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# The influence of educational attainment and immigration status on outcomes of a national self-management program for hip and knee osteoarthritis – results on 22 741 patients from the BOA register

Master thesis in Public Health Sciences (30 ECTS)

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**Abstract**

**Background:** Supervised exercise and delivered education are first step treatment for knee, hip and hand osteoarthritis (OA) according to international guidelines. It is uncertain whether OA outcomes from participation in the Swedish self-management program “Better management of Osteoarthritis (BOA)” differs for participants with different sociodemographic background. The aim of this master thesis was thus to assess to what extent there were differences by level of education and immigration status among participants in the self-management program in terms of Health, Health-related quality of life, Mobility, Health-related behaviours and Adherence to the self-management program, measured at baseline, three and 12 months. **Methods:** Analysis of covariance (ANCOVA), logistic and multinomial regression was used to analyse outcomes for 22 741 participants. **Results:** For most adjusted outcomes, there were sociodemographic inequalities at all measurement points. However, there were no educational differences in mobility and attitude to physical activity at baseline, but at the follow-ups such inequalities emerged. Conversely, the willingness to undergo joint surgery differed by immigration status at baseline, but not at the follow-ups, and immigrants were more adherent towards the self-management program than domestic born participants. **Conclusion:** These results are pioneer findings showing that it exists sociodemographic differences related to OA treatment.

*Key words*

Osteoarthritis, sociodemographic, immigration status, socioeconomic position, rehabilitation, physiotherapy, adherence

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**Introduction**

In year 2010, musculoskeletal disorders were the second biggest contributor to years lived with disabilities, where osteoarthritis (OA) of the hip and knee was the third biggest diseases among these (Vos et al., 2012). OA prevalence is estimated to increase in the coming decades as OA incidence increases with age and the world population gets older, and since there is no current cure for the disease (Felson, et al., 2000).

According to guidelines from Osteoarthritis Research Society International (Zhang et al., 2008) basic treatment for OA should consist of multidimensional measures; e.g. exercise and treatment to reduce pain, disability, joint stiffness and for improving health-related quality of life (HRQoL). If non-surgical rehabilitation fails to address this adequately, the patient should be evaluated for total joint replacement (TJR). Despite these clear guidelines, many patients with OA in the knee or hip have not been offered these alternatives before referral to secondary care for TJR evaluation (Snijders, et al., 2011; Shrier, et al., 2006).

From this background, a Swedish national program for better management of Osteoarthritis (BOA) was launched in year 2006 with the intention that all patients in Sweden with symptomatic OA should be offered this treatment. From the beginning of year 2008 when BOA became a Swedish national register until the end of 2017, 94 798 patients had been registered in BOA and there are currently 733 clinics working with concept in Sweden. Participation in the self-management program has been found to improve HRQoL, reduce pain and intake of medications related to the joint pain among the participants (The BOA Registry, 2017). The BOA register is expected to continue to grow in the proximate future within Sweden but as well internationally by similar BOA-inspired concepts.

However, it is unknown whether outcomes from participation in the self-management program differ according to educational level or country of origin, i.e. belonging to different sociodemographic groups. It is thus important to investigate if the self-management programme decreases, maintains or exacerbates any existing sociodemographic differences in health, especially since research targeting interventions within the healthcare system with the potential to diminish health disparities for patients with OA is warranted (Borkhoff, et al., 2011; Li et al.,2011).

Therefore, the overall aim of this study was to investigate if there were sociodemographic differences (by education and country of birth) in joint related pain, willingness to undergo joint surgery, HRQoL, health-related behaviours, adherence to and use of the self-management program at baseline before the self-management programme starts, at the three-month follow-up, and after 12 months among the participants of BOA.

Characteristics and epidemiology of Osteoarthritis

Osteoarthritis is characterized by an imbalance between building and degrading processes for the joint cartilage that reduce the levels of the cartilage and cause changes within the joint like bone and joint inflammation, and extra-articular effects on joint ligaments with accompanying weakness of joint supportive muscles (Felson et al., 2000).
Cardinal symptoms for OA are joint pain and stiffness which cause limitations in activities of daily living (ADL) (Litwic et al., 2013), explaining why OA is the leading disease causing impairments with walking and stair climbing (Felson et al., 2000).
OA can affect any joint but primarily affects knees, hips, hands, facet joints and feet (Litwic, Edwards, Dennison, & Cooper, 2013).

It can take many years from where a patient experiences his or hers first OA related symptoms until radiographic changes are evident (Thorstensson, 2004), but conversely can persons with clear radiographic verified OA be free from clinical symptoms (Litiwic et al., 2013). It is therefore difficult to assert the prevalence of OA in the population, it exists different ways to determine the diagnosis; by radiographic verification, by symptoms assessed by health care personnel or verification by self-reported data (Turkiewicz, 2016). OA is uncommon among the younger population, but since it is a chronic condition and as incidence increases with age consequently prevalence does too (Litiwic et al., 2013). Radiographic verified knee and hip OA has been found in 19.2 - 27.8 % and 5-10 % of the adult population respectively (Lawrence, et al., 2008; Dagenais, Garbedian, & Wai, 2009), but OA prevalence vary in different populations throughout studies, independent on which diagnostic criteria used (Pereira et al., 2011).
In a Swedish context, Turkiewicz (2016) studied the prevalence of OA in the County of Skåne and found that " one in four adults aged 45 years or older is diagnosed with OA in at least one peripheral joint and 15.4% of middle aged and elderly persons have knee OA with frequent knee pain. "(p. 53). Between the years 1992-2010, did 27 % of the population of Skåne County undertake healthcare visits due to OA in a peripheral joint, a figure that is expected to increase to 30 % until year 2032 (ibid).

Risk factors for the development of OA include non-modifiable factors such as increasing age, sex, genetics, and fully or partially modifiable factors such as muscle weakness, obesity, joint injury (Chaganti & Lane, 2011; Felson et al., 2000) and different typologies of labour

involving heavy physical loading (e.g. Assistant nurses, Construction workers, Farmers) (Andersen, Thygesen, Davidsen, & Helweg-Larsen, 2012; Felston et al., 2000).
Pain generated from weight loading of the OA-affected joint can lead to refrainment from exercising and walking, thus leading to physical inactivity, where physical inactivity in turn are a risk factor for physical inactivity-related diseases that are lethal (Thorstensson, Garellick, Rystedt, & Dahlberg, 2015). This partly explains why persons with OA have a greater risk to develop cardiovascular disease compared to the general population (Wang, Bai, He, Hu, & Liu, 2016).

Sociodemographic differences in Osteoarthritis and adherence to rehabilitation

Citizens in Sweden from a lower socioeconomic position (SEP) tend to be less physically active, work more heavily in manual work, and are more often overweight (SOU 2017:47, 2017), where these factors themselves are risk factors for the development of OA (Felson et al., 2000).
A recently published study by Kiadaliri and colleauges (2017), found that Swedish residents diagnosed with knee OA within a lower SEP had more frequent pain and worse health-related quality of life (HRQoL) than those in the higher socioeconomic strata. Similar findings have been confirmed internationally for pain, stiffness and physical functioning where those with lower education are in a greater need for TJR (Hawker, et al., 2002).
Furthermore, Wetterholm, Turkiwicz, Stigmar, Hubertsson, & Englund (2016) found that patients with higher SEP in general get their OA diagnosis earlier than patients with lower SEP, possibly due to socially patterned health seeking behaviours. An early diagnosis is important since it enables the patients to start their rehabilitation earlier.
The current state of knowledge regarding differences in pain and self-assessed health related to OA between domestic and foreign-born persons in Sweden is weak. Soares and Grossi (1999) found, in a cross-sectional study, that the frequency of pain in a week was higher among those born outside Sweden than among those born in Sweden. Similarly, Krupic, Eisler, Garellick, & Kärrholm (2013) found that foreign born adults reported worse HROQL related outcomes attributable to hip OA than those born in Sweden.

The concept of adherence has been defined as “The extent to which the patient follows medical instructions” (WHO, 2003, p.3), and the meaning of adherence could vary in the field of physiotherapy (Jack, McLean, Moffett, & Gardiner, 2010), e.g. into degree of

participation in exercise or theoretical appointments and following acquired content within the framework of the BOA self-management program.
There exists a knowledge gap if SEP (ibid.), or immigration status affects adherence to rehabilitative exercises and usage of acquired content from the self-management programs. In a systematic review covering adherence to exercise programs among older persons (Assumpcao Picorelli, Pereira, Pereira, Felício, & Sherrington, 2014), only one of included articles eclipsed the importance of SEP as an important factor for adherence to given exercises (cf. Jancey et al., 2007).

