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ORIGINAL RESEARCH

Income-Related Inequality Changes in Osteoarthritis First-Line Interventions: A Cohort Study

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Abstract

Objective: To examine income-related inequality changes in the outcomes of an osteoarthritis (OA) first-line intervention.

Design: Retrospective cohort study.

Setting: Swedish health care system.

Participants: We included 115,403 people (age: 66.2±9.7 years; females 67.8%; N=115,403) with knee (67.8%) or hip OA (32.4%) recorded in the "Swedish Osteoarthritis Registry" (SOAR).

Interventions: Exercise and education.

Main Outcome Measures: Erreygers' concentration index (E) measured income-related inequalities in "Pain intensity," "Self-efficacy," "Use of NSAIDs," and "Desire for surgery" at baseline, 3-month, and 12-month follow-ups and their differences over time. E-values range from -1 to +1 if the health variables are more concentrated among people with lower or higher income. Zero represents perfect equality. We used entropy balancing to address demographic and outcome imbalances and bootstrap replications to estimate confidence intervals for E differences over time.

Results: Comparing baseline to 3 months, "pain" concentrated more among individuals with lower income initially (E=-0.027), intensifying at 3 months (difference with baseline: E=-0.011 [95% CI: -0.014; -0.008]). Similarly, the "Desire for surgery" concentrated more among individuals with lower income initially (E=-0.009), intensifying at 3 months (difference with baseline: E=-0.012 [-0.018; -0.005]). Conversely, "Self-efficacy" concentrated more among individuals with higher income initially (E=0.058), intensifying at 3 months (difference with baseline: E=0.008 [0.004; 0.012]). Lastly, the "Use of NSAIDs" concentrated more among individuals with higher income initially (E=0.068) but narrowed at 3 months (difference with baseline: E=-0.029 [-0.038; -0.021]). Comparing baseline with 12 months, "pain" concentrated more among individuals with lower income initially (E=-0.024), intensifying at 12 months (difference with baseline: E=-0.017 [-0.022; -0.012]). Similarly, the "Desire for surgery" concentrated more among individuals with lower income initially (E=-0.016), intensifying at 12 months (difference with baseline: E=-0.012 [-0.022; -0.002]). Conversely, "Self-efficacy" concentrated more among individuals with higher income initially (E=0.059), intensifying at 12 months (difference with baseline: E=0.016 [0.011; 0.021]). The variable 'Use of NSAIDs' was not recorded in the SOAR at 12-month follow-up.

Conclusion: Our results highlight the increase of income-related inequalities in the SOAR over time.

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Osteoarthritis (OA) is the most prevalent joint disease worldwide and is a leading cause of disability.[1−3] Recent data from the Global Burden of Diseases Study revealed a staggering 113% global increase in prevalent OA cases and a 43% rise in the Nordic European region.[4,5] In Sweden, an OA first-line intervention centered on education and exercise was developed and delivered through the tax-funded national health care system to tackle the OA burden.[6] Overall, this intervention appeared effective in improving people's symptoms and functionality.[7] However, disparities emerged once considering the educational attainment and birthplace of individuals attending this program.[8] Those with higher educational attainment and native-born in Sweden tended to experience better outcomes, such as reduced pain levels and lower willingness to undergo joint surgery.[8]

In people with OA, individuals with lower socioeconomic positions (SEP) generally reported higher pain, lower self-efficacy, and a stronger desire for surgery.[8-11] The uneven distribution of health or health resources in health outcomes due to genetic or other factors such as SEP is generally referred to as "health inequalities".[12] Typically, studies on inequalities in OA outcomes focused on measures of average association (eg, relative risk and odds ratio [OR])[8-11] attributing the average outcome to the whole investigated cohort without taking into account the distribution of that outcome in the entire population or socioeconomic groups.[13] In contrast, one of the definitions of health inequalities reported by the World Health Organization defined inequalities as the differences in the distribution of health determinants among different socioeconomic groups (rather than the average association thereof).[14]

