amongst networks of researchers and PPI steering committee members. Physiotherapists were eligible for inclusion if they: (1) were practicing in Ireland, and (2) treated a patient with hip or knee OA in the past six months. The GP survey was distributed to the Irish College of General Practitioners network (n=3152), the University of Limerick Education and Research Network for General Practice (ULEARN-GP) network[23] (n=140) and via social media (Twitter, LinkedIn). GPs were eligible to take part if they were currently treating patients with hip and/or knee pain in Ireland. The survey for PwOA was advertised via social media (Twitter, LinkedIn), Arthritis Ireland social media, News Rheum patient newsletter and colleagues and networks of project steering committee and research team members. PwOA were eligible to take part if they (1) were living on the island of Ireland, (2) at least 30 years of age, (3) had chronic hip or knee pain for at least 6 months or more, and (4) did not have joint replacement surgery on at least one of the painful hips or knees. Strategies to increase recruitment via social media across all three surveys were adopted including tagging specific advocacy groups, patient or professional organisations and influencers, providing visual infographics alongside social media posts and aligning posts with events e.g. National Arthritis Day.

Outcomes

Each survey (Supplementary file 1) included an initial set of questions related to participant demographics. For healthcare professionals, these included questions on sex [are you: (1) Male, (2) Female, (3) Prefer not to say], length of time qualified, work setting, details of specific post-qualification training related to OA/chronic pain, confidence in treating hip and knee OA, percentage of typical caseload with hip or knee OA and where they prefer to access knowledge of management for persons with hip or knee OA. For PwOA, demographic information related to sex [are you: (1) Male, (2) Female, (3) Prefer not to say],

age category, geographical area and health conditions were asked. In relation to joint pain, questions regarding location, duration, severity, referrals to exercise, and use of clinical guideline specific treatments (muscle strengthening, aerobic exercise, education, weight loss) were asked. Additional questions were provided for PwOA to understand healthcare utilisation and previous experiences with exercise.

In each survey, a list of statements on exercise beliefs for hip and knee OA were provided and were rated on a 5-point Likert scale from strongly agree to strongly disagree. The belief statements were intended to align with current evidence-based guidelines[1,2] and best practice for exercise and OA. Healthcare professionals were given a more extensive list of statements that were related to exercise type or referral decisions. A final section related to barriers and enablers to exercise delivery, referral or uptake was included in each survey. Results of that analysis are presented elsewhere.

Statistical Analysis

Demographic outcomes were summarised as counts/proportions as appropriate. Belief statements were grouped and summarised descriptively by theme i.e., exercise type and effectiveness, exercise safety and exercise delivery. Although some statements had slightly different wording to facilitate understanding and relevance to each group, there were nine statements that were deemed to be comparable across groups and used to analyse differences in beliefs. Responses for the 5-point Likert scale statements were collapsed to a binary scale to label positive beliefs (“strongly agree” or “somewhat agree”) vs. negative beliefs (“strongly disagree”, “somewhat disagree” or “neither”). “Neither” was included with negative beliefs since statements were deemed to align somewhat with best practice and anything short of agreement may be considered unsatisfactory knowledge translation or personal experience. A commonly defined cut-off for consensus (>75%)[24] between stakeholders was used. Chi-square (2 x 3) tests of independence were used to assess differences in agreement with statements between three groups, and Bonferroni adjustment for between-group differences ($p<0.05$). Multivariable linear regression was used to explore associations between exercise beliefs (number of statements agreed with (range 0-9)) in PwOA and (1) physiotherapy referral from their GP *(Has your GP ever referred you to a physiotherapist for your painful joint? Yes/No)*, and (2) physiotherapy attendance *(Have you seen a physiotherapist for your painful joint? Yes/No).* Histograms, Kolmogorov-Smirnov tests and scatter plots of residuals vs. fitted values were used to test assumptions of Poisson and linear regression and linear regression was deemed more appropriate. Pearson correlation coefficients ($r>0.5$) and variance inflation factor (>5) were used to determine presence of collinearity between variables. Based on correlates of physical activity for hip

and knee OA from previous literature, the following covariates were included using an enter method in each model: sex[25], average pain rating (none/mild/moderate/severe)[25], pain duration (6 months-1 year /1-2 years /2-3 years /3-4 years /4+ years)[26] and number of comorbidities[25]. The most parsimonious models were reported checking for a 10% difference in beta coefficients upon removal of covariates ($p>0.05$). Data were analysed using IBM-SPSS version 26.0.0 and Microsoft Excel365.

Patient and public involvement

This research was conducted as part of a larger project (IMPACT) that uses a participatory health research approach. A steering committee of key stakeholders with relevant research, clinical/system expertise or lived experience (academics, people with arthritis, patient advocacy group members, physiotherapists, GPs, orthopaedic surgeon) have oversight of the project from inception to dissemination. Members of the committee were involved in designing the research question and outcome measures for these surveys, recruitment of participants, interpretation of analyses and dissemination as co-authors of the publication.

RESULTS

There was a total of 421 valid responses from the three distributed surveys, comprising 161 GPs, 163 PTs and 97 PwOA. An additional 26 GP, 33 PT and 15 PwOA surveys were collected but were not fully completed or did not contain sufficient data for analysis so were excluded. Demographic data for each stakeholder are presented in **Table 1**.

Experiences with Exercise for People with Osteoarthritis

Of the 97 PwOA, 78.4% (n=76) had spoken to their GP regarding their joint pain, 63.9% (n=62) had an X-ray of their joint. 38.5% (n=37) had been referred to physiotherapy by their GP and 48.5% (n=47) had seen a physiotherapist for their joint (either through GP- or self-referral). Additionally, 50.5% (n=49) reported having been given specific exercises for their joint by any healthcare professional. A flow diagram with breakdown of these referral patterns is displayed in **Figure 1**. **Figure 2** shows answers to questions regarding the types of treatments tried by PwOA, as per clinical guideline recommendations (aerobic exercise, strengthening exercise, education and weight management).

Within-Stakeholder Agreement in Beliefs about Exercise Type and Effectiveness, Exercise Safety and Delivery

Figure 3 shows the Likert scale results in each stakeholder group for statements (a-d), related to the effectiveness of different types of exercise and for different levels of pain or perceived severity. **Figure 4** shows the Likert scale results in each stakeholder group for

statements (e-i), related to the safety and delivery of different types of exercise for people with OA. Beliefs were predominantly positive amongst GP's [positive consensus (>75% agreement) on 7/9 statements], PTs (6/9 statements) and PwOA (5/9 statements).

Between-Stakeholder Differences in Beliefs about Exercise Type and Effectiveness, Exercise Safety and Delivery

Results of chi-square tests for differences in agreement between stakeholders across beliefs statements are presented in **Table 2**. There were differences in stakeholder responses across all statements, except for statement (d): *"Exercise works just as well for everybody, regardless of the amount of pain they have"* (X^2 = 5.14, p=0.076). All three stakeholder groups reached a negative consensus regarding this statement. In six of the eight statements where differences were observed, patient beliefs were significantly different to healthcare professional beliefs. There were two statements with a medium effect size for differences between PwOA and service providers: statements *(b) "Hip and knee problems can be improved by specific muscle strengthening exercises"* (*V*=0.309) and *(h) "Most patients with hip or knee OA would benefit from a supervised group exercise programme"* (*V*=0.384). All other differences had a small effect size.

Table 1. Descriptive statistics using count (proportions) for healthcare professionals and people with osteoarthritis demographics

Healthcare Professionals Demographics	GP (n=161) Count (%)	PT (n=163) Count (%)	People with Hip or Knee Osteoarthritis Demographics	PwOA N=97 Count (%)
Sex:			**Sex:**	
Female	88 (54.7)	128 (78.5)	Female	76 (78.4)
Male	72 (44.7)	34 (20.9)	Male	20 (20.6)
Prefer not to say	1 (0.6)	1 (0.6)	Prefer not to say	1 (1.0)
How long have you been qualified?			**Most bothersome joint:**	
Less than 5 years	33 (20.5)	19 (11.7)	Knee	52 (53.8)
5-10 years	25 (15.5)	21 (12.9)	Hip	45 (46.4)
More than 10 years	103 (64.0)	123 (75.5)	**Age Category:**	
Work practice setting (GPs)			30-39 years	12 (12.4)
Urban	60 (37.3)	-	40-49 years	24 (24.7)
Rural	34 (21.1)	-	50-59 years	30 (30.9)
Mixed	67 (41.6)	-	60-69 years	25 (25.8)
Work practice setting (PTs)			70-79 years	6 (6.2)
Public hospital	-	38 (23.3)	**Living Location:**	
Private hospital	-	7 (4.3)	Inner city or suburb	46 (47.4)
Primary care	-	41 (25.2)	Town	16 (16.5)
Private practice clinic	-	70 (42.9)	Village	15 (15.5)
Other	-	7 (4.3)	Open country	20 (20.6)
Post-qualification training on OA / chronic pain			**No. of other comorbidities:**	
No	72 (44.7)	37 (22.7)	0	31 (32.0)

Inservice/webinars/reading	32 (19.9)	17 (10.4)		1-2	45 (47.9)
Course or conference	28 (17.4)	72 (44.2)		3+	18 (19.1)
Diploma/APP or certification	15 (9.3)	3 (1.8)		**Multi-joint pain(>1):**	
MSc in related field	14 (8.7)	32 (19.6)		No	6 (6.2)
PhD in related field	0	2 (1.2)		Yes	91 (93.8)
Confidence in treating hip and knee OA				**Rating of pain /symptoms on an average day**	
Not confident	2 (1.2)	0		No pain/symptoms	1 (1.0)
Slightly confident	33 (20.5)	5 (3.1)		Mild	30 (30.9)
Confident	80 (49.7)	41 (25.2)		Moderate	49 (50.5)
Very confident	36 (22.4)	86 (52.8)		Severe	17 (17.5)
Extremely confident	10 (6.2)	31 (19.0)			
% of typical caseload with hip/knee OA				**Duration of pain**	
1-5%	19 (11.8)	19 (11.7)		6 mon – 1 year	24 (24.7)
6-25%	117 (72.7)	83 (50.9)		1-2 years	13 (13.4)
26-50%	24 (14.9)	36 (22.1)		2-3 years	15 (15.5)
51-75%	1 (0.6)	18 (11.0)		3-4 years	11 (11.3)
>75%	0	5 (3.1)		More than 4 years	34 (35.1)

APP, Advanced Practice Physiotherapist; GP, General Practitioner; OA, Osteoarthritis; PT, Physiotherapist; PwOA, People with Osteoarthritis.

Table 2. Differences in agreement with statements between general practitioner (GP; n=161), physiotherapist (PT; n=163) and people with hip and knee osteoarthritis (PwOA; n=97). Agreement was defined as those who selected "strongly agree" or "somewhat agree" on Likert scales. Proportions that reached within-stakeholder "consensus", defined as >75% majority, are in bold.

Statement	Proportion in agreement			Chi-Square	Significance	Cramer's V
	GP	PT	PwOA			
(a) Hip and knee problems can be improved by general exercise e.g. walking and swimming	**97.5%**	**95.1%**	**85.6%[a]**	15.59	<0.0001	0.193
(b) Hip and knee problems can be improved by specific muscle strengthening exercises	**98.8%**	**97.5%**	**80.9%[a]**	39.04	<0.0001	0.309
(c) Exercise is effective for patients if an x-ray shows severe osteoarthritis	53.8%	63.4%	39.8%[c]	13.24	0.001	0.179
(d) Exercise works just as well for everybody, regardless of the amount of pain they have	**24.2%**	**19.6%**	32.3%	5.14	0.076	n/a
(e) General exercise e.g., walking and swimming is safe for everybody to do	**85.7%**	68.9%[b]	**87.1%**	18.13	<0.0001	0.209
(f) Specific muscle strengthening exercise is safe for everyone to do	**85.6%**	**84.5%**	69.2%[a]	11.86	0.003	0.170
(g) Every patient with hip or knee OA should try exercise treatment before surgery is considered	**86.9%**	**99.4%[b]**	**91.4%**	19.0	<0.0001	0.214
(h) Most patients with hip or knee OA would benefit from a supervised group exercise programme*	**91.3%**	**85.3%**	52.1%[a]	61.35	<0.0001	0.384
(i) Most patients with hip or knee OA would benefit from an individualized exercise programme*	**96.3%**	**93.9%**	**82.8%[a]**	15.91	<0.0001	0.196

[a]Significantly different compared to GP and PT, [b]significantly different to GP and PwOA, [c]significantly different

to PT, using Bonferroni at .05 level. *Questions for PwOA phrased as: “The best way to learn about exercise is in a supervised group setting with people who have similar pain” and “The best way to learn about exercise is in a one-on-one setting with a health professional”. Cramer’s V =0.1 small, 0.3 medium, 0.5 large effect size. GP, general practitioner; OA, osteoarthritis; PT, physiotherapist; PwOA, people with osteoarthritis.

Predictors of Patient Beliefs

There was no association between beliefs of PwOA about exercise and the question: “has your GP ever referred you to a physiotherapist for your painful joint?” (**Supplemental File 2**) [B=0.19 (95% CI -0.10, 1.50)]. In this model, a higher number of comorbidities [B=-0.26 (95% CI -0.56, -0.07)] was negatively associated with beliefs about exercise. In model 2, there was a positive association between beliefs of PwOA about exercise and the question: “Have you seen a physiotherapist for your painful joint?” [B=1.06 (95% CI 0.30, 1.82)]. Sex (male) [B=-0.72 (95% CI -1.44, -0.00)], a longer duration of pain and symptoms [B=-0.20 (95% CI -0.40, -0.01)] and a higher number of comorbidities [B=-0.29 (95% CI -0.53, -0.06)] were negatively associated with beliefs about exercise in this model.

Healthcare Professional Sources of Education

For the question, “Where do you get your knowledge of care advancements for persons with knee or hip osteoarthritis?”; the top five selected responses for GPs were continuous medical education (CME) or GP training networks (78%), published guidelines or recommendations (61%), reading medical journals (47%), conference attendance (47%) and course attendance (31%). For the question, “Where do you access your knowledge of management for persons with knee or hip osteoarthritis?”; the top five selected responses for PTs were published guidelines or recommendations (85%), reading research articles (75%), clinic protocols and discussion with peers or in-services (70%), course attendance (61%) and conference attendance (47%).

DISCUSSION

This research identified differences in beliefs about exercise effectiveness, safety and delivery between healthcare professionals and PwOA. While predominantly positive beliefs were observed across stakeholders, there was less consensus regarding the effectiveness of exercise when an X-ray shows “severe” OA. With regards to exercise referral, 48.5% of PwOA had either been referred to or self-referred to a physiotherapist for their joint pain. Referral to a physiotherapist by their GP was not associated with positive exercise beliefs.

However, attendance at a physiotherapist for joint pain was associated with positive exercise beliefs in PwOA.

If OA management guidelines do not align with the personal beliefs of service providers or users, PwOA may not receive high quality care. This study has found that GPs (7/9 statements), PTs (6/9 statements) and PwOA (5/9 statements) have largely positive beliefs regarding exercise for OA. However, there is less certainty about exercise when an X-ray shows "severe osteoarthritis" across all stakeholders, and service providers do not agree that "*exercise works just as well for everybody, regardless of the level of pain they have*". These results highlight that beliefs are generally in line with best evidence and clinical guidelines. However, there may still be some misconceptions about the effectiveness of exercise for higher levels of pain and disease. Evidence suggests that the pain-relieving qualities of exercise are effective for even moderate to severe OA disease[27–29], and a more recent meta-analysis for hip and knee OA has shown that individuals with higher pain severity at baseline benefit more from therapeutic exercise than those with lower pain[30]. This evidence should be a focus of future efforts of knowledge translation to clinicians and PwOA.

Some of the beliefs identified in this study are reflective of the traditional view of OA as a "wear and tear" disease, synonymous with a desire to protect a "damaged" joint on X-ray from further damage, as found previously[8,20]. However, an encouraging finding from this research are the overwhelmingly more positive views towards exercise observed compared to similar studies published on a cohort of UK-based PTs in 2009[13], older adults with knee pain in 2012[9] and GPs in 2017[16]. Using the comparator of statements with at least majority view (>50% agreement), in the 2009 study[13], PTs agreed on the benefit of exercise for knee pain on 4/12 statements (33%), compared to 8/9 similar statements (89%) in the current study. For older adults with knee pain, there was no agreement for any statement in the 2012 study[9], compared to 7/9 statements (78%) in the current study. This may be reflective of the younger age and inclusion of hip and knee pain in the current study. In the 2017 study[16], GPs agreed on 9/12 statements (75%), compared to 8/9 statements (89%) in the current study. While some statements varied slightly, stronger exercise recommendations in clinical guidelines and greater efforts in implementation and translation to practice in the last 10 years are likely the rationale for these changes, particularly since clinical guideline updates in 2014[1,2]. However, there is still much space to enact recommendations from a 2018 Cochrane review to provide better information and advice about the safety and value of exercise for patients[31]. In particular, providing reassurance on the role of exercise in managing symptoms, and discussion of opportunities to participate

in activities regarded as enjoyable and relevant, may encourage greater exercise participation[31].

Beliefs of PwOA about exercise were significantly less positive compared to healthcare professional beliefs for 6/9 statements, even though significantly more PwOA believed that general exercises are safe for everybody to do, compared to PTs. The greatest differences were observed for statements in relation to the benefits of strengthening exercises and group-based exercise but effect sizes were small to medium overall. Given 40% had never tried weight or strength-based training for their joint, and an additional 28% tried, but since stopped this type of exercise, healthcare professionals should be cognisant of ensuring patients understand the benefit of muscle strengthening and support patients to find enjoyable and sustainable ways to build these exercises into weekly routines. While strength-based training is not deemed superior to aerobic type exercise for pain relief in OA[27,32], knock-on benefits for improvements in physical function, longevity, bone health, and frailty[33] during ageing are important to highlight. Results for aerobic type exercise, however, were much more promising as only 14% had not tried this type of exercise for their joint and 67% were actively using. Further exploration on reasons for stopping exercise would be of benefit to determine if low adherence is related to barriers to exercise participation or a lack of perceived improvement in symptoms. While there is no strong evidence to indicate a difference in effectiveness regarding exercise setting, PwOA were less likely to agree with the benefits of a supervised group setting compared to service providers. Additional benefits of group exercise for older adults, such as social support, peer-learning, improvements in mental health and loneliness, and cost-effectiveness should, however, be considered and encouraged[34–36].