*Aim of the study*

The aim of this master thesis were to investigate if outcomes following participation in the BOA self-management program for patients with hip or knee OA were different depending upon the participants level of education (compulsory, upper secondary and university) and immigration status (domestic or foreign born). The aim was explored within three specific research questions:

1. Where there sociodemographic differences in pain, mobility, HRQoL, attitudes to surgical intervention, measured at baseline, three months and the 12 month follow-up?
2. Were there sociodemographic differences for participants' health-related behaviours at baseline, in terms of level of physical activity and attitudes towards exercise and physical activity, when measured at baseline, three months and the 12 month follow-up?
3. Were there sociodemographic differences relating to adherence to the self-management program, as measured by participation rates and usage of self-management strategies?

## Methods

Description of the self-management program and the BOA National Quality register

The self-management programme stands upon two legs: a theory part consisting of a minimum of two theory sessions, and a voluntary exercise part (cf. Figure 1). The theory sessions are approximately 90 minutes long each. The first lesson contains information regarding pathophysiology for the disease, basic epidemiology and available treatments. The second lessons targets why exercise is important for the treatment of OA, coping strategies when exercise and loading of the OA impaired joint is painful, how to incorporate exercise into daily life, self-management strategies relating to symptoms and pain. The third session is held by a patient with OA, who has been trained in the OA communicator programme, who share his or her experiences of having OA and non-surgical treatment. The second leg is aimed towards exercise, where the patient is offered an individual session with a physiotherapist to customize an exercise programme that the patient thereafter has the possibility to exercise in group sessions supervised by a physiotherapist two times per week for 6-8 weeks or if they do prefer exercising in another location or in their home.

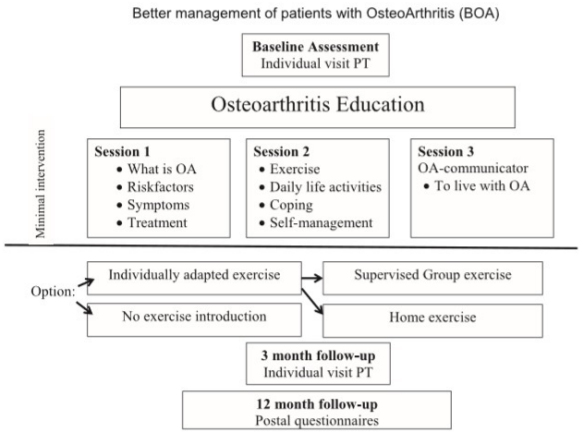


**Figure 1 (Retrieved from Thorstensson, Garellick, Rystedt, Dahlberg, 2015)**

Patient-reported outcome measures are collected at baseline when visiting the physiotherapist, after the theory and exercise sessions at a three-month follow-up to support compliance for up keeping levels of physical activity and after 12 months, when the patient receives a final questionnaire by mail or email. Other outcomes (e.g. participation to exercise, medicine consumption) are asked and reported by the responsible physio- or occupational therapist at baseline and after three months (Thorstensson, et al., 2015). The BOA register covers 222

variables including a wide range of measures such as sociodemographic characteristics, occupation and capacity for work, pain, and health-related quality of life.

## Design, ethical approval

This was a registry-based study evaluating sociodemographic outcomes from the population in the BOA-registry. The study was approved by the Regional Ethical Review Board Gothenburg (application number: 986-17). All participants in the register are informed by the responsible physiotherapist that their participation will be registered in BOA and may be used in research.

## Defining the analytical sample

The original BOA population consisted of 94 798 cases. The procedure for defining the analytic sample for this study is illustrated in figure 2 for each step. First off, cases that entered the register before the end of September of 2016 were excluded because they would not have the possibility to answer the one year follow-up (n=24 375). Second, those who had undergone TJR or decided to drop out for any other reason for surgery were excluded (n= 15 205). This was assessed by a variable the physio- or occupational therapist use at the three-month follow-up; “The patient has received a TJR in most impaired joint since the first visit” or “The patient has cancelled for other reasons than surgery”. In the final step participants with missing data from any of the covariates, dependent and independent variables for the study were excluded (n=32 477), as a complete case analysis approach was used (Gelman & Hill, 2006), for a further description of all variables included in this study cf. Table 1.

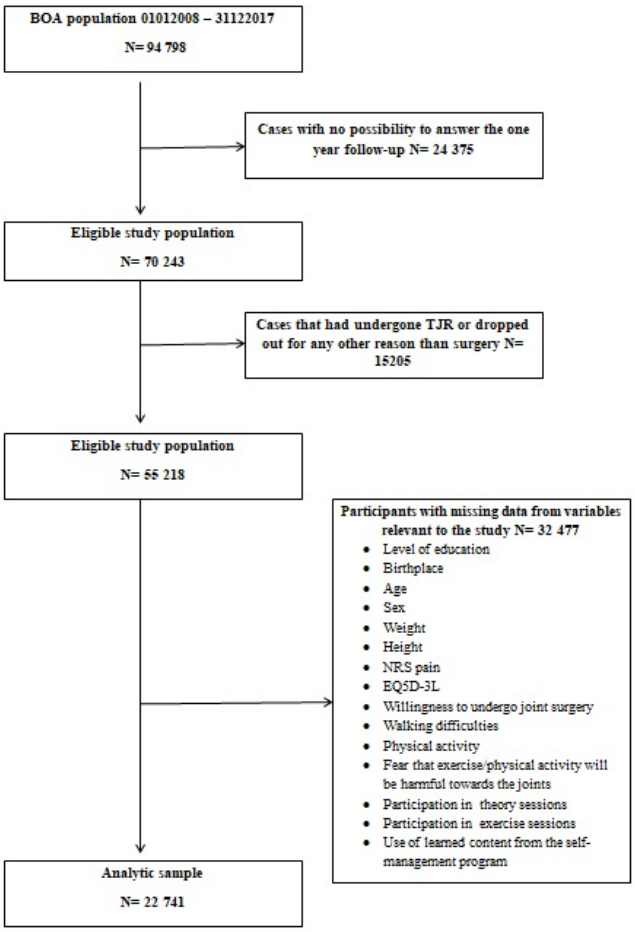


**Figure 2. Illustrating the exclusion process for defining the analytical sample of the study.**

*Variables*

The main outcome variables are presented in Table 1 in chronological order for each of the research questions, all variables used in this study were retrieved from the BOA-registry.

Pain and HRQoL

- Mean pain intensity from the patients' most troublesome joint in the past week was self-measured on a numeric rating scale (NRS), ranging from 0-10 (0= no pain, 10= maximum pain), a common validated measurement of pain intensity (Ferreira-Valente, Paris-Ribeiro, & Jensen, 2011).

- The EQ-5D-3L is a standardised self-rated measure to provide generic measures of health. It covers five aspects of health: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension has 5 levels: no problems, some problems, extreme problems, resulting in 243 possible health states diverging from -0.594 – 1. Where value 1 means that a person has no problems with any of the five health domains, and value 0 means that the person has extreme problems with all five health domains (van Reenen & Oppe, 2015).
- Do you suffer that much impairment from any joint that you are willing to undergo surgery? Yes/No.
- Does your pain cause you difficulties with walking? Yes/No.

**Table 1. Included variables for this study**

| | | Question assessed by | | Measurement point in time | | |
|---|---|---|---|---|---|---|
| **Variabels** | **Indicator** | **Patient** | **PT/OT** | **Baseline** | **Three months** | **12 Months** |
| Ind. variable | Level of education | X | | X | | |
| Ind. variable | Birthplace | X | | X | | |
| Covariate | Age | X | | X | | |
| Covariate | Sex | X | | X | | |
| Covariate | Weight | X | | X | | |
| Covariate | Height | X | | X | | |
| Dep. variable | NRS Pain | X | | X | X | X |
| Dep. variable | EQ-5D-3L | X | | X | X | X |
| Dep. variable | Willingness for joint surgery | X | | X | X | X |
| Dep. variable | Walking difficulties | X | | X | X | X |
| Dep. variable | Physical activity | X | | X | X | X |
| Dep. variable | Fear that exercise/physical activity will be harmful towards the joints | X | | X | X | X |
| Dep. variable | Participation in theory sessions | | X | | X | |
| Dep. variable | Participation in exercise sessions | | X | | X | |
| Dep. variable | Use of learned content from the self-management program | X | | | X | X |

PT (Physiotherapist), OT (Occupational therapist)

Health behaviour

- Being physical active more than 150 minutes per week Yes/No. This was originally an ordinal variable with seven answer options (spanning from 0 minutes to more than

300 minutes). To ease the analysing process, categories 150-300 minutes and more than 300 minutes were recoded into Yes, and all other categories into No. Since at least 150 minutes of physical activity weekly is required to prevent all-cause mortality and chronic disease (WHO, 2011), participants who answered yes thus fulfilled the minimum level threshold for physical activity.

