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Association between perceived self-efficacy and physical activity level and physical fitness in patients with knee osteoarthritis

- secondary analysis from a randomized controlled trial

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Forord

Dette har vært et rart år. Det er rart å føle seg lei av uforutsigbarhet, når det nesten ikke har skjedd noen ting hele året. Nedstenging har for meg betydd mindre jobb, mindre reising og mindre sosial aktivitet. Alt dette har vært utrolig kjedelig. Heldigvis har jeg kunnet jobbe med masteroppgaven. Det føles bra å være engasjert i noe, og dette året har bare gjort meg tryggere på at jeg har valgt rett fagfelt å jobbe med og utvikle meg videre i.

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Jonas Gudmundsen Lund
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Association between perceived self-efficacy and physical activity level and physical fitness in patients with knee osteoarthritis.

Abstract

Background: Both aerobic- and strengthening exercise are recommended as first-line treatment for patients with knee osteoarthritis (OA) due to being effective treatments for pain and function. Despite increased effort on implementing this knowledge in clinical practice, many patients still do not exercise, and OA patients are in general more sedentary than the healthy population. Self-efficacy has shown to affect adherence to exercise as well as physical activity (PA) level, but improving self-efficacy is seldom a part of the rehabilitation. The aim of this study was to investigate the relationship between perceived self-efficacy and PA level and physical fitness in people with knee OA.

Methods/Design: This is a secondary analysis using baseline data from an ongoing randomized controlled trial (RCT) on the efficacy of exercise on knee-related quality of life, pain, and function in patients with knee OA. The 168 study participants have been included from the primary and secondary health care in the South-Eastern part of Norway. Men and women 35-70 years of age with mild to moderate knee OA were included. Eligible candidates were excluded if they did regularly strength training or cycling 2-3 days a week, had a BMI >35, if they had planned surgery the next 6 months, or serious diseases such as heart disease or cancer. PA level was measured using a questionnaire with response alternatives for frequency, intensity and duration. Perceived self-efficacy was assessed using the Norwegian version of the Arthritis self-efficacy scale and physical fitness was measured with a maximal oxygen consumption (VO_{2max}) test performed with an ergometer cycle. Multiple logistic regression analyses calculating odds ratio (OR) or beta value (B) and 95% confidence intervals (CI), and multiple linear regression analyses calculating beta value (B) and 95% CI were applied as appropriate. Age, sex, body mass index (BMI), education level and pain were used as covariates in regression analyses of the associations between self-efficacy and respectively PA level and physical fitness.

Results: The association between PA level and self-efficacy for pain showed an OR (95%CI) of 1.06 (0.74, 1.53). Correspondingly, the association between PA level and self-efficacy for other symptoms showed OR of 1.06 (95% CI 0.61, 1.70). There was a statistically significant association between physical fitness and self-efficacy for pain (Beta value of 0.86 ((95%CI 0.18 – 1.54, p=0.013), and for self-efficacy for other symptoms and physical fitness a Beta value of 0.93 (95% CI 0.01 – 1.77, P=0.049)

Conclusion: This study found no association between perceived self-efficacy and PA level in cross-sectional data of patients with mild to moderate knee OA, but a positive association was found between perceived self-efficacy for pain and physical fitness. Self-efficacy may be an important factor to improve in treatment of patients with knee OA as self-efficacy for pain is related to physical fitness.

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Abbreviations

OA	Osteoarthritis
RCT	Randomized controlled trial
OUS	Oslo University Hospital
PA	Physical activity
VO_{2max}	Maximal oxygen consumption
ml/kg/min	Milliliters per kilogram bodyweight per minute
VO_{2peak}	Peak value of maximal oxygen consumption during test
BMI	Body mass index
NIMI	Norwegian Institute of Sports Medicine
CI	Confidence interval
n	Number of individuals/Total responses
B	Regression coefficient
REK	Regional committee for medical research-ethics
SPSS	Statistical Package for the Social Sciences
ASES	Arthritis Self-Efficacy Scale

HUNT	The Nord-Trøndelag Health Study
BJSM	British Journal of Sports Medicine
NICE	National institute for Health and Care Excellence

1. Introduction

Osteoarthritis (OA) of the knee is a progressive disease that affects the whole joint (D. J. Hunter & Bierma-Zeinstra, 2019). The prevalence of knee OA is high in Norway and globally, and it is burden is expected to grow due to the disease being chronic and people living longer (Grotle, Hagen, Natvig, Dahl & Kvien, 2008; Vos et al., 2017). Pain and stiffness are the most common symptoms, which can lead to reduced physical activity (PA) level, poor physical fitness and contribute to premature death (Neogi, 2013). Although total knee replacement may help many patients to a better quality of life, it is not suited for everyone (Bourne, Chesworth, Davis, Mahomed & Charron, 2010), it comes with increased risk of complications and a large economical cost (Kane et al., 2003). Therefore, first-line treatment for patients with knee OA is self-management and exercise (Bannuru et al., 2019; Fransen et al., 2015).

Self- management and exercise give extremely small risk for complications, small economic costs and have been shown to be effective for both pain and function (Fransen et al., 2015). Exercise may also enhance patients´ physical fitness when dosed correctly (Schulz et al., 2020). Enhanced physical fitness is protective of several lifestyle diseases (2002), and may be more important for OA patients because of the lowered physical fitness documented in clinical studies (Minor, Hewett, Webel, Dreisinger & Kay, 1988; Philbin, Groff, Ries & Miller, 1995; Sutbeyaz, Sezer, Koseoglu, Ibrahimoglu & Tekin, 2007). Despite substantial literature underscoring the importance and effect of exercise combined with instructions on how to exercise, many patients still do not exercise and struggle to meet the minimum recommended dose of PA (Dunlop et al., 2011; Farr et al., 2008; C. Gay, C. Guiguet-Auclair, C. Mourgues, L. Gerbaud & E. Coudeyre, 2019; Wallis, Webster, Levinger & Taylor, 2013). Identifying factors to improve the patients' PA level is of great importance, both for individuals' quality of life, and for the societal economic burden.

One possibly modifiable factor influencing PA level may be self-efficacy. Self-efficacy has been defined as a person's belief that he or she has the ability to accomplish or perform a task to achieve a desired outcome (Bandura, 1977). The importance of self-efficacy for endorsing and enabling behavior change among adults with chronic conditions is well established in the literature (Marks, 2014). This is not as thoroughly studied for patients with knee OA, but has great potential considering that self-efficacy is a factor that's possible to target for physiotherapists and other clinicians through several strategies (Marks, 2014).

Two important health-related factors that have shown an association with self-efficacy are PA level (Bauman et al., 2012; Choi, Lee, Lee, Kang & Choi, 2017; Degerstedt, Alinaghizadeh, Thorstensson & Olsson, 2020; Peeters, Brown & Burton, 2015) and physical fitness (M. R. Maly, Costigan & Olney, 2006). How and why they are associated is not fully understood, and the literature shows conflicting results. Self-efficacy has also been shown to be associated with adherence to exercise (Ledingham, Cohn, Baker & Keysor, 2019; Marks, 2012), which might be important to get the wanted physiological changes after a training intervention.

With the potential of influencing both exercise adherence, physical fitness and PA levels, and therefore treatment outcomes and patients´ general health, more knowledge on self-efficacy is needed in the population with knee OA.

1.1 Aims and hypotheses

The aim of this project was to investigate the relationship between perceived self-efficacy and PA level and physical fitness in people with mild to moderate knee OA.

Null hypothesis: There is no association between perceived self-efficacy and PA level in patients with knee OA
Alternative hypothesis: There is an association between perceived self-efficacy and PA level in patients with knee OA

Null hypothesis: There is no association between perceived self-efficacy and physical fitness in patients with knee OA
Alternative hypothesis: There is an association between perceived self-efficacy and physical fitness in patients with knee OA

2. Theory

2.1 Osteoarthritis of the knee: Diagnosis and individual consequences

OA is a disease that affects the whole joint, where hyaline articular cartilage, subchondral bone, ligaments, capsule, synovium and periarticular muscles may get structural alterations (D. J. Hunter & Bierma-Zeinstra, 2019). The knee is the most commonly affected joint, followed by the hand and the hip. OA is viewed as a slowly progressive, chronic disease, where symptoms can vary, fluctuate and change over time. Some of the risk factors for knee OA is increased body mass index (BMI) previous knee injury, age, being female and hand OA (Silverwood et al., 2015).

Clinical diagnosis is the standard for knee OA (D. J. Hunter & Bierma-Zeinstra, 2019). There are several different clinical diagnostic criteria, but the NICE (National institute for Health and Care Excellence) criteria have shown to identify most patients and are therefore appropriate to use (S. T. Skou, Koes, Grønne, Young & Roos, 2020). The NICE criteria are that the patient is 1) 45 years old or older AND 2) has activity-related joint pain AND 3) has either no morning joint-related stiffness or morning stiffness that last no longer than 30 minutes (UK, 2014). Radiographs are not needed for diagnosis but can be considered if the symptoms are atypical or other diagnosis are suspected.

Common symptoms of knee OA are pain, stiffness, swelling, crepitus, bony enlargement and decreased range of motion. The disease or symptoms may not be dangerous by themselves, but the consequences of the symptoms may lead to significant health problems (Calvet et al., 2016). Pain and stiffness of the knee are the most common symptoms, which can lead to inactivity, poor health and contribute to premature death (Dieppe & Lohmander, 2005; Neogi, 2013). A prospective cohort study of 3907 people over 50 years of age found that the onset of knee pain is associated with substantial and persistent reduction of physical function, compared to those who did not get knee pain (Jinks, Jordan & Croft, 2007). Pain and disability from knee OA has a substantial impact on quality of life and the psychological distress that follows the disease should not be overseen (Vitaloni et al., 2019). For example, patients with OA experience psychological distress more frequently compared with patients with other diseases such as diabetes (Penninx et al., 1996). Worse pain from knee OA is also associated with greater loss in work productivity and early retirement, causing personal economic loss as well (David J Hunter, Schofield & Callander, 2014).

2.2 Osteoarthritis of the knee: Epidemiology and global burden

OA of the knee is one of the leading causes of global disability (Cross et al., 2014; Vos et al., 2017). OA (knee, hip and hand) is the most common chronic musculoskeletal disorder reported by women in Norway, and is also one of the most common reasons for primary care use (Kinge, Knudsen, Skirbekk & Vollset, 2015). The prevalence of knee OA in Norway was 7.1% in 2008 (Grotle et al., 2008). International data shows that the global prevalence of radiographically confirmed symptomatic knee OA was estimated to be 16% in individuals of 15 years and older, and with a global incidence of 203 per 10,000 person-years in individuals aged 20 and over (Cui et al., 2020).

With an increasing global prevalence, the burden of the disease is also expected to rise (D. J. Hunter & Bierma-Zeinstra, 2019; Wallace et al., 2017). When measured as years lived with disability, OA was ranked as number 15 in 1990, and as 11 in 2010 (Cross et al., 2014). This rise may also have considerable economical and societal consequences (Gabriel, Crowson, Campion & O'Fallon, 1997; Rothfuss, Mau, Zeidler & Brenner, 1997). The medical cost may be obvious, but the productivity loss and cost of early retirement may be even more substantial. In a study including patients from The Netherlands, the productivity loss was accounting for 83% of the total cost of €871 per month((Hermans et al., 2012). The large impact of OA on work productivity looks similar across major European countries (Kingsbury, Gross, Isherwood & Conaghan, 2014).