Then, no studies investigated inequalities regarding the use of non-steroidal anti-inflammatory (NSAIDs) drugs in OA despite their widespread use and potential adverse effects.[15] Most studies relied on SEP factors like educational attainment, overlooking income, a crucial measure of social class influencing health outcomes, material resources, and the ability to cope with life events.[16] Income showed a "dose-response" association with health,[17,18] but this socioeconomic variable is often underused in research due to individuals' reluctance to disclose income-related information.[18] Furthermore, these studies rarely collected disposable but gross income that does not reflect actual individuals' or households' spending capacity.[18]

To conclude, health care interventions can potentially exacerbate pre-existing socioeconomic inequalities, particularly ones targeting behavioral changes like this Swedish OA first-line intervention.[19] This phenomenon, referred to as "intervention-generated inequalities", was observed in the outcomes of a similar Danish OA first-line intervention.[19-21] In line with that, we aimed to investigate disposable income-related inequality changes in the outcomes (ie, pain intensity, arthritis-specific self-efficacy, the desire for surgery, and the use of NSAIDs) of an OA first-line intervention, using concentration index analysis by investigating data from the Swedish Osteoarthritis Registry (SOAR) and the "Longitudinal Integration Database for Health Insurance and Labour Market Studies" (LISA) registry. Specifically, we focused on how concentration index values changed before and after the intervention to identify potential intervention-generated inequalities.

List of abbreviations:

ASES	**Arthritis Self-efficacy Scale**
CI	**confidence interval**
E	**Erreygers' Concentration Index**
LISA	**Longitudinal Integration Database for Health Insurance and Labour Market Studies**
NSAID	**non-steroidal anti-inflammatory drug**
OA	**osteoarthritis**
OR	**odds ratio**
SEK	**Swedish Krona**
SEP	**socioeconomic positions**
SOAR	**Swedish Osteoarthritis Registry**

Methods

Study design and data sources

We conducted a retrospective cohort study on individual-level registry data. We merged 2 Swedish registries using personal identity numbers unique to all citizens in Sweden.[22] We merged and collected data from the SOAR (for the OA outcomes) and the LISA registry administered by "Statistics Sweden" (for SEP information). SOAR provides information on participants who followed an OA first-line intervention provided in the Swedish National health care system. Sweden has a publicly funded health care system where health care interventions require a minimal contribution from the individual that can reach a maximum of 1300 Swedish Krona (SEK, equivalent to ≈120 €) a year.[23,24] This Swedish OA first-line intervention is divided into 2 parts: education and exercise.[6,7,25] The former comprises 3 sessions, with the first 2 mandatory and led by a physiotherapist. The third one is optional and held by a trained patient educator. The first 2 sessions focus on OA pathophysiology, management, and the importance of exercise. The third one focusses on living with OA. Hence, participants are offered a voluntary, one-to-one session with a physiotherapist who develops an individualized exercise programme.[25] This program is tailored to the participant's specific needs and goals, aiming at improving muscle strength and dynamic control of the lower limb with OA.[25] During this session, participants receive instructions on how to perform the program and manage pain independently during exercise using a tolerable pain model.[26] Additionally, participants learn 1 or 2 exercises to incorporate into their daily routine and are encouraged to practice them daily for a few minutes.[25] Finally, participants can choose to perform their exercise program at home, in supervised group sessions with a physiotherapist twice a week for 6-8 weeks (maximum 12 sessions) or digitally.[27]

The LISA registry is a crucial tool for a better understanding of individuals' life situations in the labor market and working life. The registry provides researchers with annual data that track essential SEP, such as educational attainment, income, occupation, and employment status by calendar year.[28,29]

The research was conducted regarding the Declaration of Helsinki and reported following the Strengthening the Reporting of Observational studies in Epidemiology. Ethical approval was obtained from the Swedish Ethics Committee (Dnr: 2019-02570).