- Are you afraid that exercise or physical activity will be harmful to your joints? Yes/No.

Variables related to adherence to the self-management program

- Participation in theory lessons was assessed by a single question assessed by the physical or occupational therapist, "Has the patient participated in the theory sessions?" Yes/No.
- Number of supervised exercise sessions the patient participated in, assessed and reported by the physical or occupational therapist. This was originally an ordinal variable with five answer categories spanning from no session to more than 12. To make the variable easier to overview responses were categorized into; no exercise session, 1-9 sessions and 10 or more.
- How often do you use knowledge acquired from the self-management program? Every day or several times daily (Compared to those who answered: Every week, month, never, or don´t know). Originally the variable had six categories but for interpreting purposes the variable was recoded into two categories.

Independent variables

- Which is the highest level of education that you have obtained (compulsory, upper secondary, university)?
- Are you born in Sweden Yes/No

Covariates

All analyses were controlled for age, sex and levels of BMI. Age and sex is self-administered variables by the BOA-register, retrieved by the patient's personal identity number in the baseline questionnaire. BMI ($kg/m^2$) was calculated based on patients' self-assessed weight (kilograms) and length (centimetres).

*Statistical analysis*

For continuous dependent variables (EQ-5D-3L and NRS pain), an analysis of covariance was performed (ANCOVA) to retrieve adjusted means when controlled for covariates. The dependent variables were analysed with independent variables education or country of birth analysed in separate models, where education or country of birth were used as fixed factors, adjusted for age, BMI, sex and baseline score as covariates. E.g., when analysing differences in NRS pain between educational groups, country of birth was placed among covariates, and when analysing differences between immigrants and those born in Sweden, level of education was placed among covariates. Categorical variables were dummy coded in order to be placed among covariates, and adjusted means were calculated with 95 % confidence intervals (CI) with Bonferroni corrections.

Following dichotomous variables were included in the study: Willingness to undergo joint surgery, walking difficulty, fear that exercise or physical activity would be harmful towards the joints, physical activity, participation in theory sessions and usage of gained knowledge from the self-management program. For these variables, binary logistic regression with 95 % CI intervals were used with independent variables education and country of birth adjusted for age, BMI, sex and baseline score in a single model.

Degree of participation in exercise sessions consisted of three categories therefore multinomial logistic regression with 95 % CI interval were used. This variable was analysed with independent variables education and immigration status adjusted for age, BMI, sex and baseline score in a single model. The highest level of education (i.e. university) and being born in Sweden was designated as reference categories in both types of regression analysis. All statistical analyses were undertaken using SPSS for Windows, version 25.

**Results**

Descriptive sociodemographic characteristics for the analytical sample is described in Table 2, unadjusted associations in Table 3, multivariate analyses in Table 4 for outcomes related to pain, mobility, HRQoL and health-related behaviors, and multivariate analyses in table 5 for outcomes related to adherence to the self-management program.

**Table 2. Sociodemographic distribution over featured variables**

| | Total (n=22 741) | | Mean | min, max | SD |
|---|---|---|---|---|---|
| Gender | Men | 29.3 (6664) | | | |
| | Women | 70.7 (16077) | | | |
| Level of education | Compulsory | 32.2 (7328) | | | |
| | Upper Secondary | 37.2 (8467) | | | |
| | University | 30.5 (6946) | | | |
| Country of birth | Foreign | 7.7 (1744) | | | |
| | Domestic | 92.3 (20997) | | | |
| Most painful joint at baseline | Knee | 68.8 (15677) | | | |
| | Hip | 28.5 (6477) | | | |
| | Hand | 2.7 (607) | | | |
| | Age | | 66.3 | 27, 95 | 9 |
| | BMI | | 27.8 | 13, 71[1] | 4.7 |

Values are presented in % (n), mean & range in numbers, standard deviation (SD)

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**Table 3. Descriptive results for all outcome variables (n = 22 741)**

*Variables related to pain, mobility and HRQoL*

**NRS Pain (0-10 Scale)**

| Level of education or country of birth | Baseline Mean | SD | Three months Mean | SD | Mean change at three months compared to baseline | 12 Months Mean | SD | Mean change at 12 months compared to baseline |
|---|---|---|---|---|---|---|---|---|
| Compulsory | 5.2 | 1.8 | 4.1 | 2.0 | - 1.1 | 4.6 | 2.2 | - 0.6 |
| Upper Secondary | 5.2 | 1.9 | 4.0 | 2.0 | - 1.2 | 4.4 | 2.3 | - 0.8 |
| University | 4.8 | 1.9 | 3.6 | 2.0 | - 1.2 | 4.0 | 2.3 | - 0.8 |
| Foreign born | 5.5 | 1.9 | 4.2 | 2.0 | - 1.2 | 4.8 | 2.3 | - 0.7 |
| Domestic born | 5.1 | 1.9 | 3.9 | 2.2 | - 1.2 | 4.3 | 2.3 | - 0.8 |
| Total group | 5.1 | 1.9 | 3.9 | 2.0 | - 1.2 | 4.3 | 2.3 | - 0.8 |

**EQ-5D-3L**

| Level of education or country of birth | Baseline Mean | SD | Three months Mean | SD | Mean change at three months compared to baseline | 12 Months Mean | SD | Mean change at 12 months compared to baseline |
|---|---|---|---|---|---|---|---|---|
| Compulsory | 0.64 | 0.20 | 0.70 | 0.18 | + 0.06 | 0.66 | 0.20 | + 0.02 |
| Upper Secondary | 0.64 | 0.21 | 0.70 | 0.18 | + 0.06 | 0.67 | 0.20 | + 0.03 |
| University | 0.67 | 0.19 | 0.72 | 0.16 | + 0.05 | 0.70 | 0.19 | + 0.03 |
| Foreign born | 0.58 | 0.24 | 0.67 | 0.21 | + 0.09 | 0.63 | 0.22 | + 0.05 |
| Domestic born | 0.65 | 0.20 | 0.71 | 0.17 | + 0.06 | 0.68 | 0.19 | + 0.03 |
| Total group | 0.65 | 0.20 | 0.71 | 0.19 | + 0.06 | 0.68 | 0.26 | + 0.03 |

[1] It existed one outlier with 135 BMI that was included in the analyzing process.

| Do you suffer that much impairment from any joint that you are willing to undergo surgery? Yes/No | | | | | |
|---|---|---|---|---|---|
| Level of education or country of birth | Baseline Yes | Three Months Yes | Difference in percentage points at 3 months compared to baseline | 12 Months Yes | Difference in percentage points at 12 months compared to baseline |
| Compulsory | 22.7 (1662) | 16.0 (1172) | - 6.7 | 24.6 (1801) | + 1.9 |
| Upper Secondary | 19.2 (1694) | 13.7 (1153) | - 5.5 | 22.0 (1860) | + 2.8 |
| University | 14.7 (1019) | 9.7 (674) | - 5 | 17.4 (1210) | + 2.7 |
| Foreign born | 23.3 (406) | 15.6 (271) | - 7.7 | 24.1 (420) | + 0.8 |
| Domestic born | 18.9 (3969) | 13.0 (2728) | - 5.9 | 21.2 (4451) | + 2.3 |
| Total group | 19.2 (4375) | 13.2 (2999) | - 6 | 21.4 (4871) | + 2.2 |
| **Does your pain cause you difficulties with walking? Yes/No** | | | | | |
| Level of education or country of birth | Baseline Yes | Three months Yes | Difference in percentage points at 3 months compared to baseline | 12 Months Yes | Difference in percentage points at 12 months compared to baseline |
| Compulsory | 79.5 (5824) | 60.9 (4460) | -18.6 | 63.4 (4644) | - 16.1 |
| Upper Secondary | 78.5 (6650) | 57.4 (4864) | - 21.1 | 59.5 (5042) | - 19 |
| University | 76.1 (5287) | 54.9 (3810) | - 21.2 | 56.1 (3896) | - 20 |
| Foreign born | 80.6 (1406) | 61.7 (1076) | - 18.9 | 63.8 (1113) | - 16.8 |
| Domestic born | 77.9 (16355) | 57.4 (12058) | - 20.5 | 59.4 (12469) | - 18.5 |
| Total group | 78.1 (17761) | 57.8 (12134) | - 20.3 | 59.7 (13582) | - 18.4 |
| *Variables related to health behaviours* | | | | | |
| **Physical active more than 150 minutes per week Yes/No** | | | | | |
| Level of education or country of birth | Baseline Yes | Three months Yes | Difference in percentage points at 3 months compared to baseline | 12 Months Yes | Difference in percentage points at 12 months compared to baseline |
| Compulsory | 40.8 (2987) | 42.2 (3092) | + 1.4 | 37.6 (2753) | - 3.2 |
| Upper Secondary | 44.9 (3803) | 47.7 (4042) | + 2.8 | 44.5 (3764) | - 0.4 |
| University | 49.8 (3456) | 52.6 (3652) | + 2.8 | 50.2 (3487) | + 0.3 |
| Foreign born | 37.7 (657) | 42.4 (740) | + 4.7 | 38.7 (675) | + 1 |
| Domestic born | 45.7 (9589) | 47.8 (10046) | + 2.1 | 44.4 (9329) | - 1.3 |
| Total group | 45.1 (10246) | 47.4 (10786) | + 2.3 | 44.0 (10004) | -1.1 |
| **Are you afraid that exercise or physical activity will be harmful to your joints? Yes/No** | | | | | |
| Level of education or country of birth | Baseline Yes | Three Months Yes | Difference in percentage points at 3 months compared to baseline | 12 Months Yes | Difference in percentage points at 12 months compared to baseline |
| Compulsory | 14.3 (1048) | 5.5 (402) | - 8.8 | 9.4 (688) | - 4.9 |
| Upper Secondary | 16.4 (1385) | 5.2 (441) | - 11.2 | 8.7 (739) | - 7.7 |
| University | 15.0 (1043) | 4.2 (292) | - 10.8 | 5.7 (393) | - 9.3 |