2.2 Osteoarthritis of the knee: Treatment

It is common to refer to a treatment pyramid when explaining the different appropriate treatment options for patients with knee OA, where you go upwards in the pyramid if the previous treatment level did not bring satisfying results. This model has received criticism because this way of thinking may lead to suboptimal treatment compared to when treatments are concomitantly applied (Langworthy, Saad & Langworthy, 2010) but it is recommended as the treatment progression both in Norway and internationally.

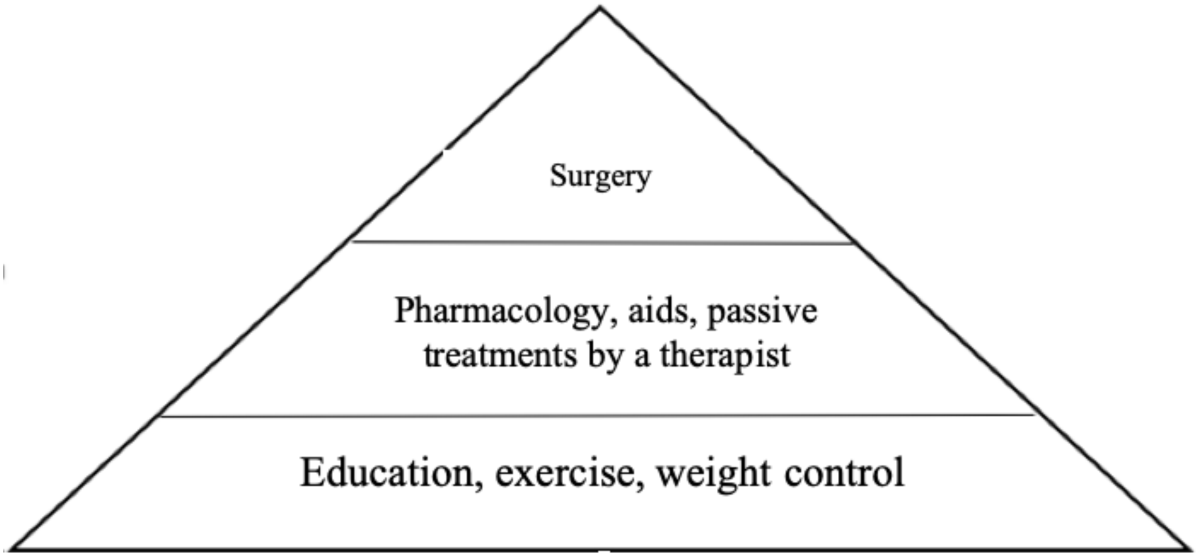

Figure 1: Treatment pyramid for knee OA

The core treatments at the bottom of the pyramid are appropriate for everyone with knee OA. Core treatment for knee OA is education about knee OA, exercise, and weight loss if appropriate (Bannuru et al., 2019). These treatments are cheap, low risk of complications and the side-effects are positive for overall health (Søren T. Skou, Pedersen, Abbott, Patterson & Barton, 2018). The next treatment level is appropriate for some with knee OA. This level includes physical therapy, pharmacology and aids like braces and walking aids. These are a little bit more costly, have low risk of complications, and have fewer beneficial side-effects. Surgery as shown at the top level of the pyramid, is appropriate for just a few with knee OA. Surgery or total knee replacement works very well for some, but is expensive, with a higher risk of complications, and with possible adverse events (Bourne et al., 2010; Kane et al., 2003).

Even though knee OA is a widely researched topic and the efficacy of treatments like exercise is well established (Verhagen et al., 2019), many patients does not receive the appropriate care (Dantas, de Fátima Salvini & McAlindon, 2020; Dhawan et al., 2014). Core treatments gets overlooked, while treatments that are no more effective than sham, and where contextual factors are more important than the intervention itself, get too much attention (Chen et al., 2020; Dantas et al., 2020; D. J. Hunter, 2018). In a recent editorial, Caneiro et al highlights the need for a patient-centered approach where biopsychosocial factors that drive pain and disability can be targeted trough non-surgical interventions (Caneiro et al., 2019). An individually tailored treatment plan is key, especially when many patients in the heterogenic knee OA population will present with one or more comorbidities (D. J. Hunter & Bierma-Zeinstra, 2019).

2.3 Physical activity in people with knee osteoarthritis

PA is defined by the World Health Organization as “any bodily movement produced by skeletal muscles that requires energy expenditure” (Caspersen, Powell & Christenson, 1985). With this definition, PA is not restricted to exercise only. It also includes activities in any domain of life, like work activities, cycling, gardening, sports or household activities. PA level is commonly measured with self-reported questionnaires or accelerometers. (Healey et al., 2020). Self-reported questionnaires are the cheapest and usually the most practical choice but lacks the objectivity that accelerometers can provide. Accurately measuring PA levels in patients with knee OA is difficult, and more high-quality assessments of tools used to measure PA is needed before it is possible to name a golden standard (Smith et al., 2019; Terwee, Bouwmeester, Van Elsland, De Vet & Dekker, 2011).

Meeting the recommendations for weekly PA levels is recommended for everyone but may have added benefits for patients with knee OA, both directly for the knee OA disease, but also for possible comorbidities. Moderate to vigorous activity provides stronger risk reduction for functional decline, but even light PA is beneficial and a dose-response relationship has been found (Sattelmair et al., 2011; White, Lee, Song, Chang & Dunlop, 2017). Burrows and colleagues found a correlation between pain and PA level whereby participants who were more physically active had less pain (Burrows, Barry, Sturnieks, Booth & Jones, 2020).

Still, a systematic review from 2013 found that only a small proportion of patients with knee OA met the PA guidelines (Wallis et al., 2013). Patients with knee OA are similarly inactive, or even more inactive, as the general population (Chloe Gay, Candy Guiguet-Auclair, Charline Mourgues, Laurent Gerbaud & Emmanuel Coudeyre, 2019; Pelle et al., 2020). Dunlop and colleagues tried to objectively measure PA levels in 1111 knee OA patients and found that only 12.9% of men and 7.7% of women met the PA guidelines (Dunlop et al., 2011). As many as 40.1% of the men and 56.5% of the women were inactive, meaning that they had done no moderate-to-vigorous PA that lasted 10 minutes or more for the last 7 days.

Being the multi-factorial disease that OA is, there may be many reasons why patients with knee OA struggle to meet the recommended guidelines (Bennell, Dobson & Hinman, 2014;

Kanavaki et al., 2017). In an exploratory study done on patients after total knee replacement, they found a tendency that fear of movement and low self-efficacy for exercise negatively impacted functional and PA outcomes (Dominick, Zeni & White, 2016). Learning more about factors that may contribute to higher PA levels among patients with knee OA is important, where even small increases may improve overall health and physical function.

2.4 Physical fitness in people with knee osteoarthritis

Another important measure for overall health and physical function is physical fitness. Physical fitness is defined as "the ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy (leisure) pursuits and to meet unforeseen emergencies" (Caspersen et al., 1985). It is operationalized as "(a set of) measurable health- and skill related attributes" (Garber et al., 2011).

That measurable health related attribute may be cardiovascular fitness. For patients with knee OA, recommended tests for cardiovascular fitness are stair climb test, 6 minute walk test and maximal oxygen uptake ($VO_{2max)}$ test, where VO_{2max} test is recognized as the golden standard (Cataneo & Cataneo, 2007; Dobson et al., 2013). A VO_{2max} test can be done using a treadmill, cycle ergometry and arm ergometry. Arm ergometry are infrequently used and treadmill tests may cause pain and insecurity for individuals with joint pain or balance issues, making the cycle ergometry a great alternative for patients with knee OA (Huggett, Connelly & Overend, 2005). VO_{2max} may serve as an index for cardiovascular fitness, where a high VO_{2max} equals high cardiovascular fitness (Deuster & Heled, 2008)

High cardiovascular fitness is protective of many lifestyle diseases, and a de-conditioning of cardiovascular fitness is associated with increased risk of lifestyle diseases (Anderssen et al., 2010; WHO, 2002). Men usually have higher VO_{2max} than women (Sparling, 1980). To live an independent lifestyle, it is estimated that an older person needs a VO_{2peak} of approximately 20 mL/kg/min (Huang, Gibson, Tran & Osness, 2005). Cardiovascular fitness usually peaks at age 20-30, and declines approximately 10% each decade (Strait & Lakatta, 2012). This decline may be accelerated for patients with knee OA due to peripheral reasons such as muscle atrophy, decreased mobility and poor balance (Sutbeyaz et al., 2007), and also by psychosocial reasons such as fear avoidance, poor social support and low self-efficacy (Moore, Holden, Foster & Jinks, 2020), eventually leading to physical disability.

There is little research exploring or describing knee OA patients´ cardiovascular fitness and the research done is usually with small samples (Munsterman, Takken & Wittink, 2012). Philbin and colleagues tested VO_{2max} measured with arm- or leg ergometry on patients with end-stage hip- or knee OA, and found the 37 patients included to be severely deconditioned (Philbin et al., 1995). Another study from 1988 found that patients with hip and knee OA have a 15-20% decrease in cardiovascular fitness (Minor et al., 1988). A study exploring cardiovascular fitness in obese individuals with or without knee OA measured through $VO2_{peak}$ with arm ergometry found the obese individuals with knee OA to have lower cardiovascular fitness (Sutbeyaz et al., 2007).

There are many reasons to why individuals with knee OA may have lower cardiovascular fitness. In a longitudinal cohort study from 2020, low self-efficacy was found as a barrier to exercise adherence and PA, while high self-efficacy was found to be a facilitator to exercise adherence and PA levels (Moore et al., 2020).

2.5 Self-efficacy

Self-efficacy has been defined as a person's belief that they have the ability to accomplish or perform a task to achieve a desired outcome, such as reducing pain or adapting daily activities to remain physically active despite pain and stiffness (Bandura, 1977). It is not concerned with the skill one has, but measures a changeable psychological aspect of pain (Lorig, Chastain, Ung, Shoor & Holman, 1989). In a study from Ledingham et al, one of the participants with high adherence stated "… and it seems like everything I did here (during exercise class), I was able to do at home with no problems" (Ledingham et al., 2019). In this example, the participant reports mastering the exercise program, conveying high self-efficacy about his ability to exercise. There are a number of ways for clinicians to both assess and enhance self-efficacy (Marks, 2014). The 5 key principles to enhance self-efficacy illustrates why it fits perfectly in the biopsychosocial model, where biological, phycological and social factors all affect each other at all times. These key principles are 1) to achieve task performance, 2) observe role models completing tasks, 3) develop motivation, emotional arousal and a desire to perform the task, 4) reduce negative feedback and 5) receive verbal encouragement or persuasion, including education about the problem (Harrison, 2004; Marks, 2014).