Physiotherapists are primary care providers of therapeutic exercise for people with OA and other chronic conditions. It was therefore hypothesised that PTs would have more positive beliefs regarding exercise compared to GPs. However, this was not shown to be the case based on findings in this study. PTs were significantly more positive regarding statement (g): *Every patient with hip or knee OA should try exercise treatment before surgery is considered.* However, more GPs responded positively to statement (e): *General exercise e.g., walking and swimming is safe for everybody to do,* and overall, there was a positive consensus on more statements amongst GPs (7/9) compared to PTs (6/9). These findings are somewhat at odds to the review by Nissen et al (including studies published from 2006-2019), which identified a certain lack of knowledge about the role of physical activity, exercise and physiotherapy in OA management amongst some GPs and PTs[20]. It suggests that the main barriers to implementation of exercise may not be entirely related to lack of updated knowledge or beliefs of the healthcare professionals.

In this study, referral to physiotherapy by a GP was not associated with more positive exercise beliefs in PwOA, in contrast to what was hypothesised. Although GPs had the most positive beliefs in comparison with other stakeholders, this finding may reflect the lack of time in a GP consultation to educate about exercise therapy and influence patient beliefs. A referral to exercise therapy alone may not be enough. However, seeing a PT for osteoarthritis was associated with more positive exercise beliefs. This may suggest that PTs impart important knowledge and education regarding the benefits of exercise to their patients, that, in turn, changes patient beliefs. Equally, this finding may suggest that PwOA with more positive exercise beliefs are more likely to attend a PT appointment. Tracking of changes in beliefs over time is recommended to further explore this association. Compared to GPs, PTs have more time in a consultation to discuss the effectiveness, mechanism, and safety of exercise for joint pain, which may help to influence beliefs and maximise the potential effect of exercise programs by improving adherence[37]. It is known that the provision of education for OA is superior for patient outcomes when combined with exercise therapy[38]. Almost 60% of PwOA reported having not tried self-management/education, despite some programme availability in Ireland[39]. PwOA were not asked specifically if their GP referred them to a self-management programme, which is a required area of further exploration. Additional efforts are required to support clinicians with resources to deliver trustworthy educational content for PwOA, or increase knowledge of available self-management programmes, to ensure clinical recommendations are fully implemented.

In the current study, 78% of PwOA had spoken to their GP about their joint pain, while under 50% of these people had been referred to a PT. Despite OA being amongst the leading causes of years lived with disability[40], the decision to seek care can be deterred by negative or dismissive attitudes from healthcare professionals about their non-urgent condition, or the perception that pain is part of ageing[41]. Healthcare professionals should take care regarding attitudes and language use during consultations[42] to help promote the effectiveness of first-line treatment strategies. Additionally, decisions regarding treatment timing may require additional educational strategies given clinical guidelines support surgical intervention as the last resort[1,2]. In this study more PwOA were referred to an orthopaedic consultant (58%) rather than PT (49%). From the regression analysis, it is also apparent that people with multiple comorbidities may require additional supports to improve positive beliefs about exercise for their condition. For people living with the burden of multiple conditions, additional barriers to exercise may require more supportive self-management sessions and thorough training of exercise facilitators[43].

This study has shown that the most used education sources for healthcare professionals on management of OA are: published guidelines or recommendations (85% of PTs, 61% of

GPs), use of training networks, in-clinic protocols, discussion and in-services (70% of PTs, 78% of GPs) and reading medical journals or research articles (75% of PTs, 47% of GPs). Even where clinicians report using clinical guidelines and research to guide practice, this is no guarantee that the most up-to-date recommendations are being used with confidence, or that they are being interpreted, recalled or implemented appropriately[44]. In contrast to this study, previous international investigations have shown that only a small proportion of sport and musculoskeletal PTs use research articles to change their clinical practice (10.4%)[45]. Over half of PTs instead cited “interactions with colleagues” and “attending private education short courses” as the source for change[45]. Given the high proportion of GPs that use CME small groups and training networks, peer-learning opportunities may be a viable source of intervention to ensure practice guidelines are being met[46]. The evidence to practice gap could be filled with clinical guideline supplements that address contextual barriers and time needed to treat[47], and courses/training that include opportunities to discuss real-world implementation of evidence with experienced colleagues and experts, with input from patients on delivery needs.

While efforts were made to recruit participants for this research from multiple diverse sources, this study was not a representative sample. The highest proportion (31%) of PwOA in this study were in the 50–59-year age category and 50% reported moderate joint pain. While prevalence of OA is higher in older age categories, the sample recruited is likely reflective of the online nature of participation, wide inclusion criteria (age 30+ years) and exclusion criteria for previous joint replacement surgery. Due to the timing of survey administration (during COVID-19 pandemic lockdown), traditional survey advertising methods such as GP and health clinic waiting rooms were not utilised. Completion of an anonymous survey has benefits as results cannot be influenced, however if there was any confusion related to phrasing of a certain question or statement, then this could not be clarified. The selection of other belief statements about exercise may have yielded different results. Future research should also investigate similar beliefs using qualitative approach to allow for more context to these answers.

Conclusion

Beliefs of GPs, PTs and PwOA regarding exercise as a treatment for hip and knee OA have likely become more positive in recent years. However, there is still much scope for service improvement, with less than 50% of PwOA having seen a PT for their joint pain and all stakeholders in disagreement with statements relating to effectiveness of exercise for severe joint pain. This sample included PwOA who did not have a previous joint replacement surgery and may therefore not be generalisable to an older sample with more severe

disease. Knowledge translation activities should be aimed at increasing knowledge and improving access to first-line evidence-based exercise therapies, using stakeholder co-design to provide context on barriers and facilitators.

Contributorship Statement - Toomey CM: Conceptualization, Methodology, Formal Analysis, Supervision, Writing – Original Draft. Higgins N: Methodology, Formal Analysis, Writing – Reviewing & Editing; Wood-Thornsbury A: Methodology, Formal Analysis, Writing – Reviewing & Editing; Rector J: Methodology, Formal Analysis, Writing – Reviewing & Editing; Bhardwaj A: Methodology, Writing – Review & Editing; Hayes P: Methodology, Writing – Review & Editing; Browne J: Methodology, Writing – Review & Editing; Grealis S: Methodology, Writing – Review & Editing; Maguire D: Methodology, Writing – Review & Editing; O'Hora J: Methodology, Writing – Review & Editing; Dowling I: Methodology, Writing – Review & Editing; Kennedy N: Conceptualization, Supervision, Writing – Review & Editing.

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Data Sharing Statement - All data pertaining to this study is anonymous and can be shared upon reasonable request for secondary data analysis by contacting the PI (corresponding author).

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Figure 1. Flow chart of referral patterns for people with osteoarthritis.

Figure 2. Proportion of responses to guideline-based treatments people with osteoarthritis (n=97) have tried.

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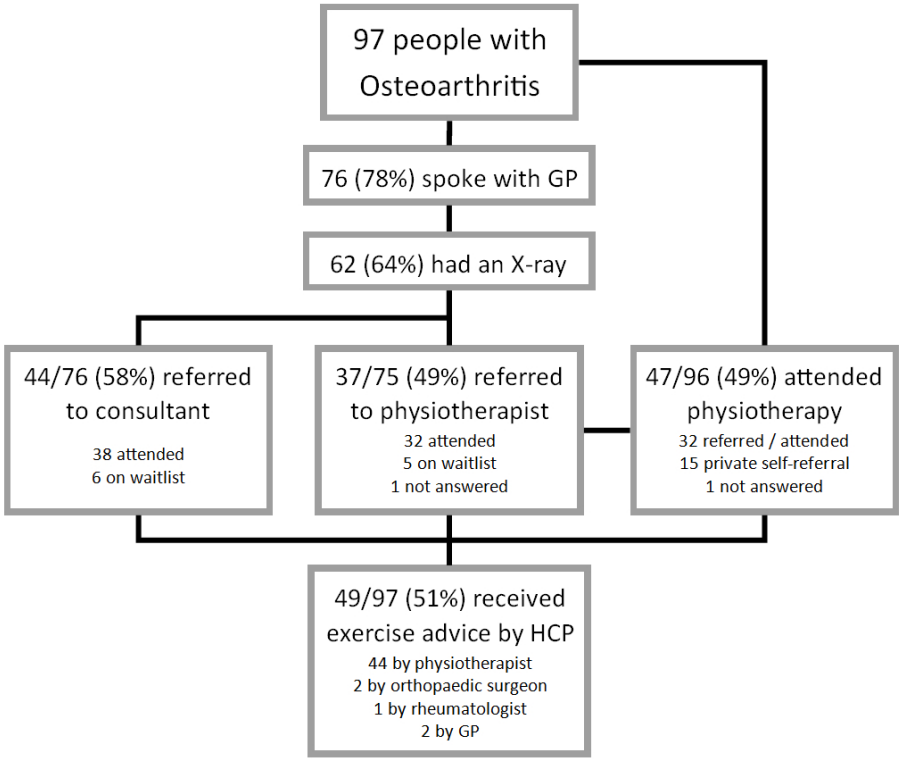

Figure 1. Flow chart of referral patterns for people with osteoarthritis.

605x459mm (47 x 47 DPI)

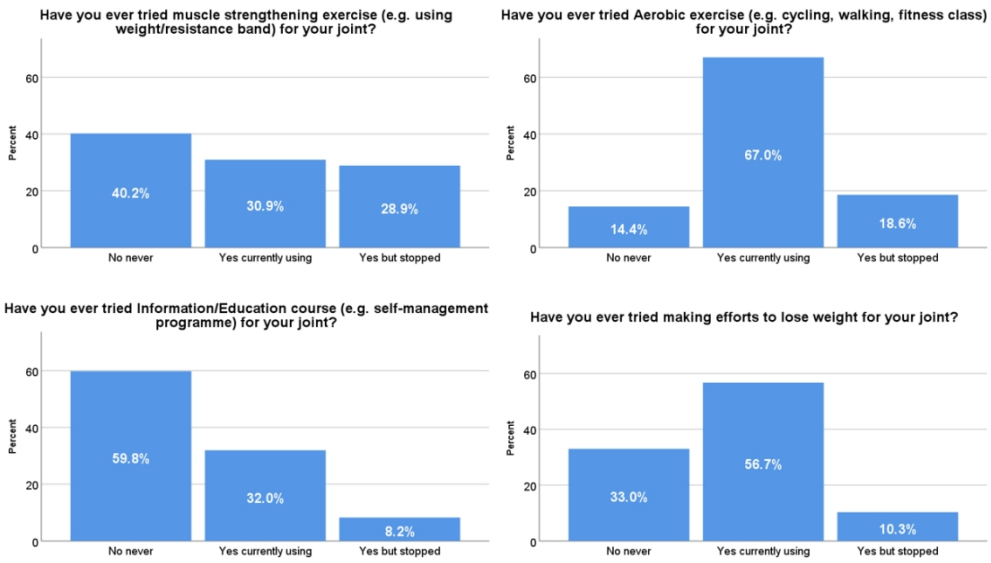

Figure 2. Proportion of responses to guideline-based treatments people with osteoarthritis (n=97) have tried.

680x385mm (47 x 47 DPI)

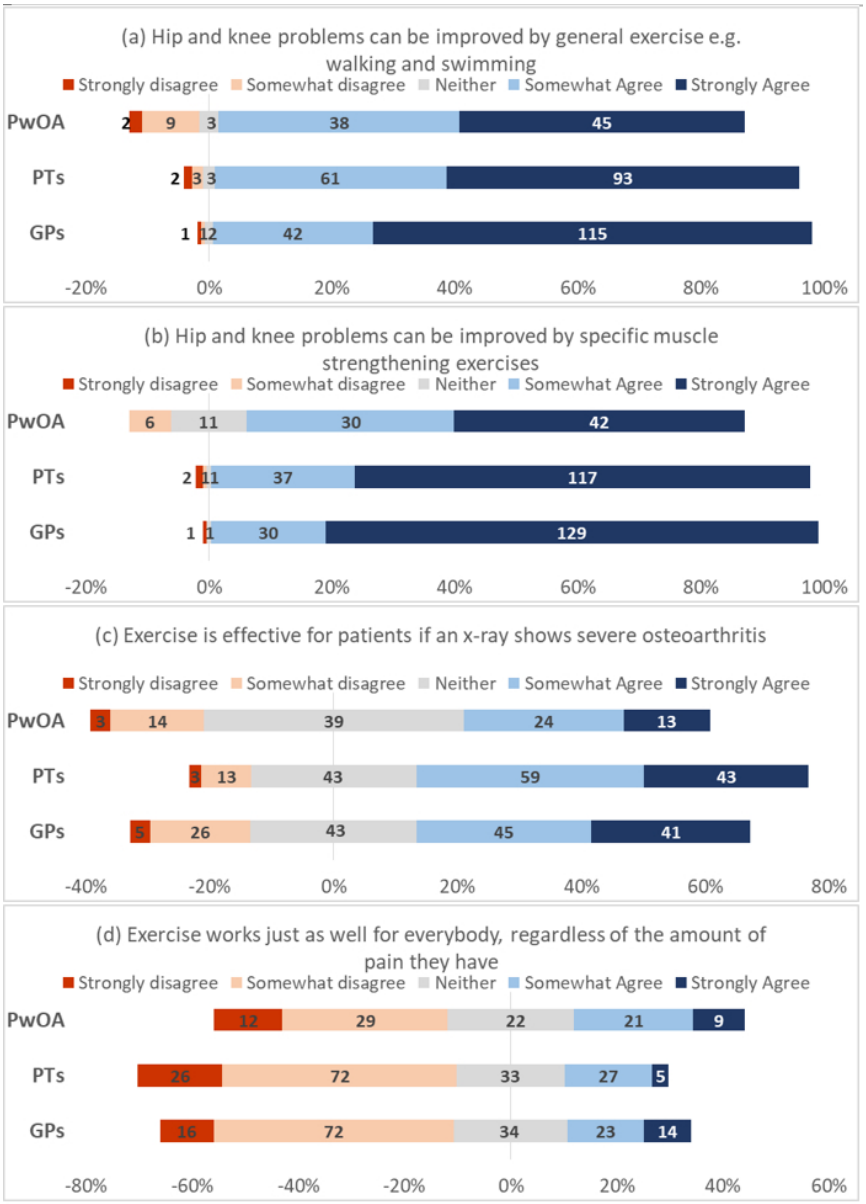

Figure 3. 100% stacked bar chart showing Likert scale results with count for each stakeholder on belief statements (a-d) related to exercise effectiveness. GP, general practitioner; PT, physiotherapist; PwOA, people with osteoarthritis.

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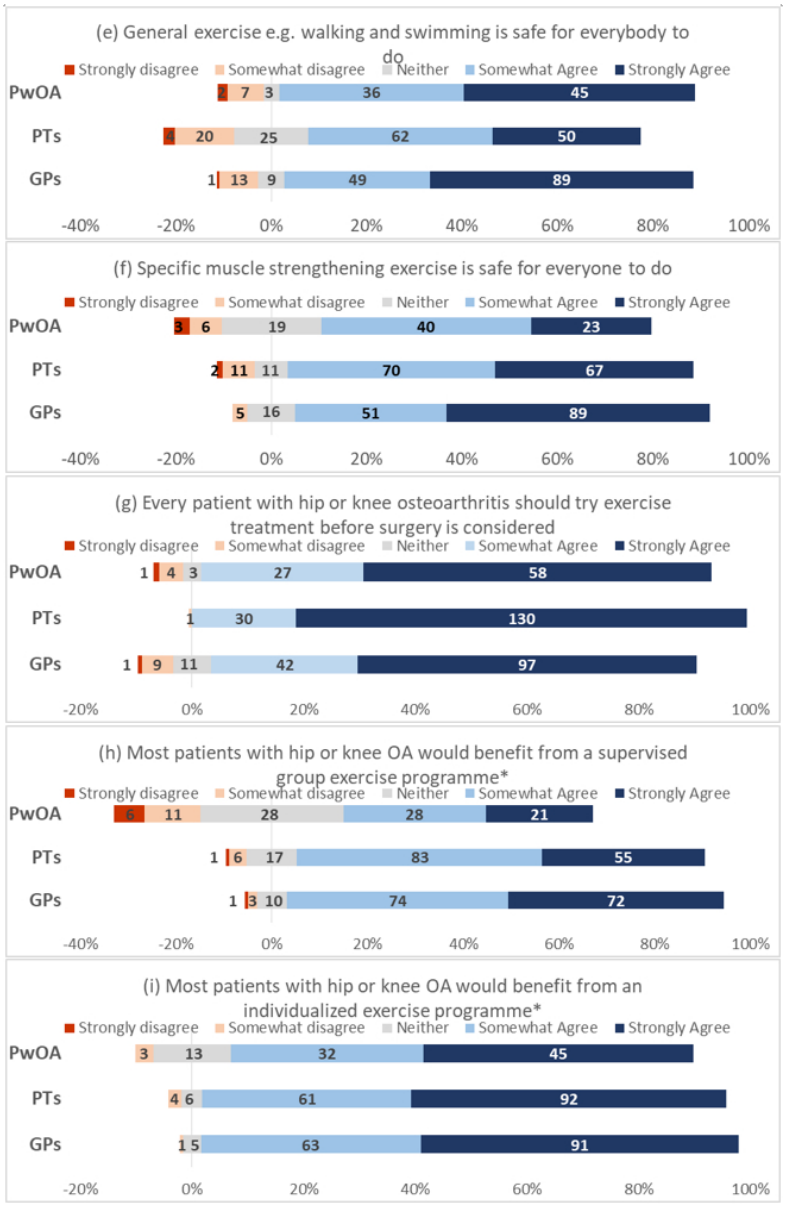

Figure 4. 100% stacked bar chart showing Likert scale results with count for each stakeholder on belief statements (e-i) related to exercise safety and delivery. *Questions for PwOA phrased slightly differently: "The best way to learn about exercise is in a supervised group setting with people who have similar pain" and "The best way to learn about exercise is in a one-on-one setting with a health professional". GP, general practitioner; PT, physiotherapist; PwOA, people with osteoarthritis

354x545mm (47 x 47 DPI)

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Survey 1: Beliefs, Barriers and Enablers to Exercise Prescription for Hip and Knee Osteoarthritis in General Practice in Ireland

Instructions for completing this questionnaire

- When completing the questionnaire, please try and provide answers that most accurately reflect your usual clinical practice. There are no 'correct' or 'incorrect' answers.
- Please do not consult any literature while completing this questionnaire.