| | | | | | |
|---|---|---|---|---|---|
| Foreign born | 23.3 (407) | 10.8 (189) | - 12.5 | 17.0 (297) | - 6.3 |
| Domestic born | 14.6 (3069) | 4.5 (946) | - 10.1 | 7.3 (1523) | - 7.3 |
| Total group | 15.3 (3476) | 5.0 (1135) | - 10.3 | 8.0 (1820) | - 7.3 |

*Variables related to adherence to the self-management program*

**Number of supervised exercise sessions the patient participated in**

| Level of education or country of birth | None | 1 – 9 Times | 10 Times or more |
|---|---|---|---|
| Compulsory | 40.6 (2972) | 26.9 (1974) | 32.5 (2382) |
| Upper Secondary | 42.8 (3625) | 28.2 (2391) | 28.9 (2451) |
| University | 40.3 (2800) | 30.6 (2125) | 29.1 (2021) |
| Foreign born | 36.1 (629) | 31.8 (554) | 32.2 (561) |
| Domestic born | 41.8 (8768) | 28.3 (5936) | 30.0 (6293) |
| Total group | 41.3 (9397) | 28.5 (6490) | 30.1 (6854) |

**How often do you use acquired knowledge from the self-management program? Every day or several times daily (compared to those who answered: Every week, month, never, or don´t know)**

| Level of education or country of birth | Three months Yes | 12 Months Yes | Difference in percentage points at 12 months compared to three months |
|---|---|---|---|
| Compulsory | 60.7 (4450) | 36.8 (2700) | - 23.9 |
| Upper Secondary | 61.3 (5188) | 37.4 (3170) | - 23.9 |
| University | 63.0 (4375) | 40.7 (2824) | - 22.3 |
| Foreign born | 65.1 (1135) | 43.2 (753) | - 21.9 |
| Domestic born | 61.3 (12878) | 37.8 (7941) | - 23.5 |
| Total group | 61.6 (14013) | 38.2 (8694) | - 23.4 |

Variables NRS Pain and EQ-5D-3L are presented in numbers, all other values are presented in % (numbers inside brackets)

**Table 4. Adjusted sociodemographic outcomes for Variables related to pain, mobility, HRQoL and health-related behaviors, stratified by level of education and country of origin (n = 22 741).**

*Variables related to pain, mobility and HRQoL*

**NRS Pain (0-10 Scale) Mean values**

| Education or country of birth | Baseline Mean | Baseline CI | Three months Mean | Three months CI | 12 Months Mean | 12 Months CI |
|---|---|---|---|---|---|---|
| Compulsory | **5.2** | **5.2 - 5.3** | **4.0** | **4.0 - 4.1** | **4.5** | **4.4 - 4.5** |
| Upper Secondary | **5.2** | **5.1 - 5.2** | **4.0** | **3.9 - 4.0** | **4.3** | **4.3 - 4.4** |
| University | **4.8** | **4.8 - 4.9** | **3.8** | **3.8 - 3.8** | **4.1** | **4.1 - 4.2** |
| Foreign | **5.5** | **5.4 - 5.5** | **4.0** | **3.9 - 4.1** | **4.5** | **4.4 - 4.6** |
| Domestic | **5.1** | **5.0 - 5.1** | **3.9** | **3.9 - 4.0** | **4.3** | **4.3 - 4.3** |

**EQ-5D-3L Mean values**

| Education or country of birth | Baseline Mean | Baseline CI | Three months Mean | Three months CI | 12 Months Mean | 12 Months CI |
|---|---|---|---|---|---|---|
| Compulsory | **0.63** | **0.63 - 0.64** | **0.70** | **0.70 - 0.70** | **0.67** | **0.67 - 0.67** |
| Upper Secondary | **0.64** | **0.64 - 0.65** | **0.71** | **0.71 - 0.71** | **0.67** | **0.67 - 0.68** |

| | | | | | | |
|---|---|---|---|---|---|---|
| University | **0.66** | **0.66 - 0.67** | **0.72** | **0.71 - 0.72** | **0.68** | **0.68 - 0.69** |
| Foreign | **0.59** | **0.58 - 0.60** | **0.69** | **0.69 - 0.70** | **0.66** | **0.65 - 0.66** |
| Domestic | **0.65** | **0.65 - 0.65** | **0.71** | **0.71 - 0.71** | **0.68** | **0.68 - 0.68** |

**Do you suffer that much impairment from any joint that you are willing to undergo surgery? Yes/No**

| | Baseline | | Three months | | 12 Months | |
|---|---|---|---|---|---|---|
| Education or country of birth | OR | CI | OR | CI | OR | CI |
| Compulsory | **1.65** | **1.51 – 1.81** | **1.36** | **1.21 – 1.52** | **1.23** | **1.12 – 1.35** |
| Upper Secondary | **1.27** | **1.16 – 1.39** | **1.20** | **1.07 – 1.35** | **1.12** | **1.03 – 1.23** |
| University | 1 | | 1 | | 1 | |
| Foreign born | **1.34** | **1.19 – 1.51** | 1.09 | 0.93 – 1.27 | 1.07 | 0.94 – 1.22 |
| Domestic born | 1 | | 1 | | 1 | |

**Does your pain cause you difficulties with walking? Yes/No**

| | Baseline | | Three months | | 12 Months | |
|---|---|---|---|---|---|---|
| Education or country of birth | OR | CI | OR | CI | OR | CI |
| Compulsory | 1.05 | 0.97 – 1.15 | **1.12** | **1.03 – 1.20** | **1.16** | **1.03 – 1.20** |
| Upper Secondary | 1.05 | 0.98 – 1.15 | 1.02 | 0.95 – 1.10 | 1.06 | 0.99 – 1.14 |
| University | 1 | | 1 | | 1 | |
| Foreign born | **1.13** | **1.0 – 1.28** | **1.14** | **1.02 – 1.27** | **1.16** | **1.04 – 1.30** |
| Domestic born | 1 | | 1 | | 1 | |

*Variables related to health behaviors*

**Odds for being physical active more than 150 minutes per week Yes/No**

| | Baseline | | Three Months | | 12 Months | |
|---|---|---|---|---|---|---|
| Education or country of birth | OR | CI | OR | CI | OR | CI |
| Compulsory | **0.79** | **0.74 – 0.85** | **0.79** | **0.74 – 0.90** | **0.71** | **0.66 – 0.77** |
| Upper Secondary | **0.87** | **0.82 – 0.93** | **0.88** | **0.82 – 0.95** | **0.85** | **0.79 – 0.91** |
| University | 1 | | 1 | | 1 | |
| Foreign born | **0.74** | **0.66 – 0.82** | **0.90** | **0.90 – 1.00** | **0.88** | **0.78 – 0.98** |
| Domestic born | 1 | | 1 | | 1 | |

**Are you afraid that exercise or physical activity will be harmful to your joints?**

| | Baseline | | Three Months | | 12 Months | |
|---|---|---|---|---|---|---|
| Education or country of birth | OR | CI | OR | CI | OR | CI |
| Compulsory | 1.06 | 0.96 – 1.17 | **1.40** | **1.19 – 1.65** | **1.86** | **1.62 – 2.14** |
| Upper Secondary | 0.97 | 0.89 – 1.07 | 1.15 | 0.98 – 1.35 | **1.45** | **1.26 – 1.65** |
| University | 1 | | 1 | | 1 | |
| Foreign born | **1.81** | **1.60 – 2.04** | **2.26** | **1.89 – 2.69** | **2.50** | **2.16 – 2.90** |
| Domestic born | 1 | | 1 | | 1 | |

Significant results are indicated in bold. Continuous variables (NRS Pain and EQ-5D-3L) were analyzed with ANCOVA, adjusted mean scores are presented with CI 95%. When analyzing outcomes for different educational groups; educational level was used as a fixed factor, and age, sex, BMI, birthplace were used as covariates in all models. When analyzing outcomes for country of birth; country of birth was used as a fixed factor, and age, sex, BMI, educational level were used as covariates in all models. Furthermore, On the three and 12-month follow-up, baseline values were added as covariates in the models.