Population

We considered eligible for this study people who had their data registered in the SOAR with a first registration (baseline) between 2008 and 2018 and who had knee or hip OA as the primary cause of their pain. We excluded participants who had completed the program more than once or accessed its digital version.

Variables

Descriptive variables

Participants reported their demographic characteristics at the baseline except for the "Index Joint" (categorical variable - hip or knee),[7] which the physiotherapist established based on the participant's medical history, symptoms, and clinical assessment. In the case of multiple joints with OA, the most symptomatic joint was considered the index joint for the treatment. The participants reported their "Assigned sex (at birth)" (categorical variable − males/females), "Age" (continuous variable), and height and weight, which were merged into the body mass index "BMI" (continuous variable). Moreover, we extracted the "educational attainment" from LISA that was categorized for this study (categorical variable − low (primary school [0-9 years])/medium (secondary school up to postsecondary education) [10-14 years])/high (postsecondary education [≥15 years]).

Outcome variables: Primary outcome

The primary outcome of this study is "Pain intensity". This variable was retrieved from the SOAR and reported by the participants. Specifically, we retrieved mean "Pain intensity" during the last week (continuous variable) in participants' "Index joint" (continuous variable 0-10, Numeric Rating Scale[30]). This variable was collected at the baseline, 3-month, and 12-month follow-ups.

Outcome variables: Secondary outcomes

The secondary outcomes of this study are "Desire for surgery", "Self-efficacy", and "Use of NSAIDs".

These variables were retrieved from the SOAR. The participants reported their "Desire for surgery" and "Self-efficacy" at the baseline, 3-month, and 12-month follow-ups. "Desire for surgery" (binary variable - yes/no) was assessed with the question: "Are your knee/hip symptoms so severe that you wish to undergo surgery?".[31] "Self-efficacy" was assessed with the "Arthritis self-efficacy scale" (continuous variable 10-100 − pain and symptom arthritis self-efficacy scale, ASES). The ASES scale is a reliable instrument that assesses patients' arthritis-specific self-efficacy, namely, their beliefs about their ability to perform a specific task and cope with OA.[32] The full version is composed of 3 subscales: (1) "self-efficacy pain scale" (5 items); (2) "function scale" (9 items); (3) "other symptoms scale" (6 items). Participants indicate to what extent they feel confident they can do the tasks reported in the items from 10 ("very uncertain") to 100 ("very certain"). In the SOAR, only (1) and (3) were adopted and combined as suggested in the scale instruction.[32] Cronbach's alpha for internal consistency ranged between 0.82 and 0.91 and test-retest correlations between 0.81 and 0.91, similar to the original version,[32] showing that the Swedish ASES met satisfactorily psychometric standards. Similar results are reported in the 2 subscales adopted with a Cronbach's alpha of 0.92 for the "self-efficacy pain scale" and 0.82 for the "other symptoms" scale.[33] ASES was used in the SOAR from 2012 to 2015. The physiotherapists collected the "Use of NSAIDs". They reported whether participants had taken any medications for their joint pain in the last 3 months and whether or not they were NSAIDs (binary variable - yes/no).[31] "Use of NSAIDs" was measured at baseline and 3-month follow-up.

Socioeconomic index

"Individuals' disposable income" (continuous variable) in the year before the enrolment to the SOAR was retrieved from LISA and considered for the analysis. Disposable income is the part of an individual's income used for saving or consumption. Specifically, it considers income from employment, social welfare, pension (both public and private), sickness benefits, income from business activities and capital minus taxes and deductions, and several other benefits. The disposable income per consumption unit in the household is calculated by dividing the sum of all family members' disposable incomes by the total consumption weight of the family. One adult weighs 1.0, 2 adults weigh 1.51, and children weigh 0.56-0.76 (depending on age) in the household.[28] The income is reported in SEK (10 SEK ≈1 €).