Section 1. Information about you

1. How long have you been qualified as a General Practitioner?
   ☐ Less than 5 years experience
   ☐ 5-10 years experience
   ☐ Greater than 10 years experience
2. How many GP's work in your practice (including yourself)
3. Are you: ☐ Female ☐ Male ☐Other ☐Prefer not to disclose
4. Is your primary practice: ☐ urban ☐ rural ☐ mixed
5. Is your practice:
   ☐ Primary care reimbursement scheme only
   ☐ Private practice only
   ☐ Mixed
6. Since graduating from University, do you remember receiving any specific postgraduate training in musculoskeletal (MSK) which contained education about hip or knee osteoarthritis or chronic pain? (By this we do not mean clinical placements or jobs in rheumatology or orthopaedics)
   ☐ Yes ☐ No
   If yes, what type of training?
   ☐ CME small groups (or guest speaker)
   ☐ Diploma in MSK
   ☐ M.Sc. in Sports & Exercise Medicine
   ☐ Sports Medicine Faculty conferences
   ☐ Private Hospital Day Course
   ☐ Therapeutic Intra Articular and Soft Tissue Injection and Assessment Course
   ☐ Specific Modules on MSK on your GP training Scheme
   ☐ Other _____
7. How would you rate your confidence in treating hip and knee osteoarthritis?
   ☐ Not confident
   ☐ Slightly confident
   ☐ Confident
   ☐ Very confident
   ☐ Extremely confident
8. Do you have, or have you ever suffered from chronic knee or hip pain yourself?
   ☐ Yes ☐ No
9. What percentage of your typical caseload is made up of patients with hip and/or knee pain?
   ☐1-5% ☐ 6-25% ☐ 26-50% ☐ 51-75% ☐ >75%

Section 2. Exercise beliefs for hip and knee osteoarthritis

2.1 Where do you get your knowledge of care advancements for persons with knee or hip osteoarthritis? (Tick all that apply)

☐ Published guidelines or recommendations (e.g. NICE, EULAR, OARSI)
☐ Reading medical journals
☐ Twitter or other social media
☐ Podcasts
☐ CME networks or other GP networks
☐ Conference attendance
☐ Course attendance

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Other _____

We are interested in your views about the role of exercise in the treatment of hip and knee osteoarthritis. Please indicate the extent to which you agree or disagree with the statements given by ticking or placing an 'X' in one box per row.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.2 Hip and knee problems are improved by general exercise e.g. walking and swimming					
2.3 Hip and knee problems are improved by specific muscle strengthening exercises					
2.4 General exercise e.g. walking and swimming is safe for everybody to do					
2.5 Specific muscle strengthening exercise is safe for everyone to do					
2.6 Every patient with hip or knee OA should try conservative exercise treatment before more invasive procedures are recommended					
2.7 Exercise for hip or knee OA is most beneficial when it is tailored to meet individual patient needs					
2.8 A standard set of exercises is sufficient for every patient with hip or knee OA					
2.9 Education on lifestyle change is important for patients with OA					
2.10 Education on strategies for self-management of pain are important for patients with OA					
2.11 It is important that people with OA increase their overall activity levels					
2.12 Exercise is effective for patients if an x-ray shows severe knee osteoarthritis					
2.13 Exercise for OA is more effectively provided by physiotherapists than GPs					
2.14 Time constraints prevent the provision of advice on individual exercises for OA					
2.15 Exercise for OA should preferably be used after drug treatment has been tried					
2.16 Exercise for chronic knee pain would be used more frequently if access to physiotherapy was easier					

Section 3. Clinical scenario of a patient with osteoarthritis

Presented below is a clinical scenario of a patient with suspected knee osteoarthritis who presents to you with this problem for the first time. All questions in this section relate to the care you would give this particular patient.

Patient:	Mrs. Murphy, 60-year old shop owner, no health insurance
Complaint:	Right sided knee pain
History:	Gradually worsening over 3 years
	No history of trauma
	Pain when walking and at rest, worst when climbing stairs.
	No night pain.
	Activities of daily living are manageable. Difficulty gardening.
	Finding work increasingly difficult due to the stairs
	Tried going to gym but stopped – thinks was making pain worse.
	Otherwise well – mild hypertension
	Has tried ibuprofen with no effect
Medication:	Amlodipine
Examination:	Mild Obesity with Body Mass Index of 33
	Knees – bilaterally no effusions.
	Joint line tenderness on palpation.
	No pain or reduced mobility around knee cap
	Slightly reduced flexion of the right knee.
	Hips – no abnormality detected

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

3.1 Select some **key words** you would use to describe their diagnosis **to the patient**. (Select all that apply)

☐ Mild	☐ Cartilage thinning	☐ Fear avoidance
☐ Moderate	☐ Overloading	☐ Pain sensitivity
☐ Severe	☐ Overweight	☐ Bone on bone
☐ Degeneration	☐ Deterioration	☐ Weakness
☐ Wear and tear	☐ Normal ageing	☐ Joint swelling
☐ Arthritis	☐ Joint damage	Other _____

3.2 What investigation(s)/assessment(s), if any, would you do/order for this patient at this point

☐ None ☐ Knee x-ray ☐ Blood tests ☐ Other _____

3.3 At this consultation, what approaches would you use, or suggest, to manage this patient? (please tick all that apply)

☐ None	☐ Advice on footwear	☐ Exercise
☐ Ice	☐ General activity	☐ Injection of steroids
☐ Heat	☐ Provision of walking aid	☐ Oral NSAID
☐ Rest	☐ Weight Loss	☐ Topical NSAID
☐ Weak opioids	☐ Paracetemol	☐ Glucosamine/Chondroitin

☐ Other, please state _____

3.4 If you selected exercise above, what form would this take? (Select all that apply)

☐ Suggest general exercise and activity
☐ Suggest specific exercises
☐ Give a leaflet or online resource
☐ Refer to physiotherapy or other exercise specialist
☐ Other (please state) _____

3.5 In an ideal world without barriers, would you refer the patient to physiotherapy or orthopaedic consultant or neither, at this stage?

☐ Physiotherapy
☐ Orthopaedic consultant
☐ Neither

3.6 In your current practice, would you refer this patient to physiotherapy at this stage?

☐ Yes
☐ No

If yes, why? (Select all that apply)

☐ Deemed an appropriate candidate for supervised conservative treatment
☐ Ease of access to physiotherapy
☐ Lack of time to appropriately address exercise needs in practice
☐ Lack of response to NSAIDS
☐ Other _____

If no, why not? (Select all that apply)

☐ Not an appropriate candidate for conservative treatment
☐ Long waiting lists and poor access to physiotherapy
☐ Other interventions are a priority
☐ Exercise will make the pain worse
☐ Patient has tried exercise
☐ I would prefer to examine further therapeutic options first (e.g., develop a pain management plan or give an intra articular steroid injection)
☐ Other _____

3.7 In your current practice, would you refer this patient to an orthopaedic consultant at this stage?

☐ Yes
☐ No

If yes, why? (Select all that apply)

☐ Deemed an appropriate candidate for surgery right now

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☐ Will likely need a joint replacement in a few years so put on waiting list now
☐ Need a specialist opinion
☐ Other _____

If no, why not? (Select all that apply)
☐ More conservative treatmenta have not been exhausted
☐ Symptoms not severe enough to warrant joint replacement
☐ Waiting list too long
☐ Other _____

3.8 Would you refer the patient to see someone else, either in the primary or community team or into secondary care, at this point?
☐ Yes
☐ No
If yes, who? _____

Section 4. Barriers and enablers to exercise prescription and referral in general practice

In your practice and experience of treating patients with osteoarthritis, what are the main barriers to exercise prescription or referral? (Please select all that apply)
☐ Insufficient time in consultation
☐ Insufficient expertise
☐ Uncertainty about the effects of exercise
☐ Uncertainty about the most appropriate exercise type
☐ Uncertainty about the safety of exercise
☐ Cost and accessibility of physiotherapy for patient
☐ Physiotherapy waiting lists are too long
☐ Lack of a standardized physiotherapy programme for OA in the region
☐ Patients prefer other management options
☐ Patients want an orthopaedic consultant referral
☐ English language barrier for patients
☐ Severity of disease (symptoms too mild)
☐ Severity of disease (symptoms too severe)
☐ Older age of patient
☐ Presence of many comorbidities
☐ Other _____

What enablers would help you to prescribe or refer a patient with osteoarthritis to exercise in your practice?

☐ Increased formal post-qualification education e.g. diploma or masters
☐ Increased post-qualification training e.g. workshops, videos
☐ Increased exercise education during GP training
☐ More consultation time to provide exercise prescription
☐ Shorter waiting lists and improved access to physiotherapy
☐ Presence of an evidence-based physiotherapy-supervised group exercise programme for osteoarthritis in the locality
☐ Patients who recognize the importance of strategies for self-management of pain using appropriate exercise recommendations
☐ Low cost community-based exercise programmes
☐ Renumeration for exercise prescription and follow up consultations
☐ Other _____

Thank you for taking the time to complete this questionnaire. Your time and participation is greatly appreciated.

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Survey 2: Beliefs, Barriers and Enablers to Group Exercise Programme Delivery for Hip and Knee Osteoarthritis in Physiotherapy Practice in Ireland

The questionnaire is divided into 3 sections and should take approximately **7 minutes** to complete.
Instructions for completing this questionnaire

- When completing the questionnaire, please try and provide answers that most accurately reflect your usual clinical practice. There are no 'correct' or 'incorrect' answers.
- Please do not consult any literature while completing this questionnaire.

Section 1. Information about you

1. How long have you been qualified as a Physiotherapist?
   ☐ Less than 5 years experience
   ☐ 5-10 years experience
   ☐ Greater than 10 years experience
2. How many Physiotherapists work in your clinic (including yourself) _____
3. Are you: ☐ Female ☐ Male ☐ Other ☐ Prefer not to disclose
4. Is your primary work setting:
   ☐ Public hospital
   ☐ Private hospital
   ☐ Primary, community and continuing care
   ☐ Private practice clinic
   ☐ Education
   ☐ Other (please state) _____
5. Have you undertaken any specific post-qualification training, which involved education about hip or knee osteoarthritis or chronic pain? (By this we do not mean clinical placements or jobs in rheumatology or orthopaedics) ☐ Yes ☐ No

If yes, what type of training? (Provide additional details if you wish to expand)

☐ In-service training Additional details _____
☐ M.Sc. (taught) in this/similar field Additional details _____
☐ M.Sc. (research) in this/similar field Additional details _____
☐ PhD in this/similar field Additional details _____
☐ Day, weekend or online course (please name most relevant)
_____
☐ Other _____

6. How would you rate your confidence in treating hip and knee osteoarthritis?
   ☐ Not confident
   ☐ Slightly confident
   ☐ Confident
   ☐ Very confident
   ☐ Extremely confident
7. Do you have, or have you ever suffered from chronic knee or hip pain yourself? ☐ Yes ☐ No
8. What percentage of your typical caseload is made up of patients with hip and/or knee osteoarthritis?
   ☐ 1-5% ☐ 6-25% ☐ 26-50% ☐ 51-75% ☐ >75%

Section 2. Exercise beliefs for hip and knee osteoarthritis

2.1 Where do you access your knowledge of management for persons with knee or hip osteoarthritis? (Tick all that apply)

☐ Published guidelines or recommendations (e.g. NICE, EULAR, OARSI)
☐ Clinic protocols, discussion with peers or in-services
☐ Reading published research articles
☐ Twitter or other social media
☐ Podcasts
☐Blogs
☐Infographics
☐Videos
☐ ISCP specialist groups and other network events
☐ Conference attendance
☐ Course attendance

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☐ Other _____

Please now rank in order your preferred resources to learn from

We are interested in your views about the role of exercise in the treatment of hip and knee osteoarthritis. Please indicate the extent to which you agree or disagree with the statements given by ticking one box per row.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.2 Hip and knee problems are improved by general exercise e.g. walking and swimming					
2.3 Hip and knee problems are improved by specific muscle strengthening exercises					
2.4 Hip and knee problems are improved by focusing on motor or neuromuscular control of the joints during exercise					
2.5 General exercise e.g. walking and swimming is safe for most patients to do					
2.6 Specific muscle strengthening exercise is safe for most patients to do					
2.7 Neuromuscular control exercises are safe for most patients to do					
2.8 Every patient with hip or knee OA should try conservative exercise treatment before surgery is considered					
2.9 Exercise for hip or knee OA is most beneficial when it is tailored to meet individual patient needs					
2.10 A standard set of exercises with individual progression is sufficient for every patient with hip or knee OA					
2.11 Education on lifestyle change is important for patients with OA					
2.12 Education on strategies for self-management of pain are important for patients with OA					
2.13 It is important that people with OA increase their overall activity levels					
2.14 Exercise is effective for patients if an x-ray shows severe knee osteoarthritis					
2.15 Most patients with hip or knee OA would benefit from a supervised group exercise programme					
2.16 Most patients with hip or knee OA would benefit from an individualized exercise programme					

Section 3. Barriers and enablers to exercise programme delivery in physiotherapy practice

3.1 Please select the current level of government COVID19 restrictions in place as you are completing this survey

☐ Level 1 ☐ Level 2 ☐ Level ☐ Level 4 ☐ Level 5

3.2 **Pre-COVID19** restrictions in March 2020, were you or your clinic providing **group exercise classes** for patients with hip or knee osteoarthritis? ☐ Yes ☐ No

If Yes, what was the average number of classes per week? _____

If No, were you interested in offering group exercise classes for osteoarthritis in an ideal world and **if no barriers** existed?

☐ Yes

☐ No

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3.3 **Pre-COVID19** restrictions in March 2020, **what** were the main **barriers** to providing group exercise programmes for patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Insufficient space and equipment resources
☐ Insufficient personnel (staff) resources
☐ Insufficient referrals or low OA caseload
☐ Patients want individualized programmes
☐ Patients prefer other management options e.g. manual therapy
☐ Insufficient expertise
☐ Uncertainty about the effects of exercise
☐ Uncertainty about the most appropriate exercise type
☐ Uncertainty about the safety of exercise
☐ Cost for patient
☐ Access for patient (e.g. travel, parking, time)
☐ Scheduling conflict related to patient working hours and clinic hours
☐ Lack of a standardised programme or protocol for exercise for OA
☐ English language barrier for patients
☐ Lack of support from colleagues or managers
☐ Other _____

3.4 Are you currently offering **group exercise classes** for patients with hip or knee osteoarthritis and **to what capacity**?

☐ Yes, face to face at full capacity
☐ Yes, face to face at reduced capacity compared to Pre-COVID19 restrictions
☐ Yes, online classes only
☐ Yes, combination of face-to-face and online
☐ No

3.5 **Under current restrictions**, are there any **additional barriers** to providing **face-to-face** group exercise programmes for patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Government restrictions currently do not allow for group classes
☐ Hospital or clinic protocols currently do not allow for group classes
☐ Patients do not want to attend clinic
☐ Not enough resources for adequate distancing for class members
☐ Sanitization procedures are too time consuming
☐ Own COVID-related safety concerns
☐ Other _____

3.6 **Under current restrictions**, are there any **additional barriers** to providing **online** group exercise programmes for patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Lack of IT resources in clinic (e.g. online platform, webcams, high speed Wi-Fi)
☐ Lack of personnel (staff) with IT knowledge
☐ Patients lack IT resources or knowledge
☐ Patients prefer to wait until they can access face-to-face treatment
☐ Uncertainty about the effectiveness of online group exercise
☐ Own personal preference
☐ Other _____

3.7 What **enablers** would help you to provide **face to face group exercise** classes to patients with osteoarthritis in your practice if COVID restrictions were not a factor? (Please select all that apply)

☐ None
☐ More university post-qualification education e.g. diploma or masters
☐ More other post-qualification training e.g. short courses, workshops, videos
☐ More education on group exercise delivery during physiotherapy training
☐ Appropriate referrals from GP or other sources
☐ GPs who impart knowledge regarding benefits of exercise to patients upon referral

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☐ Resources to deliver quality educational material regarding self-management alongside exercise
☐ More support from colleagues or managers
☐ Other_____

3.8 What **enablers** would help you to provide an option of **online** group exercise classes to patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Improved IT infrastructure in clinic (e.g. laptops, webcams)
☐ IT skills resources for delivering online programmes (e.g. tutorials, do's and don'ts)
☐ Access to IT resources (e.g. tutorials) to provide patients with
☐ Improved Wi-Fi and bandwidth nationwide
☐ Strong evidence for effectiveness of existing online programmes
☐ An online registry allowing collection of patient outcomes pre- and post- programme
☐ Other _____

3.9 Would you be interested in receiving **training** (1.5 day workshop) to effectively implement and deliver a standardized, international, evidence-based group exercise and education programme with online and face-to-face options for patients with osteoarthritis in your clinic?