Self-efficacy is measured with self-administered questionnaires (Miles, Pincus, Carnes, Taylor & Underwood, 2011). There are several questionnaires one can choose, and the choice usually comes down to which study population the questionnaire was made for and which domain one wants to examine. For example the Academic Self-Efficacy scale is developed to measure self-efficacy in relationship with academic performance in students (Zimmerman, Bandura & Martinez-Pons, 1992), and Self-efficacy for exercise is developed to measure an individuals´ self-efficacy for exercise in older adults (McAuley, 1993). For the arthritis population, Arthritis Self-Efficacy Scale (ASES) is the logical choice, as it is meant to measure self-efficacy in an arthritis population. This scale is internationally used and have been translated to several different languages (Brand, Nyland, Henzman & Mcginnis, 2013; Hamilton & Li, 2020). The Norwegian version used in this study is also the only measure of self-efficacy that has undergone a Rasch analysis (Garratt, Klokkerud, Løchting & Hagen, 2017).

As mentioned earlier, pain is the most important symptom of knee OA, and PA levels is important for health outcomes and disease progression. In a study from 2020, Degerstedt and colleagues investigated self-efficacy as a predictor of reduced pain and higher levels of PA among patients with OA (Degerstedt et al., 2020). They did an observational study which included 3266 patients and found that self-efficacy at baseline was associated with change over time in pain and PA at 3 and 12 months after the supported OA self-management program. Patients with higher perceived self-efficacy at baseline had less pain and higher PA levels at follow-up.

Self-efficacy has also shown to be associated with physical fitness. A study from 2006 with 54 knee OA patients included found self-efficacy to have a strong correlation with measures of physical performance (M. R. Maly et al., 2006). The same authors also suggested that self-efficacy should be an integral part of treatment if care is aimed at improving physical performance.

In addition to having an association to pain, function and PA, self-efficacy may also be a contributing factor to exercise adherence. This could also be one of the explanations to why self-efficacy is associated to the health-related factors, where adherence could possibly be seen as a mediator between self-efficacy and PA levels or physical fitness. Adherence is defined as «the extent to which a person´s behavior corresponds with agreed recommendations from a healthcare provider» (Holden, Haywood, Potia, Gee & McLean, 2014). Adherence to therapeutic exercise is a pre-requisite for successful rehabilitation

(Holden et al., 2014). Aileen Ledingham and colleagues found that subjects who reported low adherence expressed ambivalence about the effects of exercise and a desire for more social support. Those who reported high adherence exhibited self-determination and self-efficacy (Ledingham et al., 2019).

Due to the possibility self-efficacy has to affect several important factors for the knee OA population, it is important for both practitioners and researchers to explore patient's self-efficacy.

3. Method

3.1 The context of this project

This project is a secondary analysis using baseline data from a randomized controlled trial (RCT) on the efficacy of strength training or cycling on knee-related quality of life, pain, and function compared to usual care in patients with knee OA (Øiestad et al., 2013) (Clinicaltrials.org Identifier: NCT01682980). The RCT was anchored at Oslo University Hospital (OUS) in 2013 and is ongoing with close collaboration with Professor Britt Elin Øiestad at OsloMet.

3.2 Population

The 168 study participants were included from the primary and secondary health care in the Oslo and Viken regions. The inclusion criteria were men and women between 35 and 70 years of age with mild to moderate knee OA as confirmed by pain on most days the last month and radiographic grade 2 or 3 on a 0-4 scale where 0 is normal joint and 4 is severe damaged (Kellgren & Lawrence, 1957). The Kellgren and Lawrence classification system is shown in table 1.

Table 1. Kellgren and Lawrence classification system

Grade	Description
0	No changes
1	Doubtful narrowing of joint space and possible osteophytic lipping
2	Definite osteophytes and possible narrowing of joint space
3	Moderate multiple osteophytes, definite narrowing of joint space, and some sclerosis, and possible deformity of bone ends
4	Large osteophytes, marked narrowing of joint space, severe sclerosis and definite deformity of bone ends

Eligible candidates were not included if they had severe knee OA (grade 4) or other known major musculoskeletal impairments in the lower extremities or the back, already trained strength training or cycling 2-3 days a week, had a BMI >35, if they had serious diseases such as heart disease or cancer, any known mental or psychological diseases, known drug abuse, if they had contraindications for MRI, did not speak Norwegian, or if they were scheduled for surgery in any joint the nearest year (Øiestad et al., 2013).

3.3 Procedure

The assessments were done at Norwegian Institute of Sports Medicine (NIMI). Outcome assessments were performed at baseline, after the intervention (14 weeks) and 1 year after baseline. The patients started by warming up 20 minutes on a bicycle before the VO_{2max} test. Then an isokinetic muscle strength test and range of motion test were performed before the participants answered the questionnaire package. The session took around 1.5 hours. In this project, only baseline data were used.

3.4 Assessment and outcomes

3.4.1 Background variables

Age, pain last week, education level and information about known heart disease was collected by self-reported questionnaire. Standardized measures of height and weight were taken in relation to the VO_{2max} test. The standardized measures of height and weight were used to calculate BMI, where BMI is weight divided by squared height. For example, a patient with a height of 1.9m and a weight of 90kg, the calculation would be 90: (1.9 x 1.9) = 24.9 kg/m2. Pain last week was reported using a numeric rating scale (NRS) scale from 0-10. Education level contained four categories (primary school, high school, college or university for 1-4 years and college or university for >4 years) before it was dichotomized in to no higher or higher education level with a cut-off between college or university or no college or university.

3.4.2 Perceived self-efficacy

The Norwegian version of the Arthritis Self-Efficacy Scale (ASES)(Lorig et al., 1989) was used to test the participants' perceived self-efficacy. The Norwegian version contains 11 questions regarding the patient's certainty to perform various tasks related to pain (5 questions) and symptoms (6 questions), where each item was rated from 1 (very uncertain) to 5 (very certain). Scoring the test is done by adding the ratings from each question (1 to 5) and dividing on the number of questions (5 for pain and 6 for questions) to get the mean score. One score for perceived self-efficacy in relation to pain and one score for perceived self-efficacy in relation to symptoms. A high score indicates high self-efficacy. The Norwegian version is different from the original version in that the original version contains 20 items in total, where the additional items are related the function. Good concurrent validity and internal reliability has been reported for the original version of the scale (Lorig et al., 1989) and it is recommended for use in clinical studies base on good validity, reliability and demonstrated change with interventions (Brady, 2011). A study published in 2017 found that the Norwegian version of the ASES, in which we used, had good fit to the Rasch model (Garratt, Klokkerud, Lochting & Hagen, 2017).

3.4.3 Physical activity

PA was measured with a self-reported questionnaire as developed for The Nord-Trøndelag Health Study (HUNT) in Norway (Kurtze, Rangul, Hustvedt & Flanders, 2008). The questionnaire includes questions with response alternatives for 1) frequency (how many times per week), 2) intensity (if they had to breathe heavily) and 3) duration (how many minutes/hours per session). The responses are transformed into an index-score with the procedure described by Kurtze and colleagues in 2008 (Kurtze et al., 2008). The procedure is to calculate the product of all responses using the score for index seen in table 2, which then results in a continuous score influences by all of the three aspects of PA.

Table 2. Questions developed for the HUNT study with index score

Question		Response alternative	Score for index
How frequently do you exercise?	1	Never	0
	2	Less than once a week	.5
	3	Once a week	1
	4	2-3 times per week	2.5
	5	Almost every day	5
If you do such exercise as frequently as once or more times a week: how hard do you push yourself?	1	I take it easy without breaking into a sweat or losing my breath	1
	2	I push myself so hard that I lose my breath and break into a sweat	2
	3	I push myself to near exhaustion	3
How long does each session last?	1	Less than 15 minutes	0.10
	2	16-30 minutes	0.38
	3	30 minutes to 1 hour	0.75
	4	More than 1 hour	1

For example, if a patient report being physically active 2-3 times a week where they push themselves enough to break a sweat for 16-30 minutes each time, it would be calculated as (2.5 x 2 x 0.38) =1.9. This continuous score was then dichotomized in to low- and moderate-high PA level, using the same cut-off (2.5) as a previous study (Ernstsen et al., 2016). The PA questions in HUNT 1 has shown to be reproduceable and an appropriate tool for use in epidemiological studies (Kurtze et al., 2008).

3.4.4 Physical fitness

Physical fitness was assessed at baseline and the two follow-ups. Before the test, both height and weight were measured using standardized methods by a physiologist. The voluntary maximal oxygen consumption (VO_{2max}) test was done on an ergometer cycle (Monark 839E, Sweden). The procedure started with a 20-minute progressive warm-up at 45–90% of VO_{2max}, where the patients started at an easy load and ended up at moderate to hard load. This was followed by an all-out incremental "ramp test", lasting approximately 4–6 minutes. During the ramp test, the patients kept the cadence as steady as possible at 90 repetitions per maximum, and the workload increased by 25 Watts every 30 seconds, to a supramaximal workload and totally exhaustion (rate of perceived exertion 17–19 in Borg scale). The VO_{2max} was recorded in ml/kg/min.

3.5 Statistical analysis

Descriptive statistics, including patient characteristics such as age, sex, BMI, education level and known heart disease, and descriptive statistics of pain, PA level, physical fitness, and self-efficacy, are summarized using frequency and percentage or mean and standard deviation as appropriate.

A logistic regression was used to analyze the association between the dichotomized variable PA level and perceived self-efficacy for pain, and for perceived self-efficacy for other symptoms. The analysis was done separately for self-efficacy for pain and self-efficacy for other symptoms. PA level was used as the dependent variable, and self-efficacy pain and other symptoms as the independent variables. Predictive models were chosen with emphasis on respectively self-efficacy pain and other symptoms as the independent variables, using age, sex, BMI, education level (Bauman et al., 2012; Choi et al., 2017), pain (Burrows et al., 2020; M. R. Maly et al., 2006) and known heart disease as covariates. These were chosen based on previous literature and their possible association to both the dependent- and independent variable. All analysis will be performed in IBM SPSS Statistics version 26. The significance level was set to 5% ($p<0.05$) and 95% confidence intervals.

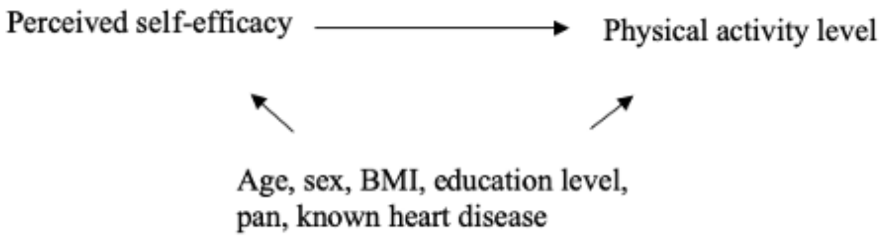

Figure 2: Relationship between the independent variable, the dependent variable and covariates in the logistic regression analyses

The variables were checked for multicollinearity before finalizing the model, and a Casewise list of outliers were not made because no outliers were found. The results are presented with Odds ratio (OR), 95% confidence intervals (CI) and p-value.