Logistic regression and odds ratios (OR) are presented with confidence intervals (95 % CI). Models are controlled for age, sex, BMI in all models, and for baseline values on three and 12 months.

**Table 5. Adjusted sociodemographic outcomes related to adherence to the self-management program, stratified by level of education and country of origin (n = 22 741).**

**Odds for Number of supervised exercise sessions the patient participated in compared to none (0 times reference group)**

| Education or country of birth | 1-9 Times | | 10 Times or more | |
|---|---|---|---|---|
| | OR | CI | OR | CI |
| Compulsory | **0.82** | **0.76 – 0.89** | 0.97 | 0.90 – 1.05 |
| Upper Secondary | **0.90** | **0.84 – 0.98** | 0.99 | 0.92 – 1.07 |
| University | 1 | | 1 | |

| | | | | |
|---|---|---|---|---|
| Foreign born | **1.26** | **1.12 – 1.42** | **1.26** | **1.11 – 1.42** |
| Domestic born | 1 | | 1 | |
| **How often do you use acquired knowledge from the self-management program? Every day or several times daily (compared to those who answered: Every week, month, never, or don´t know)** | | | | |
| | Three Months | | 12 Months | |
| Education or country of birth | OR | CI | OR | CI |
| Compulsory education | **0.84** | **0.78 – 0.90** | **0.85** | **0.79 – 0.91** |
| Upper Secondary School | 0.98 | 0.92 – 1.05 | **0.91** | **0.85 – 0.98** |
| University | 1 | | 1 | |
| | | | | |
| Foreign born | **1.16** | **1.05 – 1.29** | **1.20** | **1.08 – 1.33** |
| Domestic born | 1 | | 1 | |

Significant results are indicated in bold. Number of supervised exercise sessions are analyzed with multinomial logistic regression. Odds ratios (OR) are presented with confidence intervals (95 % CI), and are controlled for age, sex, BMI. Use of acquired knowledge from the self-management program are analyzed with logistic regression. Odds ratios (OR) are presented with confidence intervals (95 % CI), and are controlled for age, sex, BMI, outcomes on 12 months are adjusted for values at three months.

*Pain, HRQoL and mobility*

NRS pain

Table 3 shows the unadjusted mean pain scores by education and immigration status. The results show that, at baseline, participants with a compulsory education had a 0.4 higher mean pain score than participants with a university education. By the 12 month follow-up, the mean pain score had been reduced with 0.8 among participants with upper secondary and university education, and with 0.6 among participants with compulsory education. Thus, at the 12 month follow-up the difference in mean pain score had increased to 0.6 between participants with university and compulsory education. When adjusting for age, sex, BMI, and baseline scores (Table 4), participants with compulsory education had a 0.4 higher mean pain score at baseline, a 0.2 higher mean score at three months and 0.4 at the 12-month follow-up, when compared to participants with a university education.

In the unadjusted analyses (Table 3) immigrants had a 0.4 higher mean pain score than domestic born participants at baseline, 0.3 at three months and 0.5 at the 12-month follow-up. When adjusting for age, sex, BMI, and baseline scores (Table 4), immigrants had a 0.4 higher mean pain score than domestic born participants at baseline and 0.2 at the 12 month follow-up.

EQ-5D-3L

Unadjusted results (Table 3) show that participants with compulsory education had a 0.03 lower mean EQ-5D-3L index score at baseline than participants with university education, and 0.04 at the 12-month follow-up. After adjusting for age, sex, BMI, and (Table 4),

participants with university education had a 0.03 lower mean EQ-5D-3L score at baseline, 0.02 at three months and 0.01 at the 12 month follow-up than participants with compulsory education.

In the unadjusted analyses (Table 3) immigrants had a 0.07 lower mean EQ-5D-3L score at baseline, 0.04 lower at three months and 0.05 lower at the 12- month follow-up than domestic born participants. When adjusting for age, sex, BMI, and baseline scores (Table 4), immigrants had a 0.06 lower mean EQ-5D-3L scores at baseline, and 0.02 lower mean EQ-5D-3L score at both the three and 12-month follow-up than domestic born participants.

Willingness to undergo joint surgery

Unadjusted data showed that when comparing to baseline, that there was a small decrease at three months and a small increase at the 12 month follow-up in the proportion of participants reporting willingness to undergo joint surgery, among all education and immigration status groups. Among those with university level education, the proportion of participants who wanted to undergo TJR was 14.7 % at baseline and 17.4 % at the 12 month follow-up, compared to 22.7 % at baseline and 24.6 % at the 12-month follow-up for participants with compulsory education (Table 3).

After adjusting for age, sex, BMI, and baseline scores (in the analyses at follow-up), the likelihood of reporting willingness to undergo surgery was larger for participants with compulsory (OR 1.65 CI 1.51-1.81) and upper secondary education (OR 1.27 CI 1.16-1.39) at baseline when compared to participants with university education. At the 12-month follow-up, educational differences in OR to report a willingness to undergo joint surgery was 1.23 (CI 1.12-1.35) for participants with compulsory and 1.12 for participants with upper secondary education (CI 1.03-1.23) compared to those with a university education.

The proportion of immigrant participants who wanted to undergo TJR was 23.3 % at baseline and 24.1 % at the 12-month follow-up, compared to 18.9 % at baseline and 21.9 % at the 12-month follow-up for domestic born participants (Table 3).

Immigrants reported a higher probability (OR 1.34, CI 1.19-1.51) of desiring joint surgery when compared to domestic born participants at baseline, but at the three and 12-month follow-up the odds ratio was much lower (1.09 and 1.07 respectively) and no longer statistically significant (Table 4).

Walking difficulty

Unadjusted results (Table 3) showed that participants with lower education reported more difficulties ambulating on most affected joint than those with higher education at all measurement points. The adjusted OR (Table 4) to report walking difficulties for participants with compulsory education as compared to those with university education was 1.05 (CI 0.97-1.15) and were thus statistically non-significant at baseline, but the association became stronger and statistically significant at both three months 1.12 (CI 1.03-1.20), and at the 12-month follow-up 1.16 (CI 1.03-1.20).

Unadjusted results (Table 3) showed that domestic born participants were more likely to report more difficulties ambulating on most affected joint than foreign born participants at all measurement points. These differences remained at all three measurement points after adjusting for covariates (Table 4).

*Health behaviour*

Physical activity more than 150 minutes per week

Unadjusted results showed (Table 3), that the proportions of participants who reported being physically active, were 9.0 percentage units higher at baseline, 10.6 at three months and 12.6 at the 12 month follow-up among participants with university education than among those with compulsory education.

After adjusting for covariates (Table 4), the likelihood of reporting being physically active more than 150 minutes per week was lower for participants with compulsory (OR 0.79 CI 0.74-0.85) and upper secondary education (OR 0.87 CI 0.82-0.93) at baseline when compared to participants with university education. The odds ratios were of the same magnitude at the three-month follow-up. At the 12-month follow-up, educational differences in the likelihood to report being physically active more than 150 minutes per week was 0.71 (CI 0.66-0.77) for participants with compulsory and 0.85 for participants with upper secondary education (CI 0.79-0.91) compared to those with a university education.

Unadjusted results (Table 3), showed that the proportions of participants who reported being physically active more than 150 minutes per week, were 8 percentage units higher at baseline, 5.4 at three months and 5.7 at the 12-month follow-up among domestic born participants than

among foreign born participants. After adjustments for covariates (Table 4), the likelihood of reporting being physically active more than 150 minutes per week was lower for foreign born participants (OR 0.74 CI 0.66-0.82) at baseline, three months (OR 0.90 CI 0.90-1.00), and at the 12-month follow-up (OR 0.88 CI 0.78-0.98), when compared to domestic born participants.

Are you afraid that exercise or physical activity will be harmful to your joints?

At baseline, similar proportions of participants with different levels of education reported the belief that exercise or physical activity would be harmful for educational and immigrant status groups (Table 3).