☐ Extremely interested
☐ Very interested
☐ Moderately interested
☐ Slightly interested
☐ Not at all interested
If not interested, why? _____

3.10 If interested, how much would you be willing to pay for this continuous professional development training?

☐ €100-150
☐ €151-200
☐ €201-250
☐ €251-300
☐ €301-350
☐ More than €350
☐ N/A

Thank you for taking the time to complete this questionnaire. Your time and participation is greatly appreciated.

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Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Survey 3: Survey on the Role of Exercise for Hip and Knee Osteoarthritis in Adults in Ireland

The questions below are divided into 3 sections. Please complete the questions to the best of your ability.

Section 1. Information about you

1. Are you: ☐ Female ☐ Male ☐ Other ☐ Prefer not to disclose
2. Which age category do you fall into?
   - ☐ 30 to 39 years
   - ☐ 40 to 49 years
   - ☐ 50 to 59 years
   - ☐ 60 to 69 years
   - ☐ 70 to 79 years
   - ☐ 80 to 89 years
   - ☐ 90 years or older
3. Which province in Ireland do you reside in? ☐ Munster ☐ Ulster ☐ Connacht ☐ Leinster

****If "Ulster" is selected, question 3(b) will appear.**

3(b) Do you access your healthcare in:
- ☐Northern Ireland (NHS)
- ☐Republic of Ireland (HSE)
- ☐A combination of both

4. Which of the following best describes where you live?
   - ☐ Inner city
   - ☐ Suburb of a city
   - ☐ Town
   - ☐ Village
   - ☐ Open country
   - ☐ Island off Ireland
5. Have you ever been told by a health professional that you have a diagnosis of the following?(Select all that apply)

☐ Arthritis	☐ Diabetes Mellitus (type 1 or 2)
☐ Osteoarthritis	☐ Kidney or liver disease
☐ Wear and tear	☐ Anemia (reduced number of red blood cells)
☐ Degenerative changes	☐ Other blood disease
☐ Rheumatoid arthritis	☐ Cancer
☐ Hypertension	☐ Depression
☐ Heart Disease	☐ Anxiety
☐ Ulcer or other bowel diseases	☐ Other mental health disorder
☐ Neurological disease e.g. Parkinson's/MS	
☐ Respiratory diseases e.g. COPD	☐ Thyroid Disease
☐ Hemochromatosis	☐ Fibromyalgia
☐ Other health condition _____	

6. Have you had pain and joint symptoms in any of the following joints for **6 months or more** (select all that apply)

☐Right Knee	☐Left Knee
☐Right Hip	☐Left Hip
☐Right Ankle	☐Left Ankle
☐Right Shoulder	☐Left Shoulder
☐Right Elbow	☐Left Elbow
☐Right Wrist	☐Left Wrist
☐Right Hand/Fingers	☐Left Hand/Fingers
☐Lower Back	☐Other, please describe_____
☐Mid Back	
☐Neck	

7. Have you ever had joint replacement surgery for any of your painful joints? Please select below the joints that have been replaced.

☐Right Knee	☐Left Knee
☐Right Hip	☐Left Hip
☐Right Ankle	☐Left Ankle
☐Right Shoulder	☐Left Shoulder

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☐Right Elbow ☐Left Elbow
☐Right Wrist ☐Left Wrist
☐Right Hand/Fingers ☐Left Hand/Fingers
☐Other, please describe_____

8. Of your hip and/or knee joints that have **NOT** been replaced, which joint are you most bothered by? (select one)

☐Right Knee ☐Left Knee
☐Right Hip ☐Left Hip

All remaining questions will now be related to the joint that you have chosen.

9. How long have you been experiencing pain in your [insert chosen joint]?
   - ☐ 6 months – 1 year
   - ☐ 1 – 2 years
   - ☐ 2 – 3 years
   - ☐ 3 – 4 years
   - ☐ 4 – 5 years
   - ☐ More than 5 years
10. Have you seen or spoken to your GP about your painful [insert chosen joint]? ☐Yes ☐No
11. Have you ever had an x-ray of your [insert chosen joint]? ☐ Yes ☐ No
12. Has your GP ever referred you to an **orthopaedic consultant** for your [insert chosen joint]?
    - ☐ Yes
    - ☐ No
    - ☐ Currently on a waiting list (private consultant referral)
    - ☐ Currently on a waiting list (public consultant referral)

** If on a waiting list, how long have you been waiting?

- ☐ Less than 6 months
- ☐ 6 months – 1 year
- ☐ 1 year – 1.5 years
- ☐ 1.5 years – 2 years
- ☐ More than 2 years

13. Has your GP ever referred you to a **physiotherapist** for your [insert chosen joint]?
    - ☐ Yes
    - ☐ No
    - ☐ Currently on a waiting list (private consultant referral)
    - ☐ Currently on a waiting list (public consultant referral)

    * If on a waiting list, how long have you been waiting?

    - ☐ Less than 6 months
    - ☐ 6 months – 1 year
    - ☐ 1 year – 1.5 years
    - ☐ 1.5 years – 2 years
    - ☐ More than 2 years
14. How would you rate the pain and symptoms you are experiencing in your hip and/or knee on an average day?
    - ☐ No pain or symptoms
    - ☐ Mild pain and symptoms
    - ☐ Moderate pain and symptoms
    - ☐ Severe pain and symptoms
15. Have you EVER tried any of the following specifically for your [insert chosen joint]?

Muscle strengthening exercise (e.g. using weight/resistance band)	☐No, never	☐Yes, currently using	☐Yes, stopped using
Aerobic exercise (e.g. cycling, walking, fitness class)	☐No, never	☐Yes, currently using	☐Yes, stopped using
Information/Education course (e.g. self-management programme)	☐No, never	☐Yes, currently using	☐Yes, stopped using
Making efforts to lose weight	☐No, never	☐Yes, currently using	☐Yes, stopped using

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Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Section 2. Exercise beliefs for hip and knee osteoarthritis

We are interested in your views about the role of exercise in the treatment of hip and knee osteoarthritis. Please indicate how much you agree or disagree with the statements given by selecting one option per question.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.1 Hip and knee problems can be improved by general exercise e.g. walking and swimming					
2.2 Hip and knee problems can be improved by specific muscle strengthening exercises					
2.3 General exercise e.g. walking and swimming is safe for everybody to do					
2.4 Specific muscle strengthening exercise is safe for everyone to do					
2.5 Every patient with hip or knee osteoarthritis should try exercise treatment before surgery is considered					
2.6 Patients should learn more about how to self-manage their pain and symptoms using exercise and physical activity					
2.7 The best way to learn about exercise is in a supervised group setting with people who have similar pain (Pre-COVID-19 restrictions)					
2.8 The best way to learn about exercise is in a one-on-one setting with a health professional (Pre-COVID-19 restrictions)					
2.9 Exercise is effective for patients if an x-ray shows severe knee osteoarthritis					
2.10 Exercise works just as well for everybody, regardless of the amount of pain they have					

Section 3. Barriers and enablers to exercise for hip and knee osteoarthritis

In this section we want to know more about your exercise experience and what kinds of things would prevent you or help you do more exercise

3.1 How many times a week do you exercise (e.g. 30 minute walk)?

☐ 3 or more days per week
☐ Less than 3 days per week
☐ I don't exercise

3.2 Has a health professional ever given you specific exercises for your [insert chosen joint]?

☐ Yes
☐ No
☐ Not sure

*If Yes, what type of health professional? (select all that apply)

☐ Physiotherapist
☐ GP
☐ Orthopaedic surgeon
☐ Nurse
☐ Personal trainer
☐ Other, please name _____

*If Yes, what type of exercise?

☐ Home-based individual exercises
☐ Group exercise class for osteoarthritis
☐ Other, please state _____

*If Yes, did you find the exercise beneficial?

☐ Yes
☐ No
☐ Not sure

3.3 Please select the current level of government COVID19 restrictions in place as you are completing this survey

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☐ Level 1 ☐ Level 2 ☐ Level ☐ Level 4 ☐ Level 5 (strictest restrictions)

3.4 Thinking about life **without COVID19** restrictions, **what** are the main **barriers** that would prevent you from exercising? (Please select all that apply)

☐ Pain or other joint symptoms
☐ I need assistance for mobility e.g. walking stick, wheelchair
☐ Finding time to exercise
☐ Lack of enjoyment from exercise
☐ Lack of exercise buddy or support network
☐ Wet or cold weather
☐ Other health problems
☐ Other disability e.g. visual impairment
☐ Cost of a gym membership or physiotherapy visit
☐ Cost of active wear or equipment
☐ I don't know the best types of exercise to do
☐ I don't know who to contact to learn more or do more exercise
☐ Uncertainty about the safety of exercise for joint pain
☐ Uncertainty about the benefit of exercise for joint pain
☐ Negative body image
☐ Access to facilities (e.g. availability, travel, parking)
☐ Work commitments
☐ Family commitments or other responsibilities
☐ Age
☐ Fear of injury
☐ Tiredness and fatigue
☐ Depression
☐ Other _____

3.5 Thinking about life **without COVID19** restrictions, what types of things would **help you to exercise more**? (Please select all that apply)

☐ Better knowledge of the best type of exercise to do
☐ Access to exercise that is supervised by a health professional
☐ Social aspect e.g. group exercise with other people with hip or knee pain
☐ More confidence in your joint
☐ Exercise recommendations from a GP
☐ Exercise recommendations from a physiotherapist
☐ More support from family or friends
☐ Warm and dry weather for outdoor exercise
☐ Low cost community exercise programmes
☐ Safe exercise environment (e.g. well-lit pathways)
☐ Other_____

3.6 Thinking about life **without COVID-19,** how interested would you be in attending a 6-week, twice per week, physiotherapy-supervised group exercise and education class for your hip or knee pain **at a clinic or community centre**?

☐ Extremely interested
☐ Very interested
☐ Moderately interested
☐ Slightly interested
☐ Not at all interested

If not interested, why? _____

3.7 Thinking about **current restrictions**, how interested would you be in taking part in a 6-week, twice per week, **ONLINE** physiotherapy-supervised group exercise and education class for you hip or knee pain?

☐ Extremely interested
☐ Very interested
☐ Moderately interested
☐ Slightly interested

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☐ Not at all interested
If not interested, why? _____

3.8 Do you have any experience with online-delivered healthcare or telerehabilitation from a GP or other health professional?
☐Yes
☐ No

3.9 What are the **barriers** that would prevent you taking part in an **online exercise** class? (Please select all that apply)
☐ Lack of technology equipment (e.g. laptop, smartphone or tablet, webcams)
☐ Lack of confidence in using computers, laptops etc.
☐ Wi-Fi / Broadband connection is not good enough
☐ Preference to wait until I can access face-to-face treatment
☐ Uncertain about how online group exercise would work
☐ Lack of space in home environment to perform exercises
☐ English language barriers
☐ Lack of time to take part
☐ Other _____

3.10 What would **help you** to take part in an **online** group exercise class with other people with osteoarthritis? (Please select all that apply)
☐ An initial one-to-one session with a physiotherapist to get familiar with the process
☐ Resources (e.g. videos) with explanations of how to get started
☐ Improved Wi-Fi and bandwidth
☐ Examples and testimonials from patients who have finished the classes
☐ Opportunities to chat online with other patients before and after the class
☐ Support from family members to get set up in your home
☐ A laptop or tablet
☐ Other _____

3.11 If interested, how much would you be willing to pay to take part in these exercise classes (price in euros for entire 14-15 session programme)?
☐ €0-25
☐ €26-50
☐ €51-100
☐ €101-150
☐ €151-200
☐ > €200

Thank you for taking the time to complete this questionnaire. Your time and participation is greatly appreciated.

Supplemental File 2

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Supplemental Table: Multivariable linear regression models to determine if positive beliefs about exercise in PwOA are associated with (1) referral to physiotherapist by a GP and (2) if they have seen a physiotherapist for their joint pain.

Dependent Variable: Number of exercise belief statements agreed with								
Variables Model 1 [a]	**B**	**S.E.**	**Partial Correlation**	**VIF**	**Sig.**	**Exp(B)**	**95% CI for EXP(B) Lower**	**Upper**
Has your GP ever referred you to a physiotherapist for your painful joint?	0.700	0.400	0.187	1.124	0.084	0.185	-0.095	1.496
Sex	-0.620	0.374	-0.177	1.015	0.101	-0.166	-1.363	0.124
How long have you been experiencing pain in your joint?	-0.163	0.100	-0.174	1.130	0.106	-0.173	-0.361	0.035
Number of comorbidities	-0.314	0.123	0.268	1.027	0.012	-0.259	-0.557	-0.070
Constant	7.687	0.604	-	-	0.000	-	6.485	8.888
Model 2 [b]								
Have you seen a physiotherapist for your painful joint?	1.060	0.383	0.288	1.138	0.007	0.287	0.299	1.821
Sex	-0.723	0.362	-0.212	1.003	0.049	-0.194	-1.444	-0.003
How long have you been experiencing pain in your joint?	-0.204	0.099	-0.219	1.163	0.042	-0.216	-0.400	-0.008
Number of comorbidities	-0.293	0.119	-0.257	1.026	0.016	-0.241	-0.530	-0.055
Constant	7.680	0.585	-	-	0.000	-	6.034	9.653

[a]Model variables removed due to non-significance (1): *How long have you been experiencing pain in your joint?*, *How would you rate the pain and symptoms you are experiencing in your hip and/or knee on an average day?*.
[b]Model variables removed due to non-significance (2): *How would you rate the pain and symptoms you are experiencing in your hip and/or knee on an average day?.* B, beta coefficient; GP, general practitioner; OA, osteoarthritis; PT, physiotherapist; PwOA, people with osteoarthritis; S.E., standard error; VIF, variance inflation factor.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4-5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4-5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*5-7*
Bias	9	Describe any efforts to address potential sources of bias	n/a
Study size	10	Explain how the study size was arrived at	n/a
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	6-7
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6-7
		(*e*) Describe any sensitivity analyses	n/a
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1

Outcome data	15*	Report numbers of outcome events or summary measures	Page 7, Figure 1-3
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 3
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	14-15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16,17
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Guideline-based exercise management for hip and knee osteoarthritis: a cross-sectional comparison of healthcare professional and patient beliefs in Ireland.

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Guideline-based exercise management for hip and knee osteoarthritis: a cross-sectional comparison of healthcare professional and patient beliefs in Ireland.

ABSTRACT

Objectives: To identify within-stakeholder agreement and between-stakeholder differences in beliefs regarding exercise for osteoarthritis among general practitioners (GPs), physiotherapists (PTs) and people with hip and knee osteoarthritis (PwOA). A secondary objective was to explore the association between referral patterns and beliefs of PwOA.

Design: Cross-sectional

Setting: Online surveys administered to GPs, PTs and PwOA in Ireland via social media and healthcare networks.

Participants: 421 valid responses (n=161 GPs, n=163 PTs, n=97 PwOA).

Primary and secondary outcome measures: Nine beliefs statements related to exercise effectiveness, safety and delivery were rated on a 5-point Likert scale and analysed for within-stakeholder consensus. Chi-square tests assessed differences in agreement between groups. Multivariable linear regression models tested associations between beliefs in PwOA and referral to/attendance at physiotherapy.

Results: Positive within-stakeholder consensus (>75% agreement) was reached for most statements (7/9 GPs, 6/9 PTs, 5/9 PwOA). However, beliefs of PwOA were significantly less positive compared to healthcare professionals for six statements. All stakeholders disagreed that exercise is effective regardless of the level of pain. Attendance at physiotherapy (49% of PwOA), rather than referral to physiotherapy from a GP only, was associated with positive exercise beliefs for PwOA [β=0.287 (95% CI 0.299, 1.821)].

Conclusions: Beliefs about exercise therapy for osteoarthritis are predominantly positive across all stakeholders, albeit less positive in PwOA. PwOA are more likely to have positive beliefs if they have seen a physiotherapist for their osteoarthritis. Knowledge translation should highlight the effectiveness of exercise for all levels of pain and osteoarthritis disease.

Strengths and Limitations

- Differences in beliefs about exercise between healthcare professionals and patients with osteoarthritis has not previously been examined.

- This study also explored how healthcare professional visits may influence beliefs about effectiveness of evidence-based care.
- This was a cross-sectional study so no inferences can be made.
- Different results with respect to beliefs and influences may have been found if non-online recruitment methods were available (e.g. paper surveys in healthcare settings).

INTRODUCTION

The management of hip and knee osteoarthritis (OA), as for other chronic conditions, should be determined by best available evidence. Although there is no cure for this burdensome disease, healthcare professionals in this field have for a long time had a wealth of high-quality evidence to draw from, all pointing to optimal core clinical management that consists of land-based exercise, education and weight loss if appropriate[1,2]. Despite this, implementation of these guidelines in practice is not optimal, often resulting in care that is fragmented in nature or considered low-value [3]. A global meta-analysis involving 16,103 people with OA (PwOA) in community care, revealed that only 39% received a referral or recommendation to exercise,[4] while a UK-based survey in 2018 revealed that only 3.9% of the 502 respondents with an OA diagnosis, were using exercise as part of their management[5]. Some similarities in shortcomings to implementation of guidelines for musculoskeletal health have been identified globally[6].

Alongside use of best evidence, the provision of patient-centred care is a pillar of high-quality care that should help guide treatment for PwOA[7]. Literature and expert opinion recommendations state that it is important to assess patient ideas and concerns regarding the cause and management of their pain, and to take into account their expectations and preferences for treatment[7]. Regarding exercise, researchers have identified a considerable amount of uncertainty among PwOA regarding the benefits of exercise for their pain. Results from cross-sectional surveys and semi-structured interviews have indicated that a lack of knowledge on the condition may result in patients believing that surgery is their only option[8,9]. Furthermore, a view of OA as a “wear and tear” condition was associated with the perspective that exercise was a counterintuitive treatment[8–10]. Since it is widely understood that beliefs influence health-related behaviours [11,12], and because stronger recommendations for exercise have been made since previous publications[2,5,9], an updated understanding of how PwOA view exercise is required.