A multiple linear regression was used to analyze the association between the continuous variable physical fitness (VO_{2max}) and perceived self-efficacy for pain, and for perceived self-efficacy for other symptoms. The analysis was done separately for ASES pain and ASES other symptoms. Physical fitness (VO_{2max}) was used as the dependent variable, and self-efficacy as the independent variable. A predictive model was chosen with emphasis on self-efficacy as the independent variable. Age (Strait & Lakatta, 2012), sex (Sparling, 1980), BMI (Mondal & Mishra, 2017) education level, pain last week (Degerstedt et al., 2020; Philbin et al., 1995) and known heart disease were used as covariates, which were chosen based on previous literature and the possible association to both the dependent- and the independent variable.

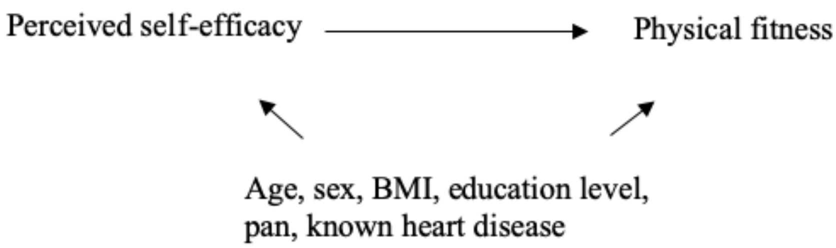

Figure 3: Relationship between the independent variable, the dependent variable and covariates in the multiple linear regression analyses

The variables were checked for normal distribution and multicollinearity before the analyses were conducted. Normal distribution was checked by examining the difference between mean and median in the relevant variable, examining the relevant variables in a histogram to see if the values followed a bell-shaped curve, and examining the normal-distribution-line in a QQ-plot. After running the model, the residuals were checked for normal distribution, that they were evenly spread around 0, and preferably no outliers. The results are presented with the unstandardized coefficients B, 95% CI and p-value.

3.6 Ethics

The RCT study was approved by the Regional Ethical Committee and The Data Inspectorate in Norway (Ref. 2012/334). All the included subjects have signed an informed written consent, and they are able to withdraw from participation in the study at any time point. Student Jonas Gudmundsen Lund has been added as a coworker in the project to gain access to the data, in which both Regional committee for medical research-ethics (REK) and Personvernsombudet (PVO) at OUS has approved. The data is stored at OUS on a secure research server and the analyses have been conducted at OUS.

4. Results

Study sample characteristics

Baseline data from a total of 168 patients were collected. The study sample included as many males as females. More than half of the sample had higher education, and there were more participants who ended up in the category with low PA level compared to moderate-to-high PA level. About one fourth of the study sample had a known heart disease (Figure 4).

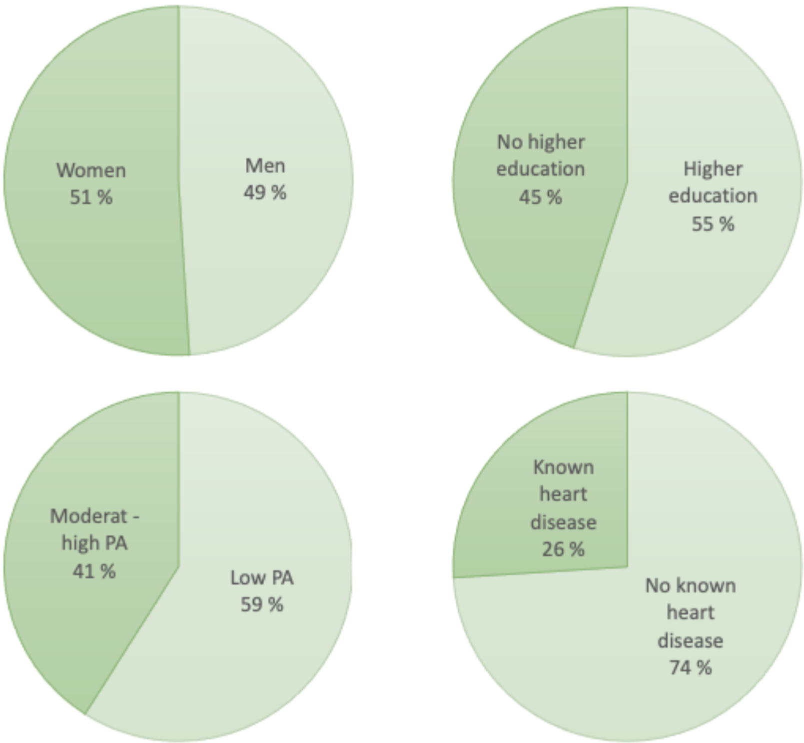

Figure 4: Descriptive data for sex, education level, PA level and known heart disease.

The participants in the study sample had a mean age of 57.2 years old, with a range from 39 to 70 years. There was a wide range in BMI and physical fitness as well, where the mean BMI was 28.8 with a range from 19.8 to 38.6, and a mean VO_{2max} at 28.4 with a range from 17.1 to 48.6 mL/kg/min. The mean knee pain reported was 5 with a range from 0-10. For self-efficacy for pain the mean was at 3.4 with a range from 1-5, and for self-efficacy for other symptoms the mean was 3.8 with a range from 1.33 to 5.

Association between PA and perceived self-efficacy

The results from the binary logistic regression showed no association between perceived self-efficacy for pain and PA level. These results are presented in Table 3 with unadjusted and adjusted results for both self-efficacy for pain and the confounders included in the model.

Table 3: Results for the association between self-efficacy for pain and PA level

Independent variables	Unadjusted		Adjusted	
	OR (95%CI)	**P**	**OR (95%CI)**	**P**
Self-efficacy for pain	1.08 (0.77, 1.51)	0.65	1.06 (0.74, 1.53)	0.733
Age	0.99 (0.96, 1.04)	0.96	0.99 (0.94, 1.03)	0.564
Sex	0.82 (0.44, 1.53)	0.53	0.89 (0.46, 1.72)	0.724
BMI	0.94 (0.87, 1.01)	0.12	0.94 (0.86, 1.03)	0.168
Education level	0.69 (0.47, 1.64)	0.69	1.30 (0.63, 2.70)	0.481
Pain last week	1.13 (0.97, 1.32)	0.11	1.12 (0.94, 1.33)	0.207
Known heart disease	1.53 (0.74, 3.14)	0.04	1.34 (0.60, 3.00)	0.474

Dependent variable= PA level where 0=low and 1= moderate to high. PA= physical activity, BMI= body mass index, OR= odds ratio, CI= confidence interval, P=p-value. All variables in unadjusted models were included in one adjusted model.

There were no statistically significant association between self-efficacy for other symptoms or PA levels either, as presented in Table 4.

Table 4: Results for the association between self-efficacy for other symptoms and PA level

Independent variables	Unadjusted		Adjusted	
	OR (95%CI)	**P**	**OR (95%CI)**	**P**
Self-efficacy for other symptoms	1.10 (0.71, 1.72)	0.66	1.06 (0.61, 1.70)	0.810
Age	0.99 (0.96, 1.04)	0.96	0.99 (0.94, 1.04)	0.578
Sex	0.82 (0.44, 1.53)	0.53	0.88 (0.45, 1.70)	0.706
BMI	0.94 (0.87, 1.01)	0.12	0.94 (0.87, 1.03)	0.175
Education level	0.69 (0.47, 1.64)	0.69	1.30 (0.62, 2.70)	0.486
Pain last week	1.13 (0.97, 1.32)	0.11	1.12 (0.94, 1.34)	0.198
Known heart disease	1.53 (0.74, 3.14)	0.04	1.35 (0.60, 3.02)	0.462

Dependent variable= PA level where 0=low and 1= moderate to high. PA= physical activity, BMI= body mass index, OR= odds ratio, CI= confidence interval, P=p-value. All variables in unadjusted models were included in one adjusted model.

Association between physical fitness and perceived self-efficacy

The results from the linear multiple regression showed a positive association between perceived self-efficacy for pain and physical fitness, presented in Table 5 together with unadjusted and adjusted results for covariates.

Table 5: Results for the association between self-efficacy for pain and physical fitness

Independent variables	Unadjusted		Adjusted	
	B (95%CI)	**P**	**B (95%CI)**	**P**
Self-efficacy for pain	0.20 (-0.87, 1.28)	0.71	0.86 (0.18, 1.54)	0.013
Age	-0.21 (-0.34, -0.07)	0.002	-0.35 (-0.44, 0.26)	<0.001
Sex	-5.59 (-7.36, -3.82)	<0.001	-6.05 (-7.28, -4.82)	<0.001
BMI	-0.68 (-0,89, -0.48)	<0.001	-0.78 (-0.93, -0.62)	<0.001
Education level	2.92 (0.99, 4.85)	0.003	1.08 (0.26, 2.42)	0.113
Pain last week	0.75 (0.29, 1.21)	0.002	0.50 (0.17, 0.81)	0.003
Known heart disease	-4.10 (-6.24, -1.95)	<0.001	1.70 (-3.17, -0.23)	0.024

Dependent variable= physical fitness as measured in VO_{2max}. VO_{2max}= maximal oxygen consumption (mL/kg/min), BMI= body mass index, B=regression coefficient, CI= confidence interval, P=p-value. All variables in unadjusted models were included in one adjusted model.

There was a statistically significant positive association between perceived self-efficacy for other symptoms and physical fitness, as presented in Table 6.

Table 6: Results for the association between self-efficacy for other symptoms and physical fitness

Independent variables	Unadjusted		Adjusted	
	B (95%CI)	**P**	**B (95%CI)**	**P**
Self-efficacy other symptoms	0.43 (-0.97, 1.83)	0.54	0.93 (0.01, 1.77)	0.049
Age	-0.34 (-0.34,-0.07)	0.002	-0.37 (-0.44, -0.25)	<0.001
Sex	-5.98 (-7.36, -3.82)	<0.001	-5.96 (-7.21, -4.74)	<0.001
BMI	-0.76 (-0,89, -0.48)	<0.001	-0.80 (-0.91, -0.60)	<0.001
Education level	1.11 (0.99, 4.85)	0.003	1.42 (-0.24, 2.46)	0.108
Pain last week	0.52 (0.29, 1.21)	0.002	0.53 (0.20, 0.84)	0.002
Known heart disease	-4.10 (-6.24, -1.95)	<0.001	-1.81 (-3.29, -0.33)	0.02

Dependent variable= physical fitness as measured in VO2max.VO2max= maximal oxygen consumption (mL/kg/min), BMI= body mass index, B=regression coefficient, CI= confidence interval, P=p-value. All variables in unadjusted models were included in one adjusted model.

5. Discussion

The aim of this study was to investigate the relationship between perceived self-efficacy for pain and other symptoms and PA level and physical fitness in people with knee OA. The results from this study showed no statistically significant association between perceived self-efficacy and PA level, but a statistically significant positive association between perceived self-efficacy for pain and other symptoms and physical fitness. Thus, this study was not able to reject the null hypothesis concerning the association between perceived self-efficacy and PA level, but the alternative hypothesis was kept concerning the association between perceived self-efficacy and physical fitness.

5.1 Results discussion

The results in this study showed that there was no statistically significant association between self-efficacy and PA levels, but an association to physical fitness. The next chapters will be a discussion of the results for each hypothesis as stated in the introduction.