At the three-month follow-up (Table 4), compulsory education was associated with a higher likelihood (OR 1.40; CI 1.19-1.65) to report the belief that exercise or physical activity would be harmful for the joints compared to participants with university education. This association existed at the 12-month follow-up for participants with compulsory (OR 1.86, CI 1.62-2.14), and upper secondary education (OR 1.45, CI 1.26-1.65).

The belief that exercise or physical activity would be harmful towards the joints was 8.7 percentage points higher for immigrants at baseline, than for domestic born participants. The adjusted odds for an immigrant to report the belief that exercise or physical activity would be harmful compared to a domestic born participant were higher at all measurement points; 1.81 (CI 1.60-2.04) at baseline, 2.26 (1.89-2.69) at the three-month follow-up, and 2.50 (CI 2.16-2.90) at the 12-month follow-up (Table 4).

*Participation in and use of the self-management program*

Between 98.9-99.0 % of participants participated in the self-management programs theory sessions (Appendix, Table 1). There existed no un-adjusted or adjusted differences in participation between the different educational groups or between foreign or domestic born participants, thus will this variable not be presented (Appendix, Table 1 & 2).

Number of supervised exercise sessions the patient participated in.

Unadjusted results (Table 3) showed that 30.6 % of participants with university education participated in 1-9 exercise sessions compared to 26.9 % of those with only compulsory education. Reversely did 32.5 % of participants with compulsory education participate in 10 or more exercise session compared to 29.2 % of those with university education. The OR for participants with compulsory and upper secondary education to participate in 1-9 exercise

sessions, rather than none, were 0.82 (CI 0.76-0.89) and 0.90 (0.84-0.98) compared to those with university education (Table 5). No statistically significant associations between education and participation in 10 or more exercise sessions were found.

The adjusted odds of both participating in 1-9 sessions, and 10 sessions or more compared to none, was 1.26 (CI 1.11-1.42, CI 1.12-1.42) for immigrants compared to Swedish born participants (Table 5).

Use of knowledge from the self-management program

Education- and immigration-dependent sociodemographic differences were present regarding how participants reported use of knowledge acquired through the self-management program at both follow-up points (Table 3). The ORs for participants with compulsory education to use what they had learnt from the self-management program daily were 0.82 (CI 0.76-0.89) at the three-month follow-up and 0.85 at 12 months (CI 0.79-0.91) compared to those with university education (Table 5). The differences in odds for participants with upper secondary education, compared to those with a university education, was only statistically significant at 3 months (OR 0.90, CI 0.84-0.98).

The OR for immigrants to report that they used what they learned from the self-management programme on a daily basis was 1.16 (CI 1.05-1.29) at the three-month follow-up, and 1.20 (CI 1.08-1.33) at 12 months, compared to domestic born participants.

## Discussion

### *Main findings*

The aim of this study was to explore sociodemographic differences within the BOA self-management program for outcomes related to Pain, HRQoL walking disabilities, willingness to undergo joint surgery, health behaviours and adherence to the self-management program. Even though all educational groups and whether participants were foreign or domestic born experienced general improvements from participating in the self-management program, it still existed sociodemographic inequalities at all measurement points.

Adjusted outcomes for Pain, EQ-5D-3L and levels of physical activity showed a persistent pattern for inequality as domestic born participants and participants with higher education did report better adjusted results at all the measurement points.

There were not adjusted educational differences for outcomes related to walking difficulties and the belief that physical activity or exercise are harmful towards the joints at baseline, but such inequalities did emerge at the three and 12-month follow-up, whereas these differences existed at all measurement points according to immigrational status in favour for domestic born participants.

Conversely did immigrants report a greater adjusted willingness to undergo joint surgery at baseline than domestic born participants, but this difference did not exist at the three and 12-month follow-up, whereas educational inequalities did exist at all three measurement points in favour for participants with higher level of education.

Furthermore, participants with lower levels of education reported lower odds to participate in 1-9 exercise sessions rather than none, and for how often they used acquired knowledge from the self-management program. But foreign participants did participate in more exercise sessions and use acquired knowledge from the self-management program to a higher extent than domestic born participants.

*Comparisons with other studies*

Outcomes related to pain, mobility and HRQoL

The finding that participants in the self-management program with lower education on average had worse pain intensity, HRQoL and more frequently experienced walking disabilities, was expected. It is well documented that people with lower SEP experience more pain and functional impairments from their OA than people with higher SEP (Luong et al., 2012).

These findings are in line with a study conducted by Weigl, Angst, Aeschlimann, Lehmann and Stucki (2006) who found that patients with higher level of education had greater odds to improve pain, joint stiffness and physical functional ability for their OA through a comprehensive rehabilitation programme compared to patients with lower levels of education, thus perhaps explaining why adjusted educational differences for walking disabilities emerged at the three and 12-month follow-up.

In addition, higher level of education has been associated with superior pain-related outcomes in multimodal rehabilitative programs for chronic pain (Gerdle, Molander, Stenberg, Stålnacke, & Enthoven, 2016) and chronic widespread pain (de Rooij, van der Leeden, Roorda, Steultjens, & Dekker, 2013). Furthermore, low baseline scores (e.g. higher levels of

baseline pain and lower EQ-5D-3L score) has been found to predict worse pain-relief in multimodal rehabilitative programs for chronic low back pain (van der Hulst, Vollenbroek-Hutten, & IJzerman, 2005), perhaps explaining educational differences in pain and HRQoL at the different measurement points.
The lack of studies presenting short and long-term treatment outcomes for different educational groups with OA, and since chronic and lower back pain differ in their aetiology compared to OA, makes it difficult to speculate if outcomes for the different educational groups in this study assessing pain, mobility and HRQoL, were expected.

Participants with lower education persistently reported higher likelihood for wanting to undergo joint surgery compared to participants with higher education at the different measurement points. This finding is line with a study conducted by Hawker and colleagues (2002), who found that persons with lower education had greater odds for reporting a willingness to undertake TJR compared to patients with higher education, although their results were not statistically significant. The authors speculated that their findings might adhere to the fact that lower educated patients with OA may experience worse OA symptoms due to increased exposure to risk factors related to the disease, thus increasing the willingness to undergo joint surgery. Participants with higher education were less likely to be willing to undergo joint surgery, which is in line with a study conducted by Youm, Chan, Belkora, & Bozic (2015). They found that patients with higher SEP referred to orthopaedic surgeon for TJR evaluation, were more prone to decline TJR than patients with lower SEP, even when controlled for age, sex and ethnicity.

The fact that immigrants in Sweden reported higher levels of OA related pain than domestic born Swedes is consistent with the only existing, to my knowledge, study authored by Krupic and colleagues (2013). They found that Swedish immigrants reported slightly higher scores in VAS pain before total hip replacement than domestic born patients. It has also been demonstrated that immigrants in Sweden in general experience more musculoskeletal pain (Soares & Grossi, 1999) and chronic musculoskeletal pain (Bergman, Herrström, Högström, Petersson, Svensson, & Jacobsson, 2011), which perhaps can lend some support for this observation.
Immigrants reported greater odds to undergo joint surgery at baseline, but this result was attenuated and became stistically insignifcant at the three and 12-month follow-ups. This finding is hard to comprehend due to the lack of studies to compare with. The self-

manamgent program intend to teach the participants about the benefits physical activity and exercise as a way to postpone or prevent TJR, and that only a minority of patients with OA will become in need for joint surgery. Hence, perhaps this message are new information for immigrants compared to domestic born participants, or maybe does the self-management program change foregin and domestic born particpants view upon joint surgery to become similar.

Overall, less educated participants and immigrants tended to report more pain, worse HRQoL, a greater willing to undergo joint surgery and mobility impairments compared their respective counterparts. Sociodemographic differences in occupational engagement may partly explain this.

Cumulative years of occupational work with construction or other jobs with high physical strain, i.e. blue-collar work, increases the risk for developing OA compared to white-collar professions (Andersen et al., 2012).

Swedish immigrants have been found to work in blue-collar professions like industrial and construction work to a higher extent than the domestic born population (DS 2000:69, 2000). And according to a Danish study of the whole working population, there is an association between lower levels of education and engagement in blue-collar work (Andersen et al., 2012). One interpretation of this is that some types of labour may "speed up" the process of developing OA. Perhaps explaining why some less educated participants and immigrants enter the self-management program in the later stages of their OA disease, compared to participants with higher education and domestic born participants. Consequently, some may present with advanced symptoms, e.g. walking difficulties, which may be difficult targets for non-surgical treatment.

Outcomes related to health behaviors

Apart from impairments caused by OA itself, less educated persons may suffer more in general from coexisting illnesses and mobility disabilities overall (Sainio et al., 2007). This has been one suggested explanation to why patients with lower educational attainment participate less in cardiac rehabilitation (Harlan et al., 1995). In line with this finding, Weigl and colleagues (2006) found that low educational attainment and suffering from more than two comorbidities were independent predictors for worse outcome studying a 4-week comprehensive rehabilitation intervention for OA. Thus, other comorbidities not covered in

this study could help to explain lower levels of physical activity for participants with lower education.