Healthcare professionals’ perceptions and beliefs will affect the advice and management they offer patients, and researchers have suggested that those with biomedical or biomechanical beliefs about OA may transfer these beliefs to their patients, thus affecting their treatment choices[13,14]. Currently, general practitioners (GPs) and physiotherapists (PTs) are considered among the core care providers for PwOA[15]. While PT’s have the knowledge and skills to adopt a key role in the management of hip and knee OA, GPs remain the most frequently accessed source of formal medical advice and treatment[15,16]. The language used by healthcare professionals, especially GPs, can have a profound influence on patients’ beliefs[17,18]. A systematic review from Cottrell et al [19] in 2010,

found that the attitudes and beliefs of GPs concerning exercise and chronic knee pain varied widely. An updated UK-based survey of GPs in 2017 found that perspectives were positive, with 87% reporting the use of exercise in their practice [16]. However, only 11% reported using exercise in ways that aligned with evidence-based guidelines [16]. This demonstrates the need for a better understanding of how GPs interact with up-to-date resources for care advancements for OA, in a time-demanding profession.

A scoping review of qualitative research exploring attitudes and beliefs, shows that PTs generally have a positive attitude to activity and exercise in OA management, despite indications that some PTs may also be lacking up-to-date knowledge about best practice or may not be adhering to evidence-based treatments[20]. In contrast, a recent mixed-methods evaluation by Barton et al [21] in 2021 reported that awareness regarding evidence supporting exercise for knee OA was good (89–96%) amongst PTs in Australia and Canada.

Greater knowledge around beliefs and belief influencers are needed in order to address negative beliefs or myths associated with exercise and joint pain. The objective of this study was to identify within-stakeholder agreement and between-stakeholder differences in beliefs in relation to statements on exercise for management of hip and knee OA in PwOA, GPs and PTs. Secondary objectives were to explore any associations between beliefs of PwOA and whether they had ever received a GP referral to physiotherapy or had seen a PT for their painful joint. Based on previous work [9,13,16], it was hypothesised that exercise beliefs of PTs would be more positive, and in line with clinical guidelines and latest evidence, compared to GPs and PwOA. It was also hypothesised that PwOA who had received a physiotherapy referral from their GP, or who had seen a PT for their condition would have more positive beliefs about exercise compared to those who had not. Finally, an exploration of common sources of education for GPs and PTs was included to understand how beliefs regarding evidence are influenced.

METHODS

Design and Recruitment

This study incorporates an analysis of three cross-sectional online surveys administered to three stakeholder groups - GPs, PTs and PwOA – in Ireland between March and September 2021. This cross-sectional study is embedded in a larger study (IMPACT – Implementation of osteoarthritis clinical guidelines together)[22], that aims to co-design and evaluate implementation strategies for an exercise and education programme for PwOA in Ireland. Surveys were adapted from previous studies in this field [9,13,16] and reviewed by co-researchers of a public and patient involvement (PPI) steering committee of representative stakeholders prior to distribution. Validation consisted of a round of pre-testing with a

convenience sample of three of each GPs, PTs and PwOA with feedback provided on readability, acceptability and appropriateness that was incorporated before distribution. Qualtrics© software (Qualtrics, Provo, UT) was used to administer the online surveys and all procedures were approved by the University of Limerick Faculty of Education & Health Sciences Research Ethics Committee (REC) (2020_12_13_EHS) and the Irish College of General Practitioners REC (ICGP_REC_21_0006). Surveys were completed anonymously after participants were provided with a participant information sheet and consent was implied by completion of the survey. Reporting is consistent with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies.

The PT survey was distributed via email invite to all members of the Irish Society of Chartered Physiotherapists (n=2022), working across all fields. The survey was also advertised via social media (Twitter, LinkedIn) and amongst networks of researchers and PPI steering committee members. Physiotherapists were eligible for inclusion if they: (1) were practicing in Ireland, and (2) treated a patient with hip or knee OA in the past six months. The GP survey was distributed to the Irish College of General Practitioners network (n=3152), the University of Limerick Education and Research Network for General Practice (ULEARN-GP) network[23] (n=140) and via social media (Twitter, LinkedIn). GPs were eligible to take part if they were currently treating patients with hip and/or knee pain in Ireland. The survey for PwOA was advertised via social media (Twitter, LinkedIn), Arthritis Ireland social media, News Rheum patient newsletter and colleagues and networks of project steering committee and research team members. PwOA were eligible to take part if they (1) were living on the island of Ireland, (2) at least 30 years of age, (3) had chronic hip or knee pain for at least 6 months or more, and (4) did not have joint replacement surgery on at least one of the painful hips or knees. Strategies to increase recruitment via social media across all three surveys were adopted including tagging specific advocacy groups, patient or professional organisations and influencers, providing visual infographics alongside social media posts and aligning posts with events e.g. National Arthritis Day.

Outcomes

Each survey (Supplementary file 1) included an initial set of questions related to participant demographics. For healthcare professionals, these included questions on sex [are you: (1) Male, (2) Female, (3) Prefer not to say], length of time qualified, work setting, details of specific post-qualification training related to OA/chronic pain, confidence in treating hip and knee OA, percentage of typical caseload with hip or knee OA and where they prefer to access knowledge of management for persons with hip or knee OA. For PwOA, demographic information related to sex [are you: (1) Male, (2) Female, (3) Prefer not to say],

age category, geographical area and health conditions were asked. In relation to joint pain, questions regarding location, duration, severity, referrals to exercise, and use of clinical guideline specific treatments (muscle strengthening, aerobic exercise, education, weight loss) were asked. Additional questions were provided for PwOA to understand healthcare utilisation and previous experiences with exercise.

In each survey, a list of statements on exercise beliefs for hip and knee OA were provided and were rated on a 5-point Likert scale from strongly agree to strongly disagree. The belief statements were intended to align with current evidence-based guidelines[1,2] and best practice for exercise and OA. Healthcare professionals were given a more extensive list of statements that were related to exercise type or referral decisions. A final section related to barriers and enablers to exercise delivery, referral or uptake was included in each survey. Results of that analysis are presented elsewhere.

Statistical Analysis

Demographic outcomes were summarised as counts/proportions as appropriate. Belief statements were grouped and summarised descriptively by theme i.e., exercise type and effectiveness, exercise safety and exercise delivery. Although some statements had slightly different wording to facilitate understanding and relevance to each group, there were nine statements that were deemed to be comparable across groups and used to analyse differences in beliefs. Responses for the 5-point Likert scale statements were collapsed to a binary scale to label positive beliefs (“strongly agree” or “somewhat agree”) vs. negative beliefs (“strongly disagree”, “somewhat disagree” or “neither”). “Neither” was included with negative beliefs since statements were deemed to align somewhat with best practice and anything short of agreement may be considered unsatisfactory knowledge translation or personal experience. A commonly defined cut-off for consensus (>75%)[24] between stakeholders was used. Chi-square (2 x 3) tests of independence were used to assess differences in agreement with statements between three groups, and Bonferroni adjustment for between-group differences ($p<0.05$). Multivariable linear regression was used to explore associations between exercise beliefs (number of statements agreed with (range 0-9)) in PwOA and (1) physiotherapy referral from their GP *(Has your GP ever referred you to a physiotherapist for your painful joint? Yes/No)*, and (2) physiotherapy attendance *(Have you seen a physiotherapist for your painful joint? Yes/No).* Histograms, Kolmogorov-Smirnov tests and scatter plots of residuals vs. fitted values were used to test assumptions of Poisson and linear regression and linear regression was deemed more appropriate. Pearson correlation coefficients ($r>0.5$) and variance inflation factor (>5) were used to determine presence of collinearity between variables. Based on correlates of physical activity for hip

and knee OA from previous literature, the following covariates were included using an enter method in each model: sex[25], average pain rating (none/mild/moderate/severe)[25], pain duration (6 months-1 year /1-2 years /2-3 years /3-4 years /4+ years)[26] and number of comorbidities[25]. The most parsimonious models were reported checking for a 10% difference in beta coefficients upon removal of covariates ($p>0.05$). Data were analysed using IBM-SPSS version 26.0.0 and Microsoft Excel365.

Patient and public involvement

This research was conducted as part of a larger project (IMPACT) that uses a participatory health research approach. A steering committee of key stakeholders with relevant research, clinical/system expertise or lived experience (academics, people with arthritis, patient advocacy group members, physiotherapists, GPs, orthopaedic surgeon) have oversight of the project from inception to dissemination. Members of the committee were involved in designing the research question and outcome measures for these surveys, recruitment of participants, interpretation of analyses and dissemination as co-authors of the publication.

RESULTS

There was a total of 421 valid responses from the three distributed surveys, comprising 161 GPs, 163 PTs and 97 PwOA. An additional 26 GP, 33 PT and 15 PwOA surveys were collected but were not fully completed or did not contain sufficient data for analysis so were excluded. Demographic data for each stakeholder are presented in **Table 1**.

Experiences with Exercise for People with Osteoarthritis

Of the 97 PwOA, 78.4% (n=76) had spoken to their GP regarding their joint pain, 63.9% (n=62) had an X-ray of their joint. 38.5% (n=37) had been referred to physiotherapy by their GP and 48.5% (n=47) had seen a physiotherapist for their joint (either through GP- or self-referral). Additionally, 50.5% (n=49) reported having been given specific exercises for their joint by any healthcare professional. A flow diagram with breakdown of these referral patterns is displayed in **Figure 1**. **Figure 2** shows answers to questions regarding the types of treatments tried by PwOA, as per clinical guideline recommendations (aerobic exercise, strengthening exercise, education and weight management).

Within-Stakeholder Agreement in Beliefs about Exercise Type and Effectiveness, Exercise Safety and Delivery

Figure 3 shows the Likert scale results in each stakeholder group for statements (a-d), related to the effectiveness of different types of exercise and for different levels of pain or perceived severity. **Figure 4** shows the Likert scale results in each stakeholder group for

statements (e-i), related to the safety and delivery of different types of exercise for people with OA. Beliefs were predominantly positive amongst GP's [positive consensus (>75% agreement) on 7/9 statements], PTs (6/9 statements) and PwOA (5/9 statements).

Between-Stakeholder Differences in Beliefs about Exercise Type and Effectiveness, Exercise Safety and Delivery

Results of chi-square tests for differences in agreement between stakeholders across beliefs statements are presented in **Table 2**. There were differences in stakeholder responses across all statements, except for statement (d): *"Exercise works just as well for everybody, regardless of the amount of pain they have"* (X^2 = 5.14, p=0.076). All three stakeholder groups reached a negative consensus regarding this statement. In six of the eight statements where differences were observed, patient beliefs were significantly different to healthcare professional beliefs. There were two statements with a medium effect size for differences between PwOA and service providers: statements *(b) "Hip and knee problems can be improved by specific muscle strengthening exercises"* (*V*=0.309) and *(h) "Most patients with hip or knee OA would benefit from a supervised group exercise programme"* (*V*=0.384). All other differences had a small effect size.

Table 1. Descriptive statistics using count (proportions) for healthcare professionals and people with osteoarthritis demographics

Healthcare Professionals Demographics	GP (n=161) Count (%)	PT (n=163) Count (%)	People with Hip or Knee Osteoarthritis Demographics	PwOA N=97 Count (%)
Sex:			**Sex:**	
Female	88 (54.7)	128 (78.5)	Female	76 (78.4)
Male	72 (44.7)	34 (20.9)	Male	20 (20.6)
Prefer not to say	1 (0.6)	1 (0.6)	Prefer not to say	1 (1.0)
How long have you been qualified?			**Most bothersome joint:**	
Less than 5 years	33 (20.5)	19 (11.7)	Knee	52 (53.8)
5-10 years	25 (15.5)	21 (12.9)	Hip	45 (46.4)
More than 10 years	103 (64.0)	123 (75.5)	**Age Category:**	
Work practice setting (GPs)			30-39 years	12 (12.4)
Urban	60 (37.3)	-	40-49 years	24 (24.7)
Rural	34 (21.1)	-	50-59 years	30 (30.9)
Mixed	67 (41.6)	-	60-69 years	25 (25.8)
Work practice setting (PTs)			70-79 years	6 (6.2)
Public hospital	-	38 (23.3)	**Living Location:**	
Private hospital	-	7 (4.3)	Inner city or suburb	46 (47.4)
Primary care	-	41 (25.2)	Town	16 (16.5)
Private practice clinic	-	70 (42.9)	Village	15 (15.5)
Other	-	7 (4.3)	Open country	20 (20.6)
Post-qualification training on OA / chronic pain			**No. of other comorbidities:**	
No	72 (44.7)	37 (22.7)	0	31 (32.0)

Inservice/webinars/reading	32 (19.9)	17 (10.4)		1-2	45 (47.9)
Course or conference	28 (17.4)	72 (44.2)		3+	18 (19.1)
Diploma/APP or certification	15 (9.3)	3 (1.8)		**Multi-joint pain(>1):**	
MSc in related field	14 (8.7)	32 (19.6)		No	6 (6.2)
PhD in related field	0	2 (1.2)		Yes	91 (93.8)
Confidence in treating hip and knee OA				**Rating of pain /symptoms on an average day**	
Not confident	2 (1.2)	0		No pain/symptoms	1 (1.0)
Slightly confident	33 (20.5)	5 (3.1)		Mild	30 (30.9)
Confident	80 (49.7)	41 (25.2)		Moderate	49 (50.5)
Very confident	36 (22.4)	86 (52.8)		Severe	17 (17.5)
Extremely confident	10 (6.2)	31 (19.0)			
% of typical caseload with hip/knee OA				**Duration of pain**	
1-5%	19 (11.8)	19 (11.7)		6 mon – 1 year	24 (24.7)
6-25%	117 (72.7)	83 (50.9)		1-2 years	13 (13.4)
26-50%	24 (14.9)	36 (22.1)		2-3 years	15 (15.5)
51-75%	1 (0.6)	18 (11.0)		3-4 years	11 (11.3)
>75%	0	5 (3.1)		More than 4 years	34 (35.1)

APP, Advanced Practice Physiotherapist; GP, General Practitioner; OA, Osteoarthritis; PT, Physiotherapist; PwOA, People with Osteoarthritis.

Table 2. Differences in agreement with statements between general practitioner (GP; n=161), physiotherapist (PT; n=163) and people with hip and knee osteoarthritis (PwOA; n=97). Agreement was defined as those who selected "strongly agree" or "somewhat agree" on Likert scales. Proportions that reached within-stakeholder "consensus", defined as >75% majority, are in bold.

Statement	**Proportion in agreement**			**Chi-Square**	**Significance**	**Cramer's V**
	GP	**PT**	**PwOA**			
(a) Hip and knee problems can be improved by general exercise e.g. walking and swimming	**97.5%**	**95.1%**	**85.6%[a]**	15.59	<0.0001	0.193
(b) Hip and knee problems can be improved by specific muscle strengthening exercises	**98.8%**	**97.5%**	**80.9%[a]**	39.04	<0.0001	0.309
(c) Exercise is effective for patients if an x-ray shows severe osteoarthritis	53.8%	63.4%	39.8%[c]	13.24	0.001	0.179
(d) Exercise works just as well for everybody, regardless of the amount of pain they have	**24.2%**	**19.6%**	32.3%	5.14	0.076	n/a
(e) General exercise e.g., walking and swimming is safe for everybody to do	**85.7%**	68.9%[b]	**87.1%**	18.13	<0.0001	0.209
(f) Specific muscle strengthening exercise is safe for everyone to do	**85.6%**	**84.5%**	69.2%[a]	11.86	0.003	0.170
(g) Every patient with hip or knee OA should try exercise treatment before surgery is considered	**86.9%**	**99.4%[b]**	**91.4%**	19.0	<0.0001	0.214
(h) Most patients with hip or knee OA would benefit from a supervised group exercise programme*	**91.3%**	**85.3%**	52.1%[a]	61.35	<0.0001	0.384
(i) Most patients with hip or knee OA would benefit from an individualized exercise programme*	**96.3%**	**93.9%**	**82.8%[a]**	15.91	<0.0001	0.196

[a]Significantly different compared to GP and PT, [b]significantly different to GP and PwOA, [c]significantly different to PT, using Bonferroni at .05 level. *Questions for PwOA phrased as: "The best way to learn about exercise is in a supervised group setting with people who have similar pain" and "The best way to learn about exercise is in a one-on-one setting with a health professional". Cramer's V =0.1 small, 0.3 medium, 0.5 large effect size. GP, general practitioner; OA, osteoarthritis; PT, physiotherapist; PwOA, people with osteoarthritis.

Predictors of Patient Beliefs

There was no association between beliefs of PwOA about exercise and the question: "has your GP ever referred you to a physiotherapist for your painful joint?" (**Supplemental File 2**) [B=0.19 (95% CI -0.10, 1.50)]. In this model, a higher number of comorbidities [B=-0.26 (95% CI -0.56, -0.07)] was negatively associated with beliefs about exercise. In model 2, there was a positive association between beliefs of PwOA about exercise and the question: "Have you seen a physiotherapist for your painful joint?" [B=1.06 (95% CI 0.30, 1.82)]. Sex (male) [B=-0.72 (95% CI -1.44, -0.00)], a longer duration of pain and symptoms [B=-0.20 (95% CI -0.40, -0.01)] and a higher number of comorbidities [B=-0.29 (95% CI -0.53, -0.06)] were negatively associated with beliefs about exercise in this model.

Healthcare Professional Sources of Education

For the question, "Where do you get your knowledge of care advancements for persons with knee or hip osteoarthritis?"; the top five selected responses for GPs were continuous medical education (CME) or GP training networks (78%), published guidelines or recommendations (61%), reading medical journals (47%), conference attendance (47%) and course attendance (31%). For the question, "Where do you access your knowledge of management for persons with knee or hip osteoarthritis?"; the top five selected responses for PTs were published guidelines or recommendations (85%), reading research articles (75%), clinic protocols and discussion with peers or in-services (70%), course attendance (61%) and conference attendance (47%).