5.1.1 Association between PA and self-efficacy for pain and other symptoms

The hypothesis that there was an association between perceived self-efficacy and PA level in patients with knee OA could not be confirmed in this study, which is different from what three other studies have found (Bauman et al., 2012; Degerstedt et al., 2020; Peeters et al., 2015), and similar to one other study (Dominick et al., 2016). A Lancet review from 2012 investigated correlates of PA, and found self-efficacy to be a consistent correlate to PA (Bauman et al., 2012). The review included nine systematic reviews that investigated the correlates in adults. Seven of the nine included reviews mentioned self-efficacy, and four of those seven reviews showed an association between self-efficacy and PA, contrary to the current study which did not find an association. However, this review did not investigate individuals with knee OA, which might influence which correlates are deemed most relevant. Degerstedt et al. did an observational, register based study which included 3266 patients with hip or knee OA. Self-efficacy was measured with ASES, and PA was self-reported and measured as number of days per week the patients were physically active more than 30 minutes. The results showed that self-efficacy at baseline was associated with change of PA over time (Degerstedt et al., 2020). The reasons why this study showed different results from the current study may be that they investigated change in PA over time and not cross-sectional baseline data. This might be an important difference, and was also the case in the study by Peeters et al. (Peeters et al., 2015). Peeters et al. investigated psychosocial factors associated with increased PA in insufficiently active adults with arthritis (Peeters et al., 2015).

They included 692 inactive men and women with arthritis, from which 296 increased their PA from 2007 till 2009. Self-efficacy was one of the factors that was significantly associated with change in PA, but the study is different from the current study which investigated baseline data. Peeters et al. also discussed that it is impossible to state what comes first of PA and self-efficacy, because self-efficacy could be both an antecedent and a consequence of increased PA (Peeters et al., 2015). Our proposed theory behind the association between PA and self-efficacy was that patients´ self-efficacy would influence their PA level, in a way where greater beliefs in that you can manage pain and other symptoms enables more PA. It might work the other way around as well, in which successfully mastering PA may increase PA related self-efficacy (Marks, 2014). Social factors may also be of importance to why it is related to change over time. Encouragement and verbal support may be a consequence of PA, when it is possible that friends or family would support them when they are being active despite of OA. Group based or social PA may also enhance PA related self-efficacy trough several mechanisms. Seeing role models successfully achieving related tasks, being encouraged by the group, and getting positive reinforcement and assistance are some examples (Marks, 2014).
Dominick et al had a similar design as the current study in 2016, where they examined the association between self-efficacy, social support and fear of movement with PA and physical function (Dominick et al., 2016) at baseline. Forty-nine patients undergoing outpatient physical therapy for total knee replacement were included. When measured at baseline, they did not find a statistically significant association between self-efficacy and baseline, similar to the current study. Still, they concluded that self-efficacy may be important for changes in PA over time.

The PA reported may be too low to be influenced by self-efficacy, and also too low to meet the recommended intensity for gains in physical fitness (Schulz et al., 2020). In the current study, patients who already resistance trained or systematically rode a bicycle for two times or more where excluded. It would have been interesting to investigate if these excluded patients had higher self-efficacy than those that were included, but since the data was part of a RCT with the intention of measuring the efficacy of exercise interventions, the people who already exercised had to be excluded. The participants included might view themselves as physically active, and might have reported that they were active every day, when this actually just means going for a stroll around the neighborhood. Walking is popular among knee OA patients because it is usually not very painful, but it may be too light to actually increase their cardiovascular fitness. This is a known issue in studies of aerobic exercise in patients with knee OA (Schulz et al., 2020), and there is no reason why this should not be a reflection of clinical practice or the patients everyday life. One might not need high self-efficacy to walk as opposed to more demanding activities such as running or hiking. It is possible that we could have revealed an association if type of activity were included in the model. Activities like going to the gym to resistance train or going for a run may require more self-efficacy than walking or light gardening.

5.1.2 Association between physical fitness and self-efficacy for pain and other symptoms

The hypothesis that there is an association between perceived self-efficacy and physical fitness in patients with knee OA was confirmed in this study, which is in line with previous research showing a strong correlation between self-efficacy and physical fitness (Harrison, 2004; M. Maly, Costigan & Olney, 2005; M. R. Maly et al., 2006; Rejeski, Miller, Foy, Messier & Rapp, 2001; Sharma et al., 2003). Bandura has stated that how an individual perform is closely related to the individuals´ belief about his or hers own capabilities (Bandura, 1977), and the results from the current study supports that notion.

There may be a range of factors that explain, or mediate, why individuals with higher self-efficacy have better physical fitness. Some of them are anchored in the literature, and some of them are speculations and theories. For instance, more knowledge about the disease can decrease individuals´ anxiety or depression, which could influence their perceived capability and lead to increased exercise adherence (Ledingham et al., 2019; Marks, 2012; Moore et al., 2020). As mentioned previously, Ledingham et al. found that subjects who reported low adherence to exercise expressed ambivalence about the effects of exercise and a desire for more social support (Ledingham et al., 2019). More knowledge about the disease and beneficial effects of exercise may therefore lead to more confidence and higher adherence to exercise, as stated in a study from 2014 (Marks, 2014). With a natural decline in health-related outcomes with age, and the old belief of OA being a “wear-and-tear” disease, individuals with low self-efficacy may expect their fitness and PA levels to decline, making it a self-fulfilling prophecy. On the other side, if a patient believes that exercise will improve pain and symptoms and not make the condition worse, this could lead to a greater belief that they will be successful and thereby increasing the effort in each exercise session, however, no studies have directly investigated this theory. Increased effort can lead to a higher total volume done, which may push the physiological benefits up. Higher intensity and higher total volume may be beneficial for other physiological factors as well, for instance hypertrophy or muscle strength, which may motivate the patient further. The effort needed to enhance physiological factors make the threshold for doing these activities higher. This threshold may be even higher for patients in pain, and therefore require higher self-efficacy to get it done, possibly explaining the positive association we see between physical fitness and perceived self-efficacy.

The unadjusted analysis did not show an association between perceived self-efficacy and physical fitness. The reason for this is unknown but might be because the relationship is influenced by many other factors that needs to be held constant to reveal a true relationship (Skelly, Dettori & Brodt, 2012).

The study revealed an association between self-efficacy and physical fitness but not between self-efficacy and PA. One would expect the same results for these two associations, considering that the relationship between PA levels and physical fitness is fairly well documented (Aadahl, Kjær, Kristensen, Mollerup & Jørgensen, 2007; Nes et al., 2011; Siconolfi, Lasater, Snow & Carleton, 1985). One would believe that the patients with higher physical fitness also were the ones who had moderately to high PA levels. As discussed previously, this may be because of the PA reported not being intense enough to elicit physiological changes in cardiovascular fitness, or that the PA reported does not require high self-efficacy. It may also be because of factors related to the study method.

5.2 Method-discussion

5.2.1 Study design, sample and data collection

Patients were recruited from primary- and secondary healthcare in Oslo and Akershus region, supposedly representing the knee OA population in Norway. However, the recruitment rate was very slow as the project was ongoing from 2013 to 2020. There exists no overview of eligible participants compared to the recruited study participants. This might have led to a selected sample of knee OA patients. However, their age, gender distribution, BMI and education level are similar to other bigger study samples used in OA research from Canada, USA and England (Felson et al., 2013; Plotnikoff et al., 2015). One can therefore assume that the study sample used here is representable for the study population of mild to moderate knee OA. This study has less patients than some studies using other designs (Rejeski et al., 2001; Sharma et al., 2003), like the study from Degerstedt et al which is an observational register based study allowing them to use data from 3266 patients (Degerstedt et al., 2020). Still, this study includes more patients than several other similar studies with comparable designs (Dominick et al., 2016; Harrison, 2004; M. R. Maly et al., 2006), which is impressive considering including VO_{2max} testing.

Patients were asked about height and weight to make sure that they met the inclusion criteria (excluded if BMI higher than 35). Before the VO_{2max} test, they were measured again using standardized measurements. This measurement revealed that some of the individuals´ mis-reported their height and weight and were actually above the exclusion criteria of BMI >35. The researchers decided that they should be included because the assessment had started. There were 16 participants who had a BMI >35. This why the range in BMI goes from 19.8-38.6 as seen in Table 1. The influence this inclusion has on the results is unknown, but the mean BMI remains similar to other study samples, and therefore remains representable for this study population.

The questions in ASES are worded in a specific way that is meant to measure the individual's self-efficacy. However, individuals may interpret the questions differently and therefore give answers that more likely represents their actual ability to accomplish the given task (Burrell, Allan, Williams & Johnston, 2018). Items in English have been more thoroughly investigated than items in Norwegian, where differences in «certain that I... » and «confident that I... » may give different answers (Burrell et al., 2018). One can assume that this also makes a difference in the Norwegian translation, which has not undergone the same volume of investigation.

The questionnaire used to measure PA level has shown to be reliable and an appropriate tool for use in epidemiological studies when tested in a population of healthy men aged 20-39 years old (Kurtze et al., 2008). It has not yet been validated for patients with knee OA. This questionnaire is more appropriate for vigorous activity compared to total energy expenditure (Kurtze et al., 2008). VO_{2max} is a vigorous test. This may explain why this questionnaires association to VO_{2max} is similar or even better than other longer questionnaires. For patients with knee OA, changes from being inactive to some low-intensity activities may mean a lot for the functional benefits (White et al., 2017). It is not known if this questionnaire is able to pick up on these small changes in the less active side of the spectrum, which is a common issue with self-reported questionnaires for PA levels (Healey et al., 2020). A systematic review of self-report PA instruments in adults with knee OA showed that none of the many instruments found showed adequate measurement properties across all domains of reliability, validity and responsiveness (Smith et al., 2019). It is also important to note the common limitations one can find in all self-reported measures. Some of these are recall bias, potential for social desirability bias, over- and under estimation of activities, and misclassification of activities (Adams et al., 2005; Healey et al., 2020; Prince et al., 2008).

The exclusion criteria for this study involved excluding those who already resistance trained or exercised with a bicycle 2-3 times per week. Patients that exercised 2-3 times or more with other types of exercise were included. Even though patients that exercised 2-3 times in other types of training could be included, it would be interesting to investigate if the excluded patients that exercised more had higher perceived self-efficacy.

5.2.2 Statistics and analyses

Multivariate analyses were used in this study, which strengthens the results. Univariate analyses do not allow adjustment for important covariates which may influence the relationship between the factors investigated. Multivariate analysis is thus the preferred choice because it takes covariates into account and allows for adjustment of possible confounding factors (Katz, 2003). Using multivariate analyses also allows us to say something about the strength and direction of the association (Foldnes, 2018). Possible confounding factors included in the analyses in this study were age, sex, BMI, education level, pain last week and known heart disease. These were included based on previous research. Age, sex and BMI are usually included in medical research. These factors have been shown to be associated to both PA and physical fitness in which PA and physical fitness decreased with age and higher BMI, and that men had higher physical fitness than women (Bauman et al., 2012; Choi et al., 2017). Pain is also associated to PA and physical fitness, where individuals in pain tend to be less physically active and participate less in exercise (Burrows et al., 2020; M. R. Maly et al., 2006). Known heart disease was seen as an important comorbidity which also could influence PA and especially physical fitness when measured as cardiovascular fitness (Eaton, 1992). Even though we accounted for several important covariates that have shown to have an association in previous studies, it is important to acknowledge that there could be other factors that should have been included. For instance, bilateral knee pain, fear avoidance and disease-severity, and social factors like social support, marital status and loneliness could be potentially interesting factors.