Statistical analysis

All analyses were performed with Stata 18.[a]

Descriptive statistics

Descriptive analysis was carried out to understand the sample's characteristics. At the inspections of q-q plots (Stata command "qnorm"), continuous variables followed a normal distribution and are reported as mean ± standard deviation (SD). Categorical variables are reported as absolute and percentage frequencies.

Concentration index − income-related inequality

To measure income-related inequality, we used Erreygers' concentration index (E). Concentration indices represent a measure of inequality that highlights to what extent a health outcome is distributed across a population ranked through a socioeconomic measure (as in this case - disposable income).[34] Various concentration indices were developed to measure inequality, like the standard and generalized concentration indexes.[34-36] However, the standard concentration index requires the investigated health variables to be on the same scale as the socioeconomic variable (ie, income − ratio-scaled measure) without an upper bound (see the formula in supplemental material S1).[37] In health economics, measures are often bounded and ordinal or cardinal, classified as either attainment (when the observed level of a health variable meets or surpasses the target level) or shortfalls (when the observed level falls below the target level).[38] Erreygers proposed the "mirror" property, which states that the magnitude of measured inequality represented by an index's absolute value should be independent of whether the index is calculated based on attainments or shortfalls.[35] The standard concentration index does not satisfy this condition. Conversely, the generalized concentration index satisfies the mirror condition but does not remain invariant to permissible transformations of ratio-scaled and cardinal variables. Finally, concentration index can measure relative inequality, invariant to equiproportionate changes in the health variable and reflecting the proportional difference in health variables between subgroups (poor and rich people). Therefore, both relative and absolute health-inequality indices are necessary. To account for these issues, Erreygers proposed their modified concentration index for bounded variables that it is supposed to be an absolute and relative indicator of inequality (see the formula in supplemental material S1).[35]

E values range from -1 to +1, where zero indicates perfect equality.[35] A positive value indicates that the health variables are more concentrated among higher incomes, and a negative value indicates that the health variables are more concentrated among lower incomes.[35] The larger the magnitude of the concentration index, the greater the extent of income-related inequality.[35] Our study focused on E changes over time to see if any "intervention generated inequalities" might be present in this Swedish OA first-

line intervention. Hence, we calculated Erreygers' concentration indices (Stata command "conindex") and their differences at baseline and 3-month follow-up for the variables "Pain intensity", "Self-efficacy", "Desire for Surgery", and "Use of NSAIDs" in relation to "Individuals' disposable income".[34] We excluded participants with missing values in the SOAR outcomes and income at either of these time points (listwise deletion). We repeated this process for the baseline and 12-month follow-up. As for "Use of NSAIDs", we only calculated baseline vs 3 months as data after 1 year were not reported in the registry.

We began our analysis by assessing data completeness, revealing minimal missingness (<1%) in income-related data, primarily attributed to a data upload error in LISA. Therefore, we considered this missingness as completely random and non-bias-inducing. Subsequently, we computed standardized mean differences (SMDs) using the "stddiff" Stata command for descriptive variables across different time points, stratified by SOAR outcomes, identifying group imbalances where SMD >0.1 (see supplemental file S2, table 1). We then stratified the population by income quartiles and SOAR outcomes, observing imbalances in all but the "Use of NSAIDs" outcome variables (SMD >0.1, see supplemental file S2, table 2). To address these differences, we employed entropy balancing ("ebalance" Stata command), weighting included participants on the mean baseline value of the unbalanced outcome of interest and related unbalanced descriptive data to represent the entire sample. For example, when analyzing "Pain intensity" values, we balanced the groups based on their baseline pain value and "Age", comparing the baseline with 3-month follow-up and the "Worst joint" to 12-month follow-up. Entropy balancing is a pre-processing, multivariate reweighting method to achieve covariate balance across 2 groups (in this case, the included group in the analysis and the whole population).[39] Finally, we used these weights to calculate concentration indices. For estimating confidence intervals (CIs) of the indices' differences, we performed 1000 bootstrap replications due to the lack of this parameter in the "conindex" Stata command.