DISCUSSION

This research identified differences in beliefs about exercise effectiveness, safety and delivery between healthcare professionals and PwOA. While predominantly positive beliefs were observed across stakeholders, there was less consensus regarding the effectiveness of exercise when an X-ray shows "severe" OA. With regards to exercise referral, 48.5% of PwOA had either been referred to or self-referred to a physiotherapist for their joint pain. Referral to a physiotherapist by their GP was not associated with positive exercise beliefs.

However, attendance at a physiotherapist for joint pain was associated with positive exercise beliefs in PwOA.

If OA management guidelines do not align with the personal beliefs of service providers or users, PwOA may not receive high quality care. This study has found that GPs (7/9 statements), PTs (6/9 statements) and PwOA (5/9 statements) have largely positive beliefs regarding exercise for OA. However, there is less certainty about exercise when an X-ray shows "severe osteoarthritis" across all stakeholders, and service providers do not agree that "*exercise works just as well for everybody, regardless of the level of pain they have*". These results highlight that beliefs are generally in line with best evidence and clinical guidelines. However, there may still be some misconceptions about the effectiveness of exercise for higher levels of pain and disease. Evidence suggests that the pain-relieving qualities of exercise are effective for even moderate to severe OA disease[27–29], and a more recent meta-analysis for hip and knee OA has shown that individuals with higher pain severity at baseline benefit more from therapeutic exercise than those with lower pain[30]. This evidence should be a focus of future efforts of knowledge translation to clinicians and PwOA.

Some of the beliefs identified in this study are reflective of the traditional view of OA as a "wear and tear" disease, synonymous with a desire to protect a "damaged" joint on X-ray from further damage, as found previously[8,20]. However, an encouraging finding from this research are the overwhelmingly more positive views towards exercise observed compared to similar studies published on a cohort of UK-based PTs in 2009[13], older adults with knee pain in 2012[9] and GPs in 2017[16]. Using the comparator of statements with at least majority view (>50% agreement), in the 2009 study[13], PTs agreed on the benefit of exercise for knee pain on 4/12 statements (33%), compared to 8/9 similar statements (89%) in the current study. For older adults with knee pain, there was no agreement for any statement in the 2012 study[9], compared to 7/9 statements (78%) in the current study. This may be reflective of the younger age and inclusion of hip and knee pain in the current study. In the 2017 study[16], GPs agreed on 9/12 statements (75%), compared to 8/9 statements (89%) in the current study. While some statements varied slightly, stronger exercise recommendations in clinical guidelines and greater efforts in implementation and translation to practice in the last 10 years are likely the rationale for these changes, particularly since clinical guideline updates in 2014[1,2]. However, there is still much space to enact recommendations from a 2018 Cochrane review to provide better information and advice about the safety and value of exercise for patients[31]. In particular, providing reassurance on the role of exercise in managing symptoms, and discussion of opportunities to participate

in activities regarded as enjoyable and relevant, may encourage greater exercise participation[31].

Beliefs of PwOA about exercise were significantly less positive compared to healthcare professional beliefs for 6/9 statements, even though significantly more PwOA believed that general exercises are safe for everybody to do, compared to PTs. The greatest differences were observed for statements in relation to the benefits of strengthening exercises and group-based exercise but effect sizes were small to medium overall. Given 40% had never tried weight or strength-based training for their joint, and an additional 28% tried, but since stopped this type of exercise, healthcare professionals should be cognisant of ensuring patients understand the benefit of muscle strengthening and support patients to find enjoyable and sustainable ways to build these exercises into weekly routines. While strength-based training is not deemed superior to aerobic type exercise for pain relief in OA[27,32], knock-on benefits for improvements in physical function, longevity, bone health, and frailty[33] during ageing are important to highlight. Results for aerobic type exercise, however, were much more promising as only 14% had not tried this type of exercise for their joint and 67% were actively using. Further exploration on reasons for stopping exercise would be of benefit to determine if low adherence is related to barriers to exercise participation or a lack of perceived improvement in symptoms. While there is no strong evidence to indicate a difference in effectiveness regarding exercise setting, PwOA were less likely to agree with the benefits of a supervised group setting compared to service providers. Additional benefits of group exercise for older adults, such as social support, peer-learning, improvements in mental health and loneliness, and cost-effectiveness should, however, be considered and encouraged[34–36].

Physiotherapists are primary care providers of therapeutic exercise for people with OA and other chronic conditions. It was therefore hypothesised that PTs would have more positive beliefs regarding exercise compared to GPs. However, this was not shown to be the case based on findings in this study. PTs were significantly more positive regarding statement (g): *Every patient with hip or knee OA should try exercise treatment before surgery is considered.* However, more GPs responded positively to statement (e): *General exercise e.g., walking and swimming is safe for everybody to do,* and overall, there was a positive consensus on more statements amongst GPs (7/9) compared to PTs (6/9). These findings are somewhat at odds to the review by Nissen et al (including studies published from 2006-2019), which identified a certain lack of knowledge about the role of physical activity, exercise and physiotherapy in OA management amongst some GPs and PTs[20]. It suggests that the main barriers to implementation of exercise may not be entirely related to lack of updated knowledge or beliefs of the healthcare professionals.

In this study, referral to physiotherapy by a GP was not associated with more positive exercise beliefs in PwOA, in contrast to what was hypothesised. Although GPs had the most positive beliefs in comparison with other stakeholders, this finding may reflect the lack of time in a GP consultation to educate about exercise therapy and influence patient beliefs. A referral to exercise therapy alone may not be enough. However, seeing a PT for osteoarthritis was associated with more positive exercise beliefs. This may suggest that PTs impart important knowledge and education regarding the benefits of exercise to their patients, that, in turn, changes patient beliefs. Equally, this finding may suggest that PwOA with more positive exercise beliefs are more likely to attend a PT appointment. Tracking of changes in beliefs over time is recommended to further explore this association. Compared to GPs, PTs have more time in a consultation to discuss the effectiveness, mechanism, and safety of exercise for joint pain, which may help to influence beliefs and maximise the potential effect of exercise programs by improving adherence[37]. It is known that the provision of education for OA is superior for patient outcomes when combined with exercise therapy[38]. Almost 60% of PwOA reported having not tried self-management/education, despite some programme availability in Ireland[39]. PwOA were not asked specifically if their GP referred them to a self-management programme, which is a required area of further exploration. Additional efforts are required to support clinicians with resources to deliver trustworthy educational content for PwOA, or increase knowledge of available self-management programmes, to ensure clinical recommendations are fully implemented.

In the current study, 78% of PwOA had spoken to their GP about their joint pain, while under 50% of these people had been referred to a PT. Despite OA being amongst the leading causes of years lived with disability[40], the decision to seek care can be deterred by negative or dismissive attitudes from healthcare professionals about their non-urgent condition, or the perception that pain is part of ageing[41]. Healthcare professionals should take care regarding attitudes and language use during consultations[42] to help promote the effectiveness of first-line treatment strategies. Additionally, decisions regarding treatment timing may require additional educational strategies given clinical guidelines support surgical intervention as the last resort[1,2]. In this study more PwOA were referred to an orthopaedic consultant (58%) rather than PT (49%). From the regression analysis, it is also apparent that people with multiple comorbidities may require additional supports to improve positive beliefs about exercise for their condition. For people living with the burden of multiple conditions, additional barriers to exercise may require more supportive self-management sessions and thorough training of exercise facilitators[43].

This study has shown that the most used education sources for healthcare professionals on management of OA are: published guidelines or recommendations (85% of PTs, 61% of

GPs), use of training networks, in-clinic protocols, discussion and in-services (70% of PTs, 78% of GPs) and reading medical journals or research articles (75% of PTs, 47% of GPs). Even where clinicians report using clinical guidelines and research to guide practice, this is no guarantee that the most up-to-date recommendations are being used with confidence, or that they are being interpreted, recalled or implemented appropriately[44]. In contrast to this study, previous international investigations have shown that only a small proportion of sport and musculoskeletal PTs use research articles to change their clinical practice (10.4%)[45]. Over half of PTs instead cited “interactions with colleagues” and “attending private education short courses” as the source for change[45]. Given the high proportion of GPs that use CME small groups and training networks, peer-learning opportunities may be a viable source of intervention to ensure practice guidelines are being met[46]. The evidence to practice gap could be filled with clinical guideline supplements that address contextual barriers and time needed to treat[47], and courses/training that include opportunities to discuss real-world implementation of evidence with experienced colleagues and experts, with input from patients on delivery needs.

While efforts were made to recruit participants for this research from multiple diverse sources, this study was not a representative sample. The highest proportion (31%) of PwOA in this study were in the 50–59-year age category and 50% reported moderate joint pain. While prevalence of OA is higher in older age categories, the sample recruited is likely reflective of the online nature of participation, wide inclusion criteria (age 30+ years) and exclusion criteria for previous joint replacement surgery. Due to the timing of survey administration (during COVID-19 pandemic lockdown), traditional survey advertising methods such as GP and health clinic waiting rooms were not utilised. Completion of an anonymous survey has benefits as results cannot be influenced, however if there was any confusion related to phrasing of a certain question or statement, then this could not be clarified. The selection of other belief statements about exercise may have yielded different results. Future research should also investigate similar beliefs using qualitative approach to allow for more context to these answers.

Conclusion

Beliefs of GPs, PTs and PwOA regarding exercise as a treatment for hip and knee OA have likely become more positive in recent years. However, there is still much scope for service improvement, with less than 50% of PwOA having seen a PT for their joint pain and all stakeholders in disagreement with statements relating to effectiveness of exercise for severe joint pain. This sample included PwOA who did not have a previous joint replacement surgery and may therefore not be generalisable to an older sample with more severe

disease. Knowledge translation activities should be aimed at increasing knowledge and improving access to first-line evidence-based exercise therapies, using stakeholder co-design to provide context on barriers and facilitators.

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Data Sharing Statement - All data pertaining to this study is anonymous and can be shared upon reasonable request for secondary data analysis by contacting the PI (corresponding author).

Ethics Approval - All procedures were approved by the University of Limerick Faculty of Education & Health Sciences Research Ethics Committee (REC) (2020_12_13_EHS) and the Irish College of General Practitioners REC (ICGP_REC_21_0006).

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Figure 1. Flow chart of referral patterns for people with osteoarthritis.

Figure 2. Proportion of responses to guideline-based treatments people with osteoarthritis (n=97) have tried.

Figure 3. 100% stacked bar chart showing Likert scale results with count for each stakeholder on belief statements (a-d) related to exercise effectiveness. GP, general practitioner; PT, physiotherapist; PwOA, people with osteoarthritis.

Figure 4. 100% stacked bar chart showing Likert scale results with count for each stakeholder on belief statements (e-i) related to exercise safety and delivery. *Questions for PwOA phrased slightly differently: “The best way to learn about exercise is in a supervised group setting with people who have similar pain” and “The best way to learn about exercise is in a one-on-one setting with a health professional”. GP, general practitioner; PT, physiotherapist; PwOA, people with osteoarthritis.

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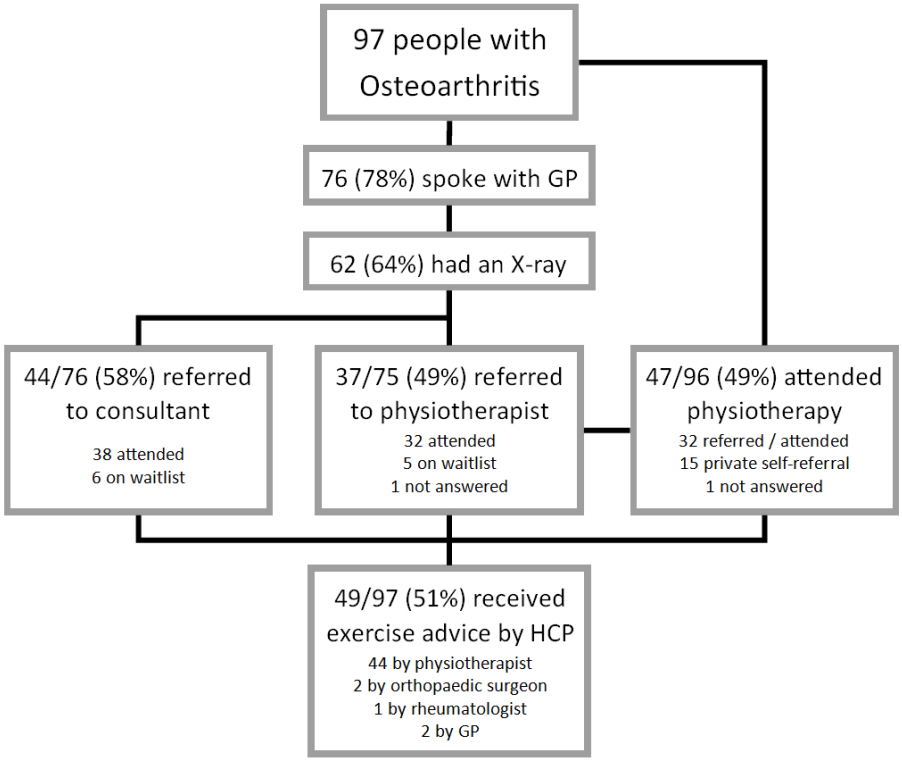

Figure 1. Flow chart of referral patterns for people with osteoarthritis.

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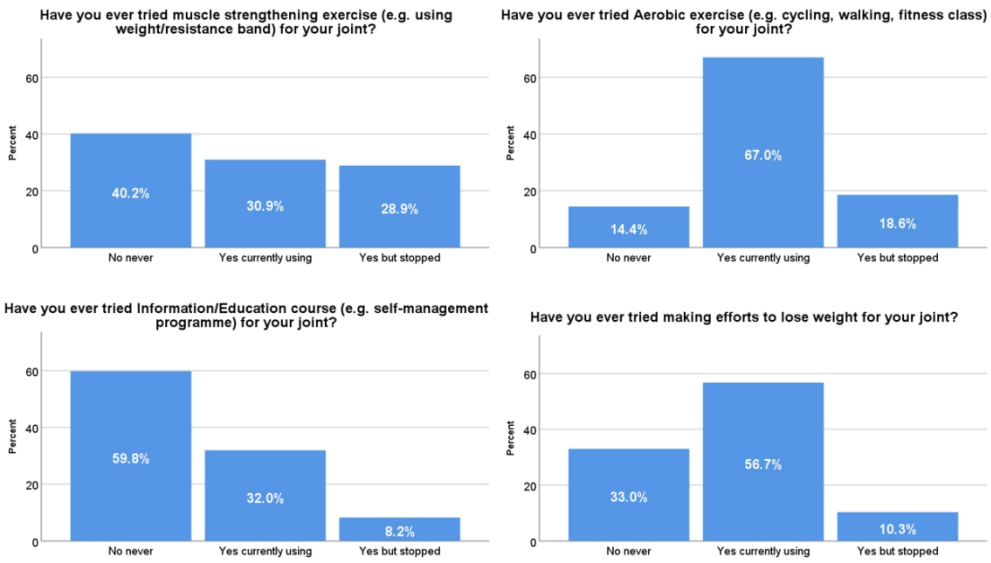

Figure 2. Proportion of responses to guideline-based treatments people with osteoarthritis (n=97) have tried.

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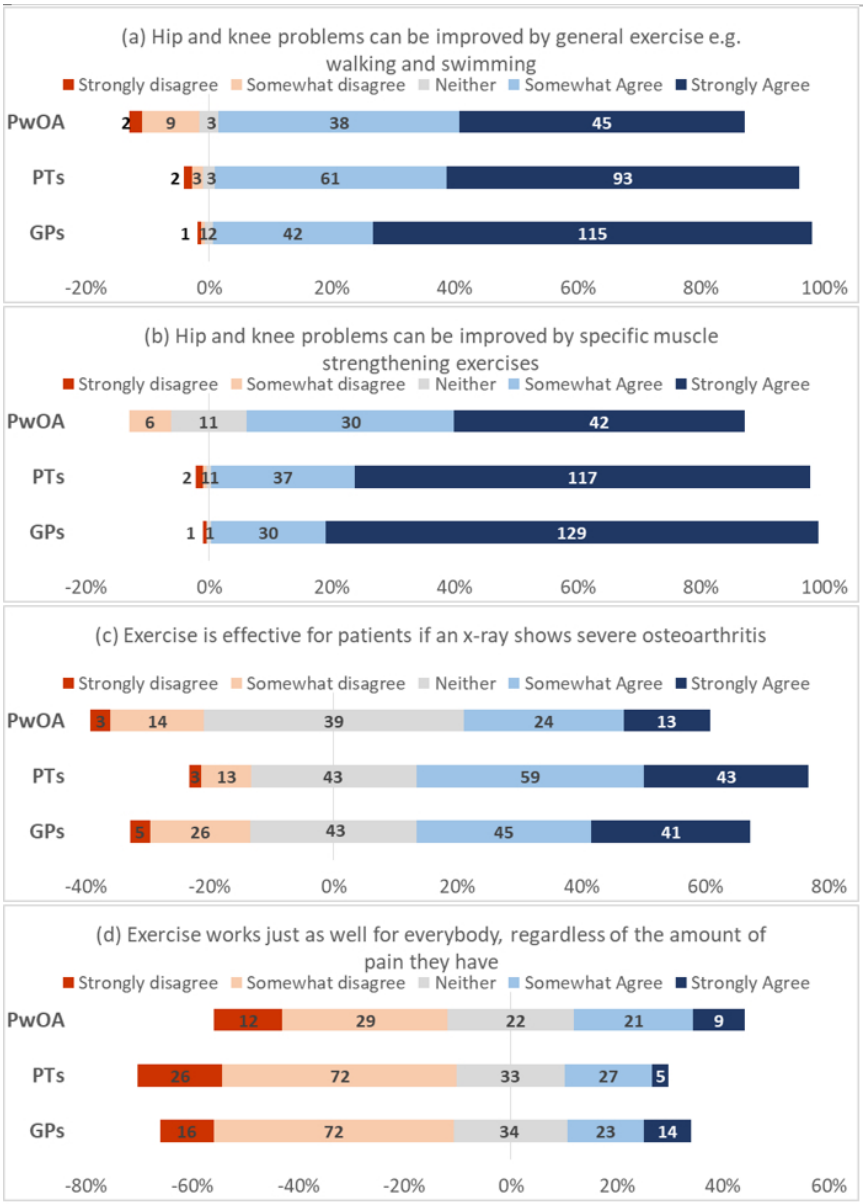

Figure 3. 100% stacked bar chart showing Likert scale results with count for each stakeholder on belief statements (a-d) related to exercise effectiveness. GP, general practitioner; PT, physiotherapist; PwOA, people with osteoarthritis.