When conducting the regression models, the initial decision was to keep the PA variable continuous instead of dichotomizing it in to high/low. Dichotomizing in to high/low may give more clinical meaning (Katz, 2003), while keeping the variables continuous keeps the analysis as strong as possible and with the possibility of inclusion in meta-analysis. VO_{2max} and both ASES scores are kept continuous. The PA level index was not normally distributed and was therefore dichotomized in to low or moderate/high PA with a cut-off already used in a previous study (Ernstsen et al., 2016). It could have been kept continuous and included in a Spearman´s rank-order correlation analysis, but dichotomizing the variable made a logistic regression possible, which in turn made adjusting for covariates an option and therefore a better choice.

It strengthens the study that both p-values and CI were reported. The p-value tells us if we can reject the null hypothesis or not, which CI not necessarily does. On the other hand, p-values does not report the estimates magnitude or the estimates precision (Nakagawa & Cuthill, 2007). Reporting only the p-value has undergone some criticism in the last few years, where over 800 signatures were collected to "call for an end to hyped claims and the dismissal of possibly crucial effects" (Amrhein, Greenland & McShane, 2019). The critique revolves around the idea that the p-value has gotten too much focus in the academic world, where results of studies have been thrown away too easily just because $p>0.05$. It is proposed that researches should recognize the uncertainty in the estimates found, and be humble concerning studies statistic validity and results (Wasserstein, Schirm & Lazar, 2019). Therefore, adding CI in the report tells us something about the precision of the estimates, which strengthens the study. Because a consensus about alternatives has still not been reached (Wasserstein et al., 2019), this study will include the p-value, but remain humble about its impact.

5.3 Discussion of implications

5.3.1 What this study adds to the literature

This study contributes with useful information about the relationship between self-efficacy and PA level and physical fitness in patients with mild to moderate knee OA. Psychosocial factors seem to be important in patients with musculoskeletal disorders, including OA. Improving self-efficacy may affect important factors for patients´ general health has not received that much attention in previous years. This study may also contribute as reference material for other similar studies, where the strategies used in managing the data is clearly described and easily reproduced. Effect sizes and confidence intervals are described, making the results available for inclusion in future meta-analyses (Nakagawa & Cuthill, 2007). Even though we found no statistically significant association between PA and self-efficacy, reporting these results are still important to help draw a bigger picture.

5.3.2 Clinical implications

Self-efficacy for pain and other symptoms had a statistically significant association to physical fitness, which shows that self-efficacy may be an important factor for increasing physical fitness of knee OA patients. However, the data in this study were cross-sectional, and consequently, it is not possible to know if there is a causal relationship between self-efficacy and physical fitness. When looking at the relationship, a 1-point increase in perceived self-efficacy for pain or other symptoms accounted for up to a 1.539 mL/kg/min and 1.770 mL/kg/min increase in VO_{2max}, respectively. For patients in the lower levels of the physical fitness, this amount of mL/kg/min increase in VO_{2max} can be the difference between staying independent and needing help with everyday activities (Huang et al., 2005). A 1 mL/kg/min increase in VO_{2max} has also shown to decrease the risk of incident heart-failure events by 6% (Khan et al., 2014). Even though it is not possible to know if there is a causal relationship, it may be possible that an increase in self-efficacy may influence future behavior or choices which then again can lead to increased physical fitness. Considering the cost of implementing ways to enhance self-efficacy, which does not add any additional charges beyond the consultation, it may be a worthwhile target for clinicians treating patients with knee OA.

5.3.3 Further research

In this population, it would be interesting to investigate if baseline self-efficacy is associated with better intervention outcome. This was the case in the study done by Degerstedt et al. and Peeters et al., where baseline self-efficacy was associated with PA at follow-up (Degerstedt et al., 2020; Peeters et al., 2015). Patients with higher self-efficacy may get better results out of exercise interventions, as self-efficacy has shown to be associated with adherence to the exercise program (Ledingham et al., 2019). Perhaps higher self-efficacy does not help you before you get to take advantage of it through bursts in motivation, or that you get a structured exercise program from a health professional.

It would also be interesting to investigate if actual physical improvement or raised PA levels lead to enhanced self-efficacy, or to investigate if experiencing the benefits, or mastering, of PA and exercise is the factor that leads to enhanced self-efficacy. These relationships are complex and probably influenced by biological, psychological and social factors, making them difficult to fully understand and important to investigate further.

6. Conclusion

This study found no association between perceived self-efficacy and PA level, but a positive association between perceived self-efficacy and physical fitness after adjusting for covariates in patients with mild to moderate knee OA. Self-efficacy may be an important factor to improve in treatment of patients with knee OA as self-efficacy is related to physical fitness.

7. References

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Attachment 1: Draft article

Draft article

Association between perceived self-efficacy and physical activity level and physical fitness in patients with knee osteoarthritis.

Jonas Gudmundsen Lund

Co-authors will be May Arna Risberg and Britt Elin Øiestad for an updated draft.

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Word-count: 2883, tables included

Abstract

Objectives To investigate the association between perceived self-efficacy and physical activity (PA) level and physical fitness in patients with mild to moderate knee OA.

Methods This is a secondary analysis using baseline data from an ongoing randomized controlled trial (RCT) (n=168). Men and women 35-70 years of age with mild to moderate knee OA were included. Eligible candidates were excluded if they did regularly strength training or cycling 2-3 days a week, BMI >35, planned surgery the next 6 months, or serious diseases. PA level was measured using a self-report questionnaire. Perceived self-efficacy was assessed using the Norwegian version of the Arthritis self-efficacy scale and physical fitness was measured with a maximal oxygen consumption (VO_{2max}) test. Multiple logistic and multiple linear regression analyses calculating odds ratio (OR) or beta value (B) and 95% confidence intervals (CI) were applied as appropriate including adjustment for known covariates (age, sex, BMI, education level, pain and known heart disease).

Results The association between PA level and self-efficacy for pain showed an OR (95% CI) of 1.06 (0.74, 1.53), and an OR of 1.06 (95% CI 0.61, 1.70) for self-efficacy for other symptoms. There was a statistically significant association between physical fitness and self-efficacy for pain (Beta value of 0.86 ((95%CI 0.18 – 1.54, p=0.013), and for self-efficacy for other symptoms (Beta value of 0.93 (95% CI 0.01 – 1.77, P=0.049)).

Conclusions: This study found no association between perceived self-efficacy and PA level in cross-sectional data of patients with mild to moderate knee OA, but a positive association was found between perceived self-efficacy for pain and other symptoms and physical fitness.

Clinical trial identifier: NCT01682980

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Introduction

Exercise is the first-line treatment for patients with knee osteoarthritis (OA) due to a proven effect of both pain and function (Bannuru et al., 2019; Fransen et al., 2015). Exercise and physical activity (PA) can also decrease the risk of a number of comorbidities in this patient group (Booth, Roberts & Laye, 2012). Despite substantial literature emphasizing exercise as the best treatment option for patients with knee OA, many patients do not exercise (Dunlop et al., 2011; Farr et al., 2008). Patients with knee OA are also struggling to meet the minimum recommended dose of PA, and they are more sedentary than the overall population (C. Gay, C. Guiguet-Auclair, C. Mourgues, L. Gerbaud & E. Coudeyre, 2019). Identifying factors that can increase PA level and adherence to exercise is important in this large patient group.

Studies have shown that self-efficacy may be one important factor that influences PA level (Bauman et al., 2012; Degerstedt, Alinaghizadeh, Thorstensson & Olsson, 2020; Peeters, Brown & Burton, 2015), physical fitness (M. R. Maly, Costigan & Olney, 2006) and adherence to exercise in patients with knee OA (Ledingham, Cohn, Baker & Keysor, 2019; Marks, 2012). Self-efficacy has been defined as a person's belief that they have the ability to accomplish or perform a task to achieve a desired outcome (Bandura, 1977). Gay et al. found self-efficacy, body mass index (BMI) and sex to be the consistent correlates to PA levels (Chloe Gay, Candy Guiguet-Auclair, Charline Mourgues, Laurent Gerbaud & Emmanuel Coudeyre, 2019). Degerstedt et al. found high self-efficacy to have a positive effect on both pain and PA in patients with OA (Degerstedt et al., 2020). This also seems to be true over time and not just in the early stages of the disease. For example, in a study by Peeters et al., individuals with increased self-efficacy had higher odds ratio of increased level of PA compared to those with lower levels of self-efficacy beliefs (Peeters et al., 2015). With the potential of influencing both exercise adherence and PA levels, and therefore treatment outcomes and patients´ general health, more knowledge on self-efficacy is needed in the population with knee OA.

The aim of this study was thus to investigate the relationship between perceived self-efficacy and PA level and physical fitness in people with knee OA.

Method

Study population

This is a secondary analysis using baseline data from a randomized controlled trial (RCT) on the efficacy of exercise on knee-related quality of life, pain, and function in patients with knee OA (Øiestad et al., 2013) (Clinicaltrials.org Identifier: NCT01682980). The 168 study participants were included from the primary and secondary health care in the Oslo and Viken regions.

The inclusion criteria were men and women between 35 and 70 years of age with mild to moderate knee OA as confirmed by pain on most days the last month and radiographic grade 2 or 3 on a 0-4 scale where 0 is normal joint and 4 is severe damaged (Kellgren & Lawrence, 1957). Exclusion criteria were severe knee OA (grade 4) or other known major musculoskeletal impairments in the lower extremities or the back, exercising 2-3 days a week at the time of inclusion, BMI >35, serious diseases such as heart disease or cancer, any known mental or psychological diseases, known drug abuse, if they did not speak Norwegian, or if they were scheduled for surgery in any joint the nearest year (Øiestad et al., 2013).

Assessment of exposures and outcomes

The Arthritis Self-Efficacy Scale (ASES) was used to test the participants' perceived self-efficacy (Lorig, Chastain, Ung, Shoor & Holman, 1989). ASES includes 20 questions regarding self-efficacy related to function (9 questions), pain (5 questions) and other symptoms (6 questions). Good concurrent validity and internal reliability has been reported for the original version of the (Lorig et al., 1989). We used a modified Norwegian version of ASES with 11 questions regarding the patient's certainty to perform various tasks related to pain (5 questions) and symptoms (6 questions), where each item was rated from 1 (very uncertain) to 5 (very certain). The sum-scores of pain and other symptoms were divided by 5 and 6, respectively, giving a sub-score for pain from 1-5 and a sub-score for other symptoms from 1-5. A higher score indicates higher self-efficacy. The Norwegian version of the ASES, in which we used, showed good fit to the Rasch model (Garratt, Klokkerud, Lochting & Hagen, 2017).