All participants in the self-management program receive the same message regarding benefits of physical activity and advice of how to tolerate pain when exercising and in handling their OA in everyday life. Still, at both the three months for participants with compulsory education and at the 12-month follow-up for participants with either compulsory or upper secondary education, there were educational differences between the groups in the belief that exercise or physical activity is harmful for the joints, in favour for participants with university education.

Kolbe (2002) summarizes this peril for keeping adherence to self-management programs well: “knowledge is important only to the extent that it is a prerequisite for any beneficial effect on illness-related behaviour” (p. 556). It is difficult to interpret these findings and to my knowledge, prior studies assessing different sociodemographic groups as independent variables for these outcomes for OA does not exist.

Participants with lower education reported more pain, worse HRQoL and mobility outcomes due to their OA. Naturally this affects their overall ability to be functionally mobile (Sainio, Martelin, Koskinen, & Heliövaara, 2007), hampering physical activity levels, and shape their belief that exercise is dangerous for their joints and limited their motivation to participate in exercise sessions for their OA in comparison to participants with higher levels of education. Furthermore, Kolbe (2000) found that level of self-management knowledge for Asthma did not predict self-management errors. In addition did Thorstensson, Roos, Petersson, & Arvidsson, (2006) find in a qualitative study that participants felt doubts of the efficacy of exercise for knee OA, even among those where the exercise had reduced their levels of pain. In the context of this study, this may indicate that other psychological mechanisms may exist among less educated participants which make them believe to a higher extent that exercise or physical activity will harm the joints.

Speculatively, since participants in this study with lower educational attainment experienced more pain at baseline, it may appear counter intuitive for them to believe that exercise is not dangerous for the joints even after receiving self-management advice. On the contrary, this advice may be enough for higher educated participants that suffer from less pain and mobility impairments. Thus, perhaps explain why differences became statistically significant at the three and 12-month follow-up.

Immigrants were less physical active per week compared to domestic born Swedes (Lindström & Sundquist, 2001), even when controlled for education and other covariates (Dawson, Sundquist, & Johansson, 2005). In this context, religious and cultural differences has been ascribed as important factors explaining this association (Langøien, et al., 2017), tentatively explaining the difference in physical activity at all three measurement points between immigrants and domestic born participants. In addition did immigrants possess the belief that exercise or physical activity would be harmful for the joints to a larger extent than domestic born participants at all three measurement points.

Cultural differences between immigrants and domestic born Swedes has been used to explain why immigrants are less physical active (Lindström & Sundquist, 2001) and to why immigrants experience more pain related to hip OA (Krupic et al., 2013). It is thus possible that cultural differences partly can explain immigrants greater fear avoidance of exercise or physical activity for OA as well. Since physical activity levels varies between different nationalities (Lindström & Sundquist, 2001; Dawson, Sundquist, & Johansson, 2005), attitudes towards fear avoidance for exercise or physical activity for OA can possibly differ between nationalities and cultures as well.

Furthermore, the stipulation of the question targeting fear avoidance for exercise or physical activity in the questionnaire may be perceived differently for persons from different cultures and need to be cross-culturally adapted (Beaton, Bombardier, Guillemin, & Ferraz, 2000).

Outcomes related to adherence to the self-management program

Compulsory and upper secondary educated participants had lower odds of participating in 1-9 exercise sessions versus no exercise sessions when compared to those with university education. Since lower educated participants reported higher levels of pain, mobility impairments, greater willingness for surgery and fear avoidance for physical exercise or physical activity towards the joints, this may have limited their motivation for exercise. This is partly in line with a study conducted by Jack and colleagues (2010), who found that prevalence of musculoskeletal pain during exercise has been shown to predict lower adherence to rehabilitation in outpatient clinics (Jack et al., 2010). In addition, a patient's perception of their knee problems as to severe at baseline, has been found to predict disappointment with participating in rehabilitation programmes for chronic knee pain (Hurley, Walsh, Bhavnani, Britten, and Stevenson, 2010). On the contrary, Tuakli-Wosornu and colleagues (2016) found that prevalent twisting and pivoting knee pain predicted greater adherence to exercise for OA. Furthermore, has psychological factors such as anxiety,

pessimism and stigmatization been seen to impede adherence of following learned self-management advice for other diseases (Kolbe, 2000), and low levels of physical activity has been able to predict low adherence to rehabilitation (Jackson et al., 2010). Since both mental illness (Tinghög, Hemmingsoson, & Lundberg, 2007) and physical inactivity (SOU 2017:47, 2017) are more common among lower educated Swedes it can be the case that lower levels of education can predict less adherence to the BOA self-management program.
Furthermore did Jancey and colleagues (2007) find that persons living in more socioeconomic deprived areas had higher dropout rates when participating in a community exercise intervention to increase physical activity levels among the elderly, than those living in less deprived areas.
In addition has negative relationships between low SEP and adherence to self-management strategies for other diseases (Kolbe, 2002) and participation in cardiac rehabilitation (Jackson et al., 2004) been demonstrated previously. On the other hand, psychological diseases such as depression have been shown not to affect level of participation in cardiac rehabilitation (ibid). Tuakli-Wosornu et al., (2016) found in an American study that adherence to exercise for OA was lower for participants with low income compared to those with high[2], where the authors speculated that participants with low income would have greater difficulties finding transport and pay for their rehabilitation. A finding perhaps difficult to generalize to Swedish settings as exercise sessions in the self-management program are implemented in the primary care of the county with low associated costs for the client.
The proportions of participants with compulsory education that participated in 10 or more exercise sessions were 3.4 percentage points higher than for participants with university education. This result seems counter intuitive at a first glance, and should be interpreted with caution, as this was not adjusted for potential confounders (Table 3). This finding could adhere from the fact that participants with lower education just suffer more pain and disability from their OA (Luong et al., 2012) and thus have a greater need for rehabilitation.

Immigrants reported higher odds of participating in more exercises sessions, and they did utilize what they have learned from the self-management program to a higher degree when compared to domestic born Swedes. This may appear contradictory since immigrants experience more mental illness (Tinghög, Hemmingsson, Lundberg, 2007) and are less physically active (Lindström & Sundquist, 2001; Dawson, Sundquist, & Johansson, 2005),

[2] Where individual´s level of economic income can be seen as one of the three determinants (level of education, occupation, income) shaping SEP (Graham, 2007).

factors associated with lower adherence to rehabilitation (Jack et al., 2010) and utilization of self-management strategies (Kolbe, 2002). Immigrants were more compliant to the self-management programme in spite of these factors.
On the other hand, immigrants' higher levels of pain and mobility impairments could potentially act as a motivator for exercise towards OA related impairments (Tuakli-Wosornu et al., 2016). Speculatively, some immigrants in this study may come from hierarchical cultures with scarce resources within the healthcare system where the health care givers actions and recommendations are looked upon with respect, which can make immigrant participants more motivated to adhere to the BOA self-management program. In addition may the self-management program provide immigrant´s with knowledge and information related to OA that Swedish participants already had before (e.g. characteristics of OA and self-management utilities related to the disease, benefits physical activity and exercise etc.).

*Strengths and limitations*

To my knowledge, this is the first study ever that has assessed immigration status as predictors for adherence to a self-management program for OA. Only two other studies have assessed educational attainment as a predictor for adherence to OA related rehabilitation (Tuakli-Wosornu et al.,2016; Weigel et al., 2006). It is furthermore the largest study conducted so far in terms of sample size that has explored nine outcome variables adjusted for important covariates. Importantly, BMI was included, which perhaps is one of the strongest mediators between SEP and OA, in particular for knee OA (Reyes et al., 2015). Hawker and colleagues (2005) investigated if lower educated patients had greater odds to report willingness to undergo TJR and although the results indicated differences, they were not statistically significant. Therefore, this is the first study to my knowledge demonstrating a statistically significant association between educational status and willingness to undergo TJR surgery. This study has several limitations to address.

First, this study did not have any control group. This makes the effect of the self-management program hard to ascertain; would the participants have had the same outcome even if they did not participate in the program, or did the program have a casual effect upon the outcomes?