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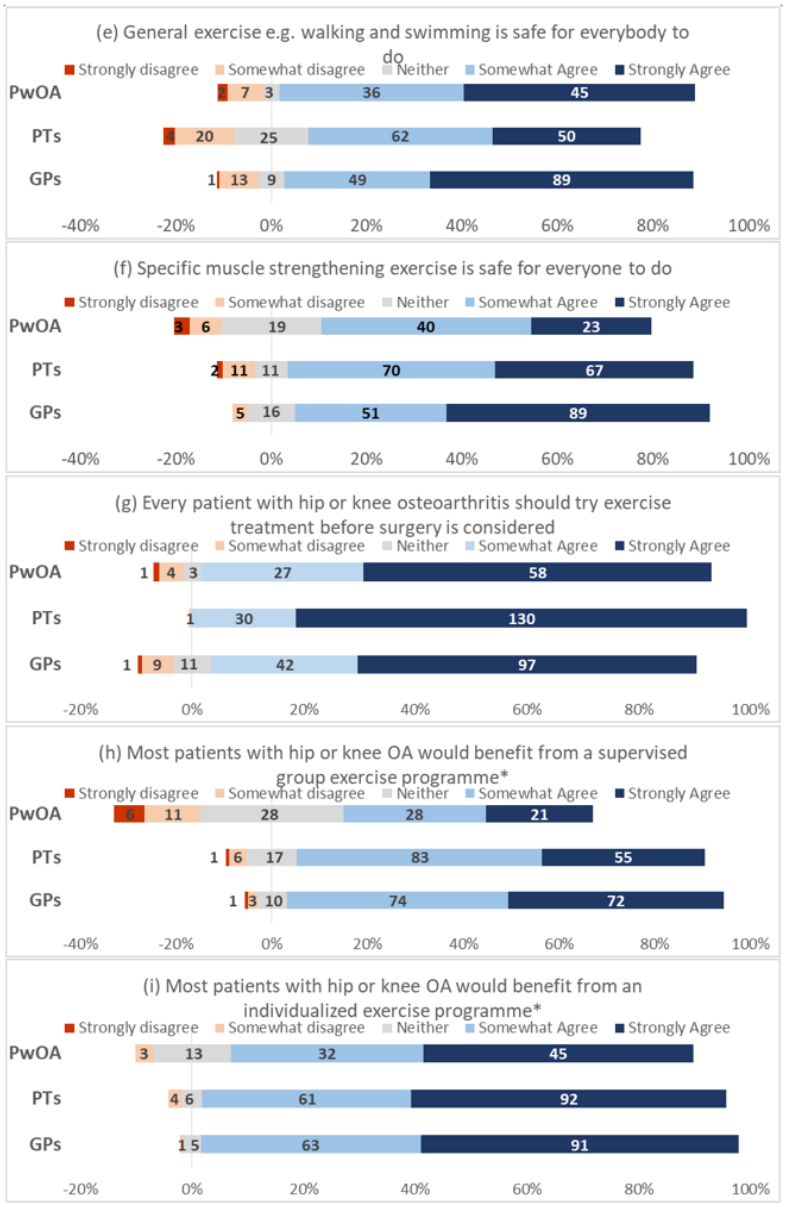

Figure 4. 100% stacked bar chart showing Likert scale results with count for each stakeholder on belief statements (e-i) related to exercise safety and delivery. *Questions for PwOA phrased slightly differently: "The best way to learn about exercise is in a supervised group setting with people who have similar pain" and "The best way to learn about exercise is in a one-on-one setting with a health professional". GP, general practitioner; PT, physiotherapist; PwOA, people with osteoarthritis

354x545mm (47 x 47 DPI)

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Survey 1: Beliefs, Barriers and Enablers to Exercise Prescription for Hip and Knee Osteoarthritis in General Practice in Ireland

Instructions for completing this questionnaire

- When completing the questionnaire, please try and provide answers that most accurately reflect your usual clinical practice. There are no 'correct' or 'incorrect' answers.
- Please do not consult any literature while completing this questionnaire.

Section 1. Information about you

1. How long have you been qualified as a General Practitioner?
   ☐ Less than 5 years experience
   ☐ 5-10 years experience
   ☐ Greater than 10 years experience
2. How many GP's work in your practice (including yourself)
3. Are you: ☐ Female ☐ Male ☐Other ☐Prefer not to disclose
4. Is your primary practice: ☐ urban ☐ rural ☐ mixed
5. Is your practice:
   ☐ Primary care reimbursement scheme only
   ☐ Private practice only
   ☐ Mixed
6. Since graduating from University, do you remember receiving any specific postgraduate training in musculoskeletal (MSK) which contained education about hip or knee osteoarthritis or chronic pain? (By this we do not mean clinical placements or jobs in rheumatology or orthopaedics)
   ☐ Yes ☐ No
   If yes, what type of training?
   ☐ CME small groups (or guest speaker)
   ☐ Diploma in MSK
   ☐ M.Sc. in Sports & Exercise Medicine
   ☐ Sports Medicine Faculty conferences
   ☐ Private Hospital Day Course
   ☐ Therapeutic Intra Articular and Soft Tissue Injection and Assessment Course
   ☐ Specific Modules on MSK on your GP training Scheme
   ☐ Other _____
7. How would you rate your confidence in treating hip and knee osteoarthritis?
   ☐ Not confident
   ☐ Slightly confident
   ☐ Confident
   ☐ Very confident
   ☐ Extremely confident
8. Do you have, or have you ever suffered from chronic knee or hip pain yourself?
   ☐ Yes ☐ No
9. What percentage of your typical caseload is made up of patients with hip and/or knee pain?
   ☐1-5% ☐ 6-25% ☐ 26-50% ☐ 51-75% ☐ >75%

Section 2. Exercise beliefs for hip and knee osteoarthritis

2.1 Where do you get your knowledge of care advancements for persons with knee or hip osteoarthritis? (Tick all that apply)

☐ Published guidelines or recommendations (e.g. NICE, EULAR, OARSI)
☐ Reading medical journals
☐ Twitter or other social media
☐ Podcasts
☐ CME networks or other GP networks
☐ Conference attendance
☐ Course attendance

Supplemental File 1

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

☐ Other _____

We are interested in your views about the role of exercise in the treatment of hip and knee osteoarthritis. Please indicate the extent to which you agree or disagree with the statements given by ticking or placing an 'X' in one box per row.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.2 Hip and knee problems are improved by general exercise e.g. walking and swimming					
2.3 Hip and knee problems are improved by specific muscle strengthening exercises					
2.4 General exercise e.g. walking and swimming is safe for everybody to do					
2.5 Specific muscle strengthening exercise is safe for everyone to do					
2.6 Every patient with hip or knee OA should try conservative exercise treatment before more invasive procedures are recommended					
2.7 Exercise for hip or knee OA is most beneficial when it is tailored to meet individual patient needs					
2.8 A standard set of exercises is sufficient for every patient with hip or knee OA					
2.9 Education on lifestyle change is important for patients with OA					
2.10 Education on strategies for self-management of pain are important for patients with OA					
2.11 It is important that people with OA increase their overall activity levels					
2.12 Exercise is effective for patients if an x-ray shows severe knee osteoarthritis					
2.13 Exercise for OA is more effectively provided by physiotherapists than GPs					
2.14 Time constraints prevent the provision of advice on individual exercises for OA					
2.15 Exercise for OA should preferably be used after drug treatment has been tried					
2.16 Exercise for chronic knee pain would be used more frequently if access to physiotherapy was easier					

Section 3. Clinical scenario of a patient with osteoarthritis

Presented below is a clinical scenario of a patient with suspected knee osteoarthritis who presents to you with this problem for the first time. All questions in this section relate to the care you would give this particular patient.

Patient:	Mrs. Murphy, 60-year old shop owner, no health insurance
Complaint:	Right sided knee pain
History:	Gradually worsening over 3 years
	No history of trauma
	Pain when walking and at rest, worst when climbing stairs.
	No night pain.
	Activities of daily living are manageable. Difficulty gardening.
	Finding work increasingly difficult due to the stairs
	Tried going to gym but stopped – thinks was making pain worse.
	Otherwise well – mild hypertension
	Has tried ibuprofen with no effect
Medication:	Amlodipine
Examination:	Mild Obesity with Body Mass Index of 33
	Knees – bilaterally no effusions.
	Joint line tenderness on palpation.
	No pain or reduced mobility around knee cap
	Slightly reduced flexion of the right knee.
	Hips – no abnormality detected

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3.1 Select some **key words** you would use to describe their diagnosis **to the patient**. (Select all that apply)

☐ Mild	☐ Cartilage thinning	☐ Fear avoidance
☐ Moderate	☐ Overloading	☐ Pain sensitivity
☐ Severe	☐ Overweight	☐ Bone on bone
☐ Degeneration	☐ Deterioration	☐ Weakness
☐ Wear and tear	☐ Normal ageing	☐ Joint swelling
☐ Arthritis	☐ Joint damage	Other _____

3.2 What investigation(s)/assessment(s), if any, would you do/order for this patient at this point

☐ None ☐ Knee x-ray ☐ Blood tests ☐ Other _____

3.3 At this consultation, what approaches would you use, or suggest, to manage this patient? (please tick all that apply)

☐ None	☐ Advice on footwear	☐ Exercise
☐ Ice	☐ General activity	☐ Injection of steroids
☐ Heat	☐ Provision of walking aid	☐ Oral NSAID
☐ Rest	☐ Weight Loss	☐ Topical NSAID
☐ Weak opioids	☐ Paracetemol	☐ Glucosamine/Chondroitin

☐ Other, please state _____

3.4 If you selected exercise above, what form would this take? (Select all that apply)

☐ Suggest general exercise and activity
☐ Suggest specific exercises
☐ Give a leaflet or online resource
☐ Refer to physiotherapy or other exercise specialist
☐ Other (please state) _____

3.5 In an ideal world without barriers, would you refer the patient to physiotherapy or orthopaedic consultant or neither, at this stage?

☐ Physiotherapy
☐ Orthopaedic consultant
☐ Neither

3.6 In your current practice, would you refer this patient to physiotherapy at this stage?

☐ Yes
☐ No

If yes, why? (Select all that apply)

☐ Deemed an appropriate candidate for supervised conservative treatment
☐ Ease of access to physiotherapy
☐ Lack of time to appropriately address exercise needs in practice
☐ Lack of response to NSAIDS
☐ Other _____

If no, why not? (Select all that apply)

☐ Not an appropriate candidate for conservative treatment
☐ Long waiting lists and poor access to physiotherapy
☐ Other interventions are a priority
☐ Exercise will make the pain worse
☐ Patient has tried exercise
☐ I would prefer to examine further therapeutic options first (e.g., develop a pain management plan or give an intra articular steroid injection)
☐ Other _____

3.7 In your current practice, would you refer this patient to an orthopaedic consultant at this stage?

☐ Yes
☐ No

If yes, why? (Select all that apply)

☐ Deemed an appropriate candidate for surgery right now

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☐ Will likely need a joint replacement in a few years so put on waiting list now
☐ Need a specialist opinion
☐ Other _____

If no, why not? (Select all that apply)
☐ More conservative treatmenta have not been exhausted
☐ Symptoms not severe enough to warrant joint replacement
☐ Waiting list too long
☐ Other _____

3.8 Would you refer the patient to see someone else, either in the primary or community team or into secondary care, at this point?
☐ Yes
☐ No
If yes, who? _____

Section 4. Barriers and enablers to exercise prescription and referral in general practice

In your practice and experience of treating patients with osteoarthritis, what are the main barriers to exercise prescription or referral? (Please select all that apply)
☐ Insufficient time in consultation
☐ Insufficient expertise
☐ Uncertainty about the effects of exercise
☐ Uncertainty about the most appropriate exercise type
☐ Uncertainty about the safety of exercise
☐ Cost and accessibility of physiotherapy for patient
☐ Physiotherapy waiting lists are too long
☐ Lack of a standardized physiotherapy programme for OA in the region
☐ Patients prefer other management options
☐ Patients want an orthopaedic consultant referral
☐ English language barrier for patients
☐ Severity of disease (symptoms too mild)
☐ Severity of disease (symptoms too severe)
☐ Older age of patient
☐ Presence of many comorbidities
☐ Other _____

What enablers would help you to prescribe or refer a patient with osteoarthritis to exercise in your practice?

☐ Increased formal post-qualification education e.g. diploma or masters
☐ Increased post-qualification training e.g. workshops, videos
☐ Increased exercise education during GP training
☐ More consultation time to provide exercise prescription
☐ Shorter waiting lists and improved access to physiotherapy
☐ Presence of an evidence-based physiotherapy-supervised group exercise programme for osteoarthritis in the locality
☐ Patients who recognize the importance of strategies for self-management of pain using appropriate exercise recommendations
☐ Low cost community-based exercise programmes
☐ Renumeration for exercise prescription and follow up consultations
☐ Other _____

Thank you for taking the time to complete this questionnaire. Your time and participation is greatly appreciated.

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Survey 2: Beliefs, Barriers and Enablers to Group Exercise Programme Delivery for Hip and Knee Osteoarthritis in Physiotherapy Practice in Ireland

The questionnaire is divided into 3 sections and should take approximately **7 minutes** to complete.
Instructions for completing this questionnaire

- When completing the questionnaire, please try and provide answers that most accurately reflect your usual clinical practice. There are no 'correct' or 'incorrect' answers.
- Please do not consult any literature while completing this questionnaire.

Section 1. Information about you

1. How long have you been qualified as a Physiotherapist?
   ☐ Less than 5 years experience
   ☐ 5-10 years experience
   ☐ Greater than 10 years experience
2. How many Physiotherapists work in your clinic (including yourself) _____
3. Are you: ☐ Female ☐ Male ☐ Other ☐ Prefer not to disclose
4. Is your primary work setting:
   ☐ Public hospital
   ☐ Private hospital
   ☐ Primary, community and continuing care
   ☐ Private practice clinic
   ☐ Education
   ☐ Other (please state) _____
5. Have you undertaken any specific post-qualification training, which involved education about hip or knee osteoarthritis or chronic pain? (By this we do not mean clinical placements or jobs in rheumatology or orthopaedics) ☐ Yes ☐ No

If yes, what type of training? (Provide additional details if you wish to expand)

☐ In-service training Additional details _____
☐ M.Sc. (taught) in this/similar field Additional details _____
☐ M.Sc. (research) in this/similar field Additional details _____
☐ PhD in this/similar field Additional details _____
☐ Day, weekend or online course (please name most relevant)
_____
☐ Other _____

6. How would you rate your confidence in treating hip and knee osteoarthritis?
   ☐ Not confident
   ☐ Slightly confident
   ☐ Confident
   ☐ Very confident
   ☐ Extremely confident
7. Do you have, or have you ever suffered from chronic knee or hip pain yourself? ☐ Yes ☐ No
8. What percentage of your typical caseload is made up of patients with hip and/or knee osteoarthritis?
   ☐ 1-5% ☐ 6-25% ☐ 26-50% ☐ 51-75% ☐ >75%

Section 2. Exercise beliefs for hip and knee osteoarthritis

2.1 Where do you access your knowledge of management for persons with knee or hip osteoarthritis? (Tick all that apply)

☐ Published guidelines or recommendations (e.g. NICE, EULAR, OARSI)
☐ Clinic protocols, discussion with peers or in-services
☐ Reading published research articles
☐ Twitter or other social media
☐ Podcasts
☐Blogs
☐Infographics
☐Videos
☐ ISCP specialist groups and other network events
☐ Conference attendance
☐ Course attendance

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☐ Other _____

Please now rank in order your preferred resources to learn from

We are interested in your views about the role of exercise in the treatment of hip and knee osteoarthritis. Please indicate the extent to which you agree or disagree with the statements given by ticking one box per row.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.2 Hip and knee problems are improved by general exercise e.g. walking and swimming					
2.3 Hip and knee problems are improved by specific muscle strengthening exercises					
2.4 Hip and knee problems are improved by focusing on motor or neuromuscular control of the joints during exercise					
2.5 General exercise e.g. walking and swimming is safe for most patients to do					
2.6 Specific muscle strengthening exercise is safe for most patients to do					
2.7 Neuromuscular control exercises are safe for most patients to do					
2.8 Every patient with hip or knee OA should try conservative exercise treatment before surgery is considered					
2.9 Exercise for hip or knee OA is most beneficial when it is tailored to meet individual patient needs					
2.10 A standard set of exercises with individual progression is sufficient for every patient with hip or knee OA					
2.11 Education on lifestyle change is important for patients with OA					
2.12 Education on strategies for self-management of pain are important for patients with OA					
2.13 It is important that people with OA increase their overall activity levels					
2.14 Exercise is effective for patients if an x-ray shows severe knee osteoarthritis					
2.15 Most patients with hip or knee OA would benefit from a supervised group exercise programme					
2.16 Most patients with hip or knee OA would benefit from an individualized exercise programme					

Section 3. Barriers and enablers to exercise programme delivery in physiotherapy practice

3.1 Please select the current level of government COVID19 restrictions in place as you are completing this survey

☐ Level 1 ☐ Level 2 ☐ Level ☐ Level 4 ☐ Level 5

3.2 **Pre-COVID19** restrictions in March 2020, were you or your clinic providing **group exercise classes** for patients with hip or knee osteoarthritis? ☐ Yes ☐ No

If Yes, what was the average number of classes per week? _____

If No, were you interested in offering group exercise classes for osteoarthritis in an ideal world and **if no barriers** existed?