PA was measured with a self-reported questionnaire as developed for The Trøndelag Health Study (HUNT) in Norway (Kurtze, Rangul, Hustvedt & Flanders, 2008). The questionnaire includes questions with response alternatives for 1) frequency (how many times per week), 2) intensity (if they had to breathe heavily), 3) duration (how many minutes/hours per session), and 4) type of activity (open box). A total index was calculated based on the product of frequency, intensity and duration with the index scores described in Table 1 (Kurtze et al., 2008), and then dichotomized in to low or moderate/high using 2.5 as cut-off as done in a previous study (Ernstsen et al., 2016).

Table 1. Questions developed for the HUNT study

Question		Response alternative	Score for index
How frequently do you exercise?	1	Never	0
	2	Less than once a week	.5
	3	Once a week	1
	4	2-3 times per week	2.5
	5	Almost every day	5
If you do such exercise as frequently as once or more times a week: how hard do you push yourself?	1	I take it easy without breaking into a sweat or losing my breath	1
	2	I push myself so hard that I lose my breath and break into a sweat	2
	3	I push myself to near exhaustion	3
How long does each session last?	1	Less than 15 minutes	0.10
	2	16-30 minutes	0.38
	3	30 minutes to 1 hour	0.75
	4	More than 1 hour	1

Physical fitness was assessed with a voluntary maximal oxygen consumption (VO_{2max}) test on an ergometer cycle (Monark 839E, Sweden) using the following procedure: The participants warmed up for 10 minutes on a stationary bike. Then the test started with a 20-minute progressive warm-up at 45–90% of VO_{2max} (starting at easy load and ending at moderate to hard load), followed by an all-out incremental “ramp test”, lasting approximately 4–6 minutes. During the ramp test, the cadence remained steady at 90 repetitions per minute and the workload increased by 25 Watts every 30 seconds, to a supramaximal workload and totally exhaustion (rate of perceived exertion 17–19 in Borg scale). Physical fitness (VO_{2max}) was recorded in milliliters of oxygen per kilogram of body weight per minute (ml/kg/min).

Other variables such as age, sex, height, weight, pain last week (Numeric Rating Scale 0-10), education level and information about known heart disease were collected by self-reported questionnaire at baseline. Weight and height were also measured with standardized equipment in relation to the VO_{2max} test. Body mass index (BMI) was calculated with the equation: BMI = kg/m^2.

Statistical analyses

Descriptive statistics, including patient characteristics such as age, sex, BMI, pain and education level, and descriptive statistics of PA level, physical fitness, and self-efficacy, are summarized using frequency and percentage or mean and standard deviation as appropriate to normality distribution.

The continuous variable PA level index was dichotomized in to low- and moderate-to-high PA level, and binary logistic regression analysis was applied to analyze the association to self-efficacy. Logistic regressions are sensitive to multicollinearity and outliers. A correlation matrix was used to check multicollinearity and a Casewise list plot was not made because no outliers were found.

Sex, age, BMI, knee pain, educational level and known heart disease were included as covariates based on previous literature (Burrows, Barry, Sturnieks, Booth & Jones, 2020; Degerstedt et al., 2020; M. R. Maly et al., 2006). The analyses were done separately for self-efficacy for pain and self-efficacy for other symptoms.

A multiple linear regression was used to analyze the association between the continuous dependent variable physical fitness (VO_{2max}) and the independent variable perceived self-efficacy for pain, and perceived self-efficacy for other symptoms. Sex, age, BMI, pain last week, education level and known heart disease were used as covariates based on previous literature (Degerstedt et al., 2020; M. R. Maly et al., 2006; Strait & Lakatta, 2012). The analyses were done separately for ASES pain and ASES other symptoms. The assumptions for linear regression analyses were considered as met for analyses containing the variable VO_{2max} because the data was normally distributed, randomly spread around 0, and a Casewise list plot was not made because no outliers were found.

To consider the significance level and possibly rejecting the null hypothesis, a p-value of p 0.05 and below and a confidence interval (CI) of 95% were used. The analysis was done in IBM SPSS Statistics version 26.0.0.1.

Results

Baseline data from a total of 168 patients were collected. The study sample was evenly divided between males and females and a bigger part of the sample had higher education (Table 2).

Table 2. Demographic and clinical characteristics at baseline

Variables		**N (168)**	**(%)**	**Mean (range)**
Age				57.2 (39 – 70)
Sex	Male	82	49%	
	Female	86	51%	
Higher education (college or higher)	Yes	93	55%	
	No	74	44%	
Body mass index				28.8 (19.8 – 38.6)
Self-efficacy (1-5)	Pain	166		3.4 (1 – 5)
	Other symptoms	166		3.8 (1.33 – 5)
Pain last week (0-10)		166		5.0 (0 –10)
VO_{2max} (ml/kg/min)		164		28.4 (17.1 – 48.6)
	Men	80		31.3 (17.4 – 48.6)
	Women	84		25.7 (17.1 – 43.6)
Physical activity level		165		1.9* (0 –10)
	Low	97	59%	
	Moderate-high	68	41%	
Known heart disease	No	123	74%	
	Yes	44	26%	

VO_{2max}, maximal oxygen consumption measured in ml/kg/min;

*presented as median instead of mean

The results showed no association between perceived self-efficacy for pain and PA level or perceived self-efficacy for other symptoms and PA level. Odds ratios and p-values are presented in table 3.

Table 3. Binary logistic regression analysis of the association between high vs. low physical activity level and perceived self-efficacy

Dependent variable physical activity level	OR (95% CI)	P-value
Self-efficacy for pain	1.08 (0.76, 1.55)	0.66
Self-efficacy for other symptoms	1.06 (0.66, 1.72)	0.81

Dependent variable: 0= low physical activity level, 1=moderate-high physical activity level
CI, confidence interval; ASES, Arthritis self-efficacy scale. Analyses were adjusted for age, sex, BMI, education level, pain and known heart disease.

A positive association was found between perceived self-efficacy for pain and physical fitness, and perceived self-efficacy for other symptoms and physical fitness. Unstandardized coefficients B, CI and p-values are presented in Table 4.

Table 4. Results for the association between physical fitness and perceived self-efficacy.

Dependent variable Physical fitness	Unadjusted		Adjusted	
	B (95% CI)	p-value	B (95% CI)	p-value
Self-efficacy for pain	0.20 (-0.87, 1.28)	0.71	0.86 (0.18, 1.54)	0.013
Self-efficacy for other symptoms	0.43 (-0.97, 1.83)	0.54	0.93 (0.01, 1.77)	0.049

Dependent variable: VO_{2max}, maximal oxygen uptake; CI, confidence interval; ASES, Arthritis self-efficacy scale. Adjusted for; sex, BMI, age, education level, pain last week and known heart disease.

Discussion

The aim of this study was to investigate the relationship between perceived self-efficacy and PA level and physical fitness in people with knee OA. The results showed, when adjusted for covariates, that self-efficacy for pain and other symptoms were not associated with PA level but had a positive association with physical fitness.

This study did not find an association between self-efficacy and PA level, in line with a study by Dominick et al. from 2016. They investigated the association between self-efficacy and PA and function after total knee replacement, and found no statistical significant association between self-efficacy and PA when measured at baseline (Dominick, Zeni & White, 2016). The authors still concluded that low self-efficacy may be associated with less improvement in PA over time. Contrarily Bauman et al. found self-efficacy to be a consistent correlate with PA in their summary on the basis of systematic reviews and PA correlates, and Degerstedt et al. found a statistically significant association between self-efficacy and PA in their observational study from 2020 (Bauman et al., 2012; Degerstedt et al., 2020). There may be several explanations for the different results: In this study, we investigated cross-sectional baseline data contrarily to Degerstedt et al. who investigated the association between self-efficacy and change over time in PA levels. This may be an important difference. In a study by Peeters et al, they discuss that increased self-efficacy could be both an antecedent and a consequence of increased PA, and that it was not possible to know which one came first (Peeters et al., 2015). Past experience with PA, i.e. successfully mastering PA may increase PA related self-efficacy (Marks, 2014). Encouragement and verbal support may also be a consequence of PA, when it is possible that friends or family would support them when they are being active despite of OA. Social or group based PA may also enhance PA related self-efficacy in patients with OA. This can happen in several ways, for example that the patient sees role models successfully achieving related tasks, being encouraged by the group and getting positive reinforcement and assistance (Marks, 2014).

The positive association between physical fitness and self-efficacy is in line with previous research, showing a strong correlation between the two measures (Harrison, 2004; M. Maly, Costigan & Olney, 2005; M. R. Maly et al., 2006; Rejeski, Miller, Foy, Messier & Rapp, 2001; Sharma et al., 2003). This supports Bandura's notion that how an individual perform is closely related to the individuals' beliefs about his or her own capabilities. Why individuals with higher self-efficacy have better physical fitness may be mediated by a range of factors. Better knowledge about the disease and effects of exercise may increase individuals´

confidence that they will be successful, and that exercise will not make the problem worse (Marks, 2014). This could also lead to more effort in each exercise session, leading to a higher total volume done, which may increase the physiological benefits of the cardiovascular system, despite the same amount of time spent physically active. More knowledge about the disease and less pain can decrease individuals´ anxiety or depression, which could influence their perception of capability and lead to increased adherence to exercise (Marks, 2012). It is also possible that individuals with lower self-efficacy expect their fitness and activity levels to decline because of age and disease expectations, making it a self-fulfilling prophecy.

Considering the association seen in this study, if an intervention to enhance individuals´ perceived self-efficacy is successful and the individuals improve their self-efficacy by one point on the scale, we can expect the VO_{2max} to increase 1 ml/kg/min. In the lower end of the fitness spectrum, this kind of increase can be the difference between staying independent or needing help with everyday activities (Huang, Gibson, Tran & Osness, 2005). Cress and Meyer found the VO_{2peak} threshold for independence to be at 20 ml/kg/min (Cress & Meyer, 2003). In a study including of 1873 healthy men, a one-unit increase in mL/kg/min was associated with 6% reduced risk of incident heart-failure events (Khan et al., 2014), which is in line with previous research finding small improvements in cardiovascular fitness to be associated with significantly lowered risk of death (Erikssen et al., 1998). With the lowest recorded VO_{2max} to be 17.1 ml/kg/min in this population, a 1-point increase compared to the decline that we expect so see with increase age can definitely be clinically meaningful.

Strengths and limitations

To my knowledge, this is the first study to investigate self-efficacy and physical fitness where a VO_{2max} test was used to test the participants physical fitness. This is recognized as the golden standard of tests for cardiovascular fitness (Fletcher et al., 2001), which strengthens the credibility of the study.

Self-efficacy can only be reported with self-report measurements, since it is a matter of perceived ability. The ASES questionnaire is a well-documented self-reported questionnaire for patients with knee OA and the Norwegian version has shown a good fit to the Rasch model (Garratt et al., 2017). The English version of ASES has undergone a lot of investigation, especially to find out if the questions included measure self-efficacy instead of other closely related factors like motivation. Something may get lost in translation when using the Norwegian version, but it is still the best option available. Anyway, the study participants in this study seemed to sometimes struggle understanding the instructions for each question, e.g., by differencing between what they believed they could do and real actions, which is a common issue in measures of perceives self-efficacy.