Secondly, since we excluded a vast majority of the eligible study population, a non-response analysis was performed for the excluded cases (n= 47 682) that had either dropped out for surgery or other reason, and for cases that did not have data upon selected variables for this

study (cf. Table 3 for an overview of these variables). The non-response analysis showed that there existed no big differences in BMI, but the analytic sample had 2.1 % more female participants, 0.8 mean higher age and the analytical sample had 1.6 % fever participants that were born in a other country (Appendix, Table 3).
Furthermore, the response analysis showed that the analytical sample had 3.8 % less participants with hip as the most painful joint at baseline. This is important to consider since patients with hip OA has been found to respond less to non-surgical treatment than patients with knee OA (Gwyne-Jones, Gray, Hutton, Stout, & Abbott, 2018). In future studies upon the BOA population could patients with hip and knee OA be analysed separately, Skou and colleagues (2017) used that approach when analysing the Danish self-management program (GLA:D). Furthermore did the analytical sample have 4 % more participants with university education and 2 % less participants with compulsory education compared to excluded cases. With awareness of these differences between the analytical sample and excluded cases, I decided to use data from the analytical sample available to us. But since associations between included and excluded cases may vary, it is important to note that our estimates could be biased.

Thirdly, When analysing NRS Pain and EQ-5D-3L with Ancova, the assumption for normality of variances were violated as the Kolmogorov-Smirnov test proved significant ( p. <0.001). It furthermore existed multiple interactions between the covariates and the independent variables at the different measurement points, hence was the final assumption for conducting an Ancova violated, i.e. “homegenity of regression slopes” (Laerdstatistcs, 2018). It should be underlined when analysing such a big data material it is almost impossible to avoid such interactions, and the underlying significance in these interactions can be explored in future studies on the BOA population.

Fourth, the level of education of the analytical sample for this study differed compared to the general Swedish population by using data from Statistics Sweden. In year 2017, the proportions of the Swedish general population in age groups 65-74, that had undergone upper secondary education was 6.3 % higher than for the analytical sample for this study, and the proportions of the general Swedish population that had undergone compulsory education was 7.1 % lower compared to the analytical sample (Table 2; Appendix, Table 4).
Hence implying that the analytical sample for this study may be less educated than the general Swedish population. But this finding should be interpreted with caution, since level

of education is self-reported for this study. The level of education in the analytical sample could differ if linked to official population registers.
In this context is should be mentioned that to take part in the self-management program it is not mandatory to speak and understand Swedish, and it is possible to undertake the school with a translator. But the prevalence of schools that offers the theory sessions in any other language than Swedish are probably scarce. Hence does the BOA concept probably recruit immigrants where the majority speaks and understand Swedish that may differ in their educational attainment, age or any other characteristic.

Fifth, most dependent variables in this study are self-reported variables over multiple measurement points that can introduce response-shift and social desirability bias among the participants (Rosenman, Teneekoon, & Hill, 2011). International reviews has in addition shown that respondents tend to underestimate their weight and overestimate their height (Gorber, Tremblay, Molner, & Gorber, 2007) which has implications for estimating participants BMI, and both under and overestimate their levels of physical activity compared to direct measurements (Prince, Adamo, Hamel, Hardt, Gorber, & Tremblay, 2008).
On the other hand, performing only direct measurements on such a vast study population such as BOA´s would be costly.

*Conclusion*

Sociodemographic determinants shapes and affect most living conditions, whether we like it or not, where trajectories for OA operate no different. And educational level is not a new predictor for outcomes related to rheumatic diseases, as Callahan, Smith and Pincus (1989), already stated 29 years ago: “The associations between formal education level and clinical status were more significant than associations between clinical status and age or duration of disease, suggesting that formal education should be included as a variable in all clinical studies”, (p.129). 29 Years later, I have only encountered two studies (Weigl et al., 2006; Tuakli et al., 2016) that have used level of education as an independent variable for OA treatment, a paradigm that has to change if physiotherapists truly want to understand outcomes related to the disease or any other musculoskeletal condition for that matter.

In this light this thesis can be seen as a pioneer study showing that there exist sociodemographic inequalities in treatment for OA related Pain, HRQoL, mobility

impairments, health-related behaviours and adherence to exercise and usage of self-management advice for the disease.

Most inequalities existed at all three measurement points, but some inequalities developed differently; educational inequalities related to mobility and attitudes towards exercise and physical activity did arise after baseline at the three and 12-month follow-up, and conversely did immigrants report a greater desire to undergo joint surgery at baseline, but not at the follow-up´s. Intriguingly did immigrants participate more in supervised exercise and utilized to a higher extent what they have learned from the self-management program than domestic born participants.

The BOA self-management program is one of Sweden's biggest public health interventions, with the potential to diminish sociodemographic inequalities in health. As this thesis show that persistent inequalities in OA related health exists within the self-management program at all measurement points, but as well that some inequalities emerge or disappear along the follow-up´s, the program may have the potential to alter sociodemographic inequalities in OA related health. It is therefore important to spread this study's results to executive board of BOA, the clinics working with the concept within Sweden and to BOA´s sibling concepts spreading abroad to secure that all participants with OA receive equal care, indifferent of their sociodemographic background.

Future research

This study has shed light upon a few variables from the BOA-register. Since this is a pioneer study upon sociodemographic related outcomes for OA and adherence to rehabilitation, findings from this study are warranted for replication. It is important in future studies to explore underlying mechanisms for sociodemographic differences relating to attitudes towards exercise and physical activity and adherence to the self-management program, where qualitative studies could be a viable approach.

Furthermore, future studies could add hip/knee OA as independent variables and extend immigrations status to include more categories (i.e. born in Sweden, Europe or outside Europe), as this dichotomization has been found to matter when analysing trends in health-related behaviours (Dawson et al., 2005) and Cardiovascular disease (Gadd, Johansson, Sundqvist, Wändell, 2003). Furthermore, the BOA-registry retains measures of health seeking behaviours prior to participating in the self-management program that are worth investigating, to bring a greater understanding of participants outcomes at baseline when entering the self-management program.

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**Appendix.**

**Table 1. Has the patient participated in the schools theory lessons? Yes/no (n=22 741)**

| Education or country of birth | OR | CI |
|---|---|---|
| Compulsory education | 0,82 | 0,60 – 1,13 |
| Upper Secondary School | 1,20 | 0,87 – 1,65 |
| University (Reference category) | | |
| Foreign born | | |
| (Domestic born reference category) | 0,96 | 0,60 – 1,55 |

Significant results are indicated in bold. Odds ratios (OR) are presented with confidence intervals (95 % CI). Model controlled for Age, Sex, BMI and baseline variable on three and 12 months.

**Table 2. Has the patient participated in the schools theory lessons? Yes/No (n=22 741)**

| Level of education or country of birth | 3 Month follow-up No | Yes |
|---|---|---|
| Compulsory | 1.2 (89) | 98.8 (7239) |
| Upper Secondary | 1.0 (82) | 99.0 (8385) |
| University | 1.1 (78) | 98.9 (6868) |
| Foreign born | 1.1 (19) | 98.9 (1725) |
| Domestic born | 1.1 (230) | 98.9 (20767) |
| Total group | 1.1 (249) | 98.9 (22492) |

values are presented in % (numbers inside brackets)

**Table 3. Sociodemographic distribution of excluded cases over featured variables**

| | Total (n=47 682) | | Mean | min, max | SD |
|---|---|---|---|---|---|
| Gender | Men | 31.4 (14645) | | | |
| | Women | 68.6 (31962) | | | |
| Level of education | Compulsory | 34.2 (16316) | | | |
| | Upper Secondary | 36.5 (17385) | | | |
| | University | 26.5 (12612) | | | |
| Country of birth | Foreign | 9.3 (4450) | | | |
| | Domestic | 88 (41946) | | | |
| Most painful joint at baseline | Knee | 65.1 (23151) | | | |
| | Hip | 32.3 (11491) | | | |
| | Hand | 2.5 (905) | | | |
| | Age | | 65.5 | 18, 100 | 9.8 |
| | BMI | | 28.1 | 14, 168 | 5 |

Values are presented in % (n), mean & range in numbers, standard deviation (SD)

**Table 4. .Level of education for the Swedish population, age cohort 65-74 years of age in year 2017.**

URL accessed 13-09-2018: http://www.statistikdatabasen.scb.se/sq/56158

| | 2017 |
|---|---|
| **Procent** | |
| **Förgymnasial utbildning kortare än 9 år** | |
| **65-74 år** | 14,67 |
| **Förgymnasial utbildning, 9 (10) år** | |
| **65-74 år** | 10,48 |
| **Gymnasial utbildning, högst 2 år** | |
| **65-74 år** | 30,57 |
| **Gymnasial utbildning, 3 år** | |
| **65-74 år** | 12,97 |
| **Eftergymnasial utbildning, mindre än 3 år** | |
| **65-74 år** | 12,56 |
| **Eftergymnasial utbildning, 3 år eller mer** | |
| **65-74 år** | 16,52 |
| **Forskarutbildning** | |
| **65-74 år** | 1,20 |
| **Uppgift om utbildningsnivå saknas** | |
| **65-74 år** | 1,02 |

**Formaterat:** Engelska (USA)