☐ Yes

☐ No

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3.3 **Pre-COVID19** restrictions in March 2020, **what** were the main **barriers** to providing group exercise programmes for patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Insufficient space and equipment resources
☐ Insufficient personnel (staff) resources
☐ Insufficient referrals or low OA caseload
☐ Patients want individualized programmes
☐ Patients prefer other management options e.g. manual therapy
☐ Insufficient expertise
☐ Uncertainty about the effects of exercise
☐ Uncertainty about the most appropriate exercise type
☐ Uncertainty about the safety of exercise
☐ Cost for patient
☐ Access for patient (e.g. travel, parking, time)
☐ Scheduling conflict related to patient working hours and clinic hours
☐ Lack of a standardised programme or protocol for exercise for OA
☐ English language barrier for patients
☐ Lack of support from colleagues or managers
☐ Other _____

3.4 Are you currently offering **group exercise classes** for patients with hip or knee osteoarthritis and **to what capacity**?

☐ Yes, face to face at full capacity
☐ Yes, face to face at reduced capacity compared to Pre-COVID19 restrictions
☐ Yes, online classes only
☐ Yes, combination of face-to-face and online
☐ No

3.5 **Under current restrictions**, are there any **additional barriers** to providing **face-to-face** group exercise programmes for patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Government restrictions currently do not allow for group classes
☐ Hospital or clinic protocols currently do not allow for group classes
☐ Patients do not want to attend clinic
☐ Not enough resources for adequate distancing for class members
☐ Sanitization procedures are too time consuming
☐ Own COVID-related safety concerns
☐ Other _____

3.6 **Under current restrictions**, are there any **additional barriers** to providing **online** group exercise programmes for patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Lack of IT resources in clinic (e.g. online platform, webcams, high speed Wi-Fi)
☐ Lack of personnel (staff) with IT knowledge
☐ Patients lack IT resources or knowledge
☐ Patients prefer to wait until they can access face-to-face treatment
☐ Uncertainty about the effectiveness of online group exercise
☐ Own personal preference
☐ Other _____

3.7 What **enablers** would help you to provide **face to face group exercise** classes to patients with osteoarthritis in your practice if COVID restrictions were not a factor? (Please select all that apply)

☐ None
☐ More university post-qualification education e.g. diploma or masters
☐ More other post-qualification training e.g. short courses, workshops, videos
☐ More education on group exercise delivery during physiotherapy training
☐ Appropriate referrals from GP or other sources
☐ GPs who impart knowledge regarding benefits of exercise to patients upon referral

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☐ Resources to deliver quality educational material regarding self-management alongside exercise
☐ More support from colleagues or managers
☐ Other_____

3.8 What **enablers** would help you to provide an option of **online** group exercise classes to patients with osteoarthritis in your practice? (Please select all that apply)

☐ None
☐ Improved IT infrastructure in clinic (e.g. laptops, webcams)
☐ IT skills resources for delivering online programmes (e.g. tutorials, do's and don'ts)
☐ Access to IT resources (e.g. tutorials) to provide patients with
☐ Improved Wi-Fi and bandwidth nationwide
☐ Strong evidence for effectiveness of existing online programmes
☐ An online registry allowing collection of patient outcomes pre- and post- programme
☐ Other _____

3.9 Would you be interested in receiving **training** (1.5 day workshop) to effectively implement and deliver a standardized, international, evidence-based group exercise and education programme with online and face-to-face options for patients with osteoarthritis in your clinic?

☐ Extremely interested
☐ Very interested
☐ Moderately interested
☐ Slightly interested
☐ Not at all interested
If not interested, why? _____

3.10 If interested, how much would you be willing to pay for this continuous professional development training?

☐ €100-150
☐ €151-200
☐ €201-250
☐ €251-300
☐ €301-350
☐ More than €350
☐ N/A

Thank you for taking the time to complete this questionnaire. Your time and participation is greatly appreciated.

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Survey 3: Survey on the Role of Exercise for Hip and Knee Osteoarthritis in Adults in Ireland

The questions below are divided into 3 sections. Please complete the questions to the best of your ability.

Section 1. Information about you

1. Are you: ☐ Female ☐ Male ☐ Other ☐ Prefer not to disclose
2. Which age category do you fall into?
   - ☐ 30 to 39 years
   - ☐ 40 to 49 years
   - ☐ 50 to 59 years
   - ☐ 60 to 69 years
   - ☐ 70 to 79 years
   - ☐ 80 to 89 years
   - ☐ 90 years or older
3. Which province in Ireland do you reside in? ☐ Munster ☐ Ulster ☐ Connacht ☐ Leinster

****If "Ulster" is selected, question 3(b) will appear.**

3(b) Do you access your healthcare in:
- ☐Northern Ireland (NHS)
- ☐Republic of Ireland (HSE)
- ☐A combination of both

4. Which of the following best describes where you live?
   - ☐ Inner city
   - ☐ Suburb of a city
   - ☐ Town
   - ☐ Village
   - ☐ Open country
   - ☐ Island off Ireland
5. Have you ever been told by a health professional that you have a diagnosis of the following?(Select all that apply)

☐ Arthritis	☐ Diabetes Mellitus (type 1 or 2)
☐ Osteoarthritis	☐ Kidney or liver disease
☐ Wear and tear	☐ Anemia (reduced number of red blood cells)
☐ Degenerative changes	☐ Other blood disease
☐ Rheumatoid arthritis	☐ Cancer
☐ Hypertension	☐ Depression
☐ Heart Disease	☐ Anxiety
☐ Ulcer or other bowel diseases	☐ Other mental health disorder
☐ Neurological disease e.g. Parkinson's/MS	
☐ Respiratory diseases e.g. COPD	☐ Thyroid Disease
☐ Hemochromatosis	☐ Fibromyalgia
☐ Other health condition _____	

6. Have you had pain and joint symptoms in any of the following joints for **6 months or more** (select all that apply)

☐Right Knee	☐Left Knee
☐Right Hip	☐Left Hip
☐Right Ankle	☐Left Ankle
☐Right Shoulder	☐Left Shoulder
☐Right Elbow	☐Left Elbow
☐Right Wrist	☐Left Wrist
☐Right Hand/Fingers	☐Left Hand/Fingers
☐Lower Back	☐Other, please describe_____
☐Mid Back	
☐Neck	

7. Have you ever had joint replacement surgery for any of your painful joints? Please select below the joints that have been replaced.

☐Right Knee	☐Left Knee
☐Right Hip	☐Left Hip
☐Right Ankle	☐Left Ankle
☐Right Shoulder	☐Left Shoulder

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☐Right Elbow ☐Left Elbow
☐Right Wrist ☐Left Wrist
☐Right Hand/Fingers ☐Left Hand/Fingers
☐Other, please describe_____

8. Of your hip and/or knee joints that have **NOT** been replaced, which joint are you most bothered by? (select one)

☐Right Knee ☐Left Knee
☐Right Hip ☐Left Hip

All remaining questions will now be related to the joint that you have chosen.

9. How long have you been experiencing pain in your [insert chosen joint]?
   - ☐ 6 months – 1 year
   - ☐ 1 – 2 years
   - ☐ 2 – 3 years
   - ☐ 3 – 4 years
   - ☐ 4 – 5 years
   - ☐ More than 5 years
10. Have you seen or spoken to your GP about your painful [insert chosen joint]? ☐Yes ☐No
11. Have you ever had an x-ray of your [insert chosen joint]? ☐ Yes ☐ No
12. Has your GP ever referred you to an **orthopaedic consultant** for your [insert chosen joint]?
    - ☐ Yes
    - ☐ No
    - ☐ Currently on a waiting list (private consultant referral)
    - ☐ Currently on a waiting list (public consultant referral)

** If on a waiting list, how long have you been waiting?

- ☐ Less than 6 months
- ☐ 6 months – 1 year
- ☐ 1 year – 1.5 years
- ☐ 1.5 years – 2 years
- ☐ More than 2 years

13. Has your GP ever referred you to a **physiotherapist** for your [insert chosen joint]?
    - ☐ Yes
    - ☐ No
    - ☐ Currently on a waiting list (private consultant referral)
    - ☐ Currently on a waiting list (public consultant referral)

    * If on a waiting list, how long have you been waiting?

    - ☐ Less than 6 months
    - ☐ 6 months – 1 year
    - ☐ 1 year – 1.5 years
    - ☐ 1.5 years – 2 years
    - ☐ More than 2 years
14. How would you rate the pain and symptoms you are experiencing in your hip and/or knee on an average day?
    - ☐ No pain or symptoms
    - ☐ Mild pain and symptoms
    - ☐ Moderate pain and symptoms
    - ☐ Severe pain and symptoms
15. Have you EVER tried any of the following specifically for your [insert chosen joint]?

Muscle strengthening exercise (e.g. using weight/resistance band)	☐No, never	☐Yes, currently using	☐Yes, stopped using
Aerobic exercise (e.g. cycling, walking, fitness class)	☐No, never	☐Yes, currently using	☐Yes, stopped using
Information/Education course (e.g. self-management programme)	☐No, never	☐Yes, currently using	☐Yes, stopped using
Making efforts to lose weight	☐No, never	☐Yes, currently using	☐Yes, stopped using

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Section 2. Exercise beliefs for hip and knee osteoarthritis

We are interested in your views about the role of exercise in the treatment of hip and knee osteoarthritis. Please indicate how much you agree or disagree with the statements given by selecting one option per question.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.1 Hip and knee problems can be improved by general exercise e.g. walking and swimming					
2.2 Hip and knee problems can be improved by specific muscle strengthening exercises					
2.3 General exercise e.g. walking and swimming is safe for everybody to do					
2.4 Specific muscle strengthening exercise is safe for everyone to do					
2.5 Every patient with hip or knee osteoarthritis should try exercise treatment before surgery is considered					
2.6 Patients should learn more about how to self-manage their pain and symptoms using exercise and physical activity					
2.7 The best way to learn about exercise is in a supervised group setting with people who have similar pain (Pre-COVID-19 restrictions)					
2.8 The best way to learn about exercise is in a one-on-one setting with a health professional (Pre-COVID-19 restrictions)					
2.9 Exercise is effective for patients if an x-ray shows severe knee osteoarthritis					
2.10 Exercise works just as well for everybody, regardless of the amount of pain they have					

Section 3. Barriers and enablers to exercise for hip and knee osteoarthritis

In this section we want to know more about your exercise experience and what kinds of things would prevent you or help you do more exercise

3.1 How many times a week do you exercise (e.g. 30 minute walk)?

☐ 3 or more days per week
☐ Less than 3 days per week
☐ I don't exercise

3.2 Has a health professional ever given you specific exercises for your [insert chosen joint]?

☐ Yes
☐ No
☐ Not sure

*If Yes, what type of health professional? (select all that apply)

☐ Physiotherapist
☐ GP
☐ Orthopaedic surgeon
☐ Nurse
☐ Personal trainer
☐ Other, please name _____

*If Yes, what type of exercise?

☐ Home-based individual exercises
☐ Group exercise class for osteoarthritis
☐ Other, please state _____

*If Yes, did you find the exercise beneficial?

☐ Yes
☐ No
☐ Not sure

3.3 Please select the current level of government COVID19 restrictions in place as you are completing this survey

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☐ Level 1 ☐ Level 2 ☐ Level ☐ Level 4 ☐ Level 5 (strictest restrictions)

3.4 Thinking about life **without COVID19** restrictions, **what** are the main **barriers** that would prevent you from exercising? (Please select all that apply)

☐ Pain or other joint symptoms
☐ I need assistance for mobility e.g. walking stick, wheelchair
☐ Finding time to exercise
☐ Lack of enjoyment from exercise
☐ Lack of exercise buddy or support network
☐ Wet or cold weather
☐ Other health problems
☐ Other disability e.g. visual impairment
☐ Cost of a gym membership or physiotherapy visit
☐ Cost of active wear or equipment
☐ I don't know the best types of exercise to do
☐ I don't know who to contact to learn more or do more exercise
☐ Uncertainty about the safety of exercise for joint pain
☐ Uncertainty about the benefit of exercise for joint pain
☐ Negative body image
☐ Access to facilities (e.g. availability, travel, parking)
☐ Work commitments
☐ Family commitments or other responsibilities
☐ Age
☐ Fear of injury
☐ Tiredness and fatigue
☐ Depression
☐ Other _____

3.5 Thinking about life **without COVID19** restrictions, what types of things would **help you to exercise more**? (Please select all that apply)

☐ Better knowledge of the best type of exercise to do
☐ Access to exercise that is supervised by a health professional
☐ Social aspect e.g. group exercise with other people with hip or knee pain
☐ More confidence in your joint
☐ Exercise recommendations from a GP
☐ Exercise recommendations from a physiotherapist
☐ More support from family or friends
☐ Warm and dry weather for outdoor exercise
☐ Low cost community exercise programmes
☐ Safe exercise environment (e.g. well-lit pathways)
☐ Other_____

3.6 Thinking about life **without COVID-19,** how interested would you be in attending a 6-week, twice per week, physiotherapy-supervised group exercise and education class for your hip or knee pain **at a clinic or community centre**?

☐ Extremely interested
☐ Very interested
☐ Moderately interested
☐ Slightly interested
☐ Not at all interested

If not interested, why? _____

3.7 Thinking about **current restrictions**, how interested would you be in taking part in a 6-week, twice per week, **ONLINE** physiotherapy-supervised group exercise and education class for you hip or knee pain?

☐ Extremely interested
☐ Very interested
☐ Moderately interested
☐ Slightly interested

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☐ Not at all interested
If not interested, why? _____

3.8 Do you have any experience with online-delivered healthcare or telerehabilitation from a GP or other health professional?
☐Yes
☐ No

3.9 What are the **barriers** that would prevent you taking part in an **online exercise** class? (Please select all that apply)
☐ Lack of technology equipment (e.g. laptop, smartphone or tablet, webcams)
☐ Lack of confidence in using computers, laptops etc.
☐ Wi-Fi / Broadband connection is not good enough
☐ Preference to wait until I can access face-to-face treatment
☐ Uncertain about how online group exercise would work
☐ Lack of space in home environment to perform exercises
☐ English language barriers
☐ Lack of time to take part
☐ Other _____

3.10 What would **help you** to take part in an **online** group exercise class with other people with osteoarthritis? (Please select all that apply)
☐ An initial one-to-one session with a physiotherapist to get familiar with the process
☐ Resources (e.g. videos) with explanations of how to get started
☐ Improved Wi-Fi and bandwidth
☐ Examples and testimonials from patients who have finished the classes
☐ Opportunities to chat online with other patients before and after the class
☐ Support from family members to get set up in your home
☐ A laptop or tablet
☐ Other _____

3.11 If interested, how much would you be willing to pay to take part in these exercise classes (price in euros for entire 14-15 session programme)?
☐ €0-25
☐ €26-50
☐ €51-100
☐ €101-150
☐ €151-200
☐ > €200

Thank you for taking the time to complete this questionnaire. Your time and participation is greatly appreciated.

Supplemental File 2

Guideline-based exercise management for hip and knee osteoarthritis: differences in healthcare professional and patient beliefs

Supplemental Table: Multivariable linear regression models to determine if positive beliefs about exercise in PwOA are associated with (1) referral to physiotherapist by a GP and (2) if they have seen a physiotherapist for their joint pain.

Dependent Variable: Number of exercise belief statements agreed with								
Variables Model 1 [a]	**B**	**S.E.**	**Partial Correlation**	**VIF**	**Sig.**	**Exp(B)**	**95% CI for EXP(B) Lower**	**Upper**
Has your GP ever referred you to a physiotherapist for your painful joint?	0.700	0.400	0.187	1.124	0.084	0.185	-0.095	1.496
Sex	-0.620	0.374	-0.177	1.015	0.101	-0.166	-1.363	0.124
How long have you been experiencing pain in your joint?	-0.163	0.100	-0.174	1.130	0.106	-0.173	-0.361	0.035
Number of comorbidities	-0.314	0.123	0.268	1.027	0.012	-0.259	-0.557	-0.070
Constant	7.687	0.604	-	-	0.000	-	6.485	8.888
Model 2 [b]								
Have you seen a physiotherapist for your painful joint?	1.060	0.383	0.288	1.138	0.007	0.287	0.299	1.821
Sex	-0.723	0.362	-0.212	1.003	0.049	-0.194	-1.444	-0.003
How long have you been experiencing pain in your joint?	-0.204	0.099	-0.219	1.163	0.042	-0.216	-0.400	-0.008
Number of comorbidities	-0.293	0.119	-0.257	1.026	0.016	-0.241	-0.530	-0.055
Constant	7.680	0.585	-	-	0.000	-	6.034	9.653

[a]Model variables removed due to non-significance (1): *How long have you been experiencing pain in your joint?*, *How would you rate the pain and symptoms you are experiencing in your hip and/or knee on an average day?*.
[b]Model variables removed due to non-significance (2): *How would you rate the pain and symptoms you are experiencing in your hip and/or knee on an average day?.* B, beta coefficient; GP, general practitioner; OA, osteoarthritis; PT, physiotherapist; PwOA, people with osteoarthritis; S.E., standard error; VIF, variance inflation factor.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4-5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4-5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*5-7*
Bias	9	Describe any efforts to address potential sources of bias	n/a
Study size	10	Explain how the study size was arrived at	n/a
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	6-7
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6-7
		(*e*) Describe any sensitivity analyses	n/a
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1

Outcome data	15*	Report numbers of outcome events or summary measures	Page 7, Figure 1-3
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 3
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	14-15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16,17
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.