The questionnaire used to measure PA is recommended for use in epidemiological research, especially if moderate- to high intensity is of interest (Kurtze et al., 2008). Still, it has not been validated for patients with knee OA. The index and cut-off scores lack validation as well, making it hard to tell if it is a valid way of treating the results from the questionnaire. Overestimating of PA is a well-known issue with self-reported measurements, and objective instruments of PA registration could have strengthened the reliability and validity of the measurements.

Conclusion

This study found no association between perceived self-efficacy and PA level, but a positive association between perceived self-efficacy and physical fitness after adjusting for covariates in patients with mild to moderate knee OA. Self-efficacy may be an important factor to improve in treatment of patients with knee OA as self-efficacy is related to physical fitness.

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Attachment 2: Questionnaire developed for the HUNT study

Vi takker for frammøtet til undersøkelsen.

Vi vil også be deg være vennlig å fylle ut dette spørreskjemaet. Opplysninger vil bli brukt i et større forskningsarbeid om forhold som har betydning for helsen.

Svar etter beste skjønn. Kryss av for bare en av svar-mulighetene (dersom det ikke står nevnt noe annet). Det utfylte skjema returneres i vedlagte svarkonvolutt. Porto er betalt.

Alle opplysningene er underlagt streng taushetsplikt.

Med hilsen
Statens skjermbildefotografering
Fylkeslegen ● Helserådet ● Statens Institutt For Folkehelse
Institutt for anvendt sosialvitenskapelig forskning/
Institutt for samfunnsforskning

Til etikett

Navn: __________

Adr. : __________

Postnr. Postkontor

F.nr. : __________

MOSJON

Med mosjon mener vi at du f.eks. går tur, går på ski, svømmer eller driver trening/idrett.

Hvor ofte driver du mosjon?
(Ta et gjennomsnitt)

Aldri	12	1
Sjeldnere enn en gang i uka		2
En gang i uka		3
2–3 ganger i uka		4
Omtrent hver dag		5

Dersom du driver slik mosjon så ofte som en eller flere ganger i uka:
Hvor hardt mosjonerer du?
(Ta et gjennomsnitt)

Tar det rolig uten å bli andpusten eller svett	13	1
Tar det så hardt at jeg blir andpusten og svett		2
Tar meg nesten helt ut		3

Hvor lenge holder du på hver gang?
(Ta et gjennomsnitt)

Mindre enn 15 minutter	14	1
16–30 minutter		2
30 minutter–1 time		3
Mer enn 1 time		4

SALT

Hvor ofte bruker du salt kjøtt eller salt fisk/sild til middag?

Aldri, eller sjeldnere enn en gang i måneden	15	1
1–2 ganger i måneden		2
Opptil en gang i uka		3
Opptil to ganger i uka		4
Mer enn to ganger i uka		5

Hvor ofte pleier du å strø ekstra salt på middagsmaten?

Sjelden eller aldri	16	1
Av og til		2
Ofte		3
Alltid eller nesten alltid		4

RØYKEVANER

		JA	NEI
Røyker du daglig for tiden?	17		

Hvis du svarte «JA», røyker du DAGLIG for tiden:

		JA	NEI
Sigaretter?	18		
Pipe?	19		
Sigarer (eller serutter/sigarillos)?	20		

		JA	NEI
Hvis du IKKE røyker SIGARETTER daglig for tiden: Har du røykt SIGARETTER daglig tidligere?	21		

Hvis du svarte «JA», hvor lenge er det siden du sluttet å røyke sigaretter daglig?

Mindre enn 3 måneder	22	1
3 måneder– 1 år		2
1–5 år		3
Mer enn 5 år		4

Hvis du røyker SIGARETTER daglig nå, eller har gjort det tidligere:

Hvor mange sigaretter røyker eller røykte du pr. dag? (Oppgi antall pr. dag medregnet håndrullede) 23 Antall

Besvares av dem som røyker daglig nå eller har røykt daglig tidligere:
(Gjelder både sigarett-, pipe- og sigar-røykere)

Hvor gammel var du da du begynte å røyke daglig? 25 år

Hvor mange år tilsammen har du røykt daglig? 27 år

ALKOHOLBRUK

Hvor ofte har du drukket alkohol (øl, vin eller brennevin) de SISTE 14 DAGENE?

Jeg har ikke drukket alkohol, men er ikke totalavholdende	29	1
Jeg har drukket 1–4 ganger		2
Jeg har drukket 5–10 ganger		3
Jeg har drukket mer enn 10 ganger		4
Jeg er totalavholdende, drikker aldri alkohol		5

		JA	NEI
Dersom du har drukket alkohol de siste 14 dagene, har det ført til at du noen gang har følt deg beruset?	30		

Har det vært perioder i livet ditt da du har drukket for mye, eller i hvert fall i meste laget?

Nei	31	1
I tvil, kanskje		2
Ja		3

Attachment 3: The Norwegian version of the Arthritis Self-Efficacy Scale for pain

Mestringsforventning
(Arthritis Self-Efficacy Scale)

Vennligst kryss av ved hvert spørsmål på det svaralternativet som passer best med hvor sikker du er på at du nå kan utføre følgende oppgaver.

Mestringsforventning av smerte:

1. Hvor sikker er du på at du kan dempe smerten ganske mye?

Meget usikker	Litt usikker	Verken sikker eller usikker	Litt sikker	Meget sikker
☐	☐	☐	☐	☐

2. Hvor sikker er du på at du kan fortsette med de fleste daglige gjøremål?

Meget usikker	Litt usikker	Verken sikker eller usikker	Litt sikker	Meget sikker
☐	☐	☐	☐	☐

3. Hvor sikker er du på at du kan hindre de revmatiske smertene i å forstyrre søvnen din?

Meget usikker	Litt usikker	Verken sikker eller usikker	Litt sikker	Meget sikker
☐	☐	☐	☐	☐

4. Hvor sikker er du på at du kan dempe de revmatiske smertene litt eller noe med andre metoder enn å ta ekstra medikamenter?

Meget usikker	Litt usikker	Verken sikker eller usikker	Litt sikker	Meget sikker
☐	☐	☐	☐	☐

5. Hvor sikker er du på at du kan dempe de revmatiske smertene mye med andre metoder enn å ta ekstra medikamenter?

Meget usikker	Litt usikker	Verken sikker eller usikker	Litt sikker	Meget sikker
☐	☐	☐	☐	☐

Attachment 4: The Norwegian version of the Arthritis Self-Efficacy Scale for other symptoms

Mestringsforventning av symptomer:

1. **<u>Hvor sikker</u> er du på at du kan påvirke trettheten din?**

Meget usikker	Litt usikker	Verken sikker eller usikker	Litt sikker	Meget sikker
☐	☐	☐	☐	☐

2. **<u>Hvor sikker</u> er du på at du kan avpasse dine aktiviteter slik at du kan være aktiv uten å forverre den revmatiske sykdommen din?**

Meget usikker	Litt usikker	Verken sikker eller usikker	Litt sikker	Meget sikker
☐	☐	☐	☐	☐

3. **<u>Hvor sikker</u> er du på at du kan gjøre noe for å komme i bedre humør når du er nedfor?**

Meget usikker	Litt usikker	Verken sikker eller usikker	Litt sikker	Meget sikker
☐	☐	☐	☐	☐

4. **<u>Hvor sikker</u> er du på at du kan takle revmatiske smerter ved daglige gjøremål-sammenliknet med andre som har samme revmatiske sykdom som deg?**

Meget usikker	Litt usikker	Verken sikker eller usikker	Litt sikker	Meget sikker
☐	☐	☐	☐	☐

5. **<u>Hvor sikker</u> er du på at du kan takle revmatiske symptomer slik at du kan gjøre de tingene du liker å gjøre?**

Meget usikker	Litt usikker	Verken sikker eller usikker	Litt sikker	Meget sikker
☐	☐	☐	☐	☐

6. **<u>Hvor sikker</u> er du på at du kan håndtere følelser av frustrasjon knyttet til den revmatiske sykdommen?**

Meget usikker	Litt usikker	Verken sikker eller usikker	Litt sikker	Meget sikker
☐	☐	☐	☐	☐

Attachment 5: REK approval

REK
REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSKNINGSETIKK

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK sør-øst C	Anders Strand		19.06.2020	20514
			Deres referanse:	

Britt Elin Øiestad

20514 Kneleddsartrose og trening

Forskningsansvarlig: Oslo universitetssykehus HF

Søker: Britt Elin Øiestad

REKs vurdering

REK viser til endringsmelding mottatt 16.06.2020, for prosjekt 2012/334 «Kneleddsartrose og trening». Sekretariatet har behandlet meldingen på fullmakt fra REK sør-øst C, med hjemmel i helseforskningsloven §11.

Den omsøkte endringen består i at Helene Killingrød Lundquist (OsloMet) inkluderes som prosjektmedarbeider. Prosjektleder opplyser at Lundquist skal gjennomføre et masterprosjekt på allerede innsamlede opplysninger. Masterprosjektet beskrives som en metodestudie, og del av foreliggende godkjent protokoll. Studenten vil ikke ha tilgang på koblingsnøkkelen, og datafilen beskrives som anonym (men komiteen legger til grunn at filen reelt sett ikke er anonym men pseudonym).

Komiteen anser endringen som hensiktsmessig, og har ingen forskningsetiske innvendinger til denne.

Vedtak

Godkjent

Komitéen har vurdert endringsmeldingen og godkjenner prosjektet slik det nå foreligger med hjemmel i helseforskningslovens § 11.

Tillatelsen er gitt under forutsetning av at prosjektendringen gjennomføres slik det er beskrevet i prosjektendringsmeldingen og endringsprotokoll, og de bestemmelser som følger av helseforskningsloven med forskrifter.

Vennligst oppgi vårt referansenummer i korrespondanse.

Med vennlig hilsen,

REK sør-øst C
Besøksadresse: Gullhaugveien 1-3, 0484 Oslo
Telefon:22 84 55 11 | **E-post**:rek-sorost@medisin.uio.no
Web:https://rekportalen.no

Attachment 6: Author guide from BJSM, collected from
https://bjsm.bmj.com/pages/authors/#editorial_policy

Original research

Original research should not exceed 3000 words; Additional data may be presented as supplementary information, which will be published online only should the article be accepted (this can be in any format: text, tables, images, videos, etc.).

Main body of the paper: We encourage short introductions when the rationale of the study is obvious, i.e. it may be as short as 3 short paragraphs that addresses "Why we did it".

We encourage the use of subheadings in the methods, results and discussion. We find it hard to imagine a discussion that has fewer than two subheadings.

Following the lead of The BMJ and its patient partnership strategy, *BJSM* is encouraging active patient involvement in setting the research agenda. As such, we require authors of Research Articles to add a Patient and Public Involvement statement in the Methods section. Please see more details above.

Word count: up to 3000 words
Abstract: up to 250 words and structured including the headings Objectives, Methods, Results and Conclusion
Tables/illustrations: up to 6 tables and/or figures
Please include a summary box summarizing in 3-4 bullet points "what are the new findings" and "how might it impact on clinical practice in the future".
Statements: have you included the necessary statements relating to contributorship, competing interests and funding, data sharing, ethical approval and patient involvement?