Results

We identified 126,308 participants from the SOAR. We excluded 7639 participants who reported joints other than the hip and knee as their first cause of pain, 2663 who attended exercises digitally, and 603 who participated in the program more than once. Finally, 115,403 (age: 66.2 years (SD: 9.7); sex: females 67.8%) people with knee and hip OA were identified (fig 1). Their average annual income was 241,414 SEK (SD: 271,223). Table 1 shows the descriptive characteristics of the general cohort.

Hence, in those included in the analysis, the Erreygers' (E) concentration indices were calculated at the different time points in the 4 investigated SOAR outcomes after entropy balancing. Then, we calculated the differences between baseline values and the 2 follow-up time points to calculate possible intervention-generated inequalities (see table 2 and fig 2).

Once comparing baseline and 3-month follow-up, the variable "pain" was more concentrated among people with lower income

Table 1 Descriptive statistics of the included population

Variables	Baseline	3 Months	12 Months
Assigned sex (at birth)	n=115,403		
Females (n (%))	78,233 (67.8)		
Males (n (%))	37,170 (32.3)		
Age	n=115,403		
(Mean ± SD)	66.2 (9.7)		
BMI	n=107,354		
(Mean ± SD)	27.7 (5.0)		
Income	n=115,356		
(Mean ± SD)	241,414.2 (271,223)		
Educational attainment (n)	n=115,074		
Low (n (%))	24,821 (21.57)		
Medium (n (%))	58,929 (51.21)		
High (n (%))	31,324 (27.22)		
Worst joint (n)	n=115,402		
Hip (n (%))	37,212 (32.4)		
Knee (n (%))	78,191 (67.8)		
Pain intensity (NRS 0-10)	n=114,908	n=80,588	n=47,648
(Mean ± SD)	5.5 (2.1)	4.4 (2.3)	4.4 (2.3)
Arthritis self-efficacy* (ASES Pain and Symptoms, 10-100)	n=45,286	n=33,465	n=26,074
(Mean ± SD)	64.8 (17.0)	69.1 (17.7)	65.0 (18.8)
Desire for surgery (n)	n=113,713	n=79,425	n=47,246
No (n (%))	82,327 (72.4)	62,027 (78.1)	36,907 (78.1)
Yes (n (%))	31,386 (27.6)	17,398 (21.9)	10,339 (21.9)
Use of NSAIDs (n)	n=113,560	n=80,428	
No (n (%))	64,460 (56.8)	54,890 (68.3)	
Yes (n (%))	49,100 (43.2)	25,538 (31.8)	

Abbreviations: BMI, body mass index; NRS, Numeric Rating Scale
* The ASES scale to measure self-efficacy was adopted only from 2012 to 2015.

Table 2 Weighted estimates of the concentration indices in the OA outcomes

Variables	N Baseline — 3 Months	Baseline	3 Months	Differences 3 Months — Baseline	N Baseline - 12 Months	Baseline	12 Months	Differences 12 Months — Baseline
Pain	n=80,304	**Erreygers' Concentration Index**			n=47,487	**Erreygers' Concentration Index**		
		-0.027	-0.039	-0.011 [-0.014; -0.008]		-0.024	-0.041	-0.017 [-0.022; -0.012]
Self-efficacy*	n=32,598	**Erreygers' Concentration Index**			n=25,320	**Erreygers' Concentration Index**		
		0.058	0.065	0.008 [0.004; 0.012]		0.059	0.076	0.016 [0.011; 0.021]
Desire for surgery	N=78,436	**Erreygers' Concentration Index**			n=46,737	**Erreygers' Concentration Index**		
		-0.009	-0.021	-0.012 [-0.018; -0.005]		-0.016	-0.028	-0.012 [-0.022; -0.002]
Use of NSAIDs	n=80,217	**Erreygers' Concentration Index**						
		0.068	0.038	-0.029 [-0.038; -0.021]				

* The ASES scale to measure self-efficacy was adopted only from 2012 to 2015.

at the baseline (E=-0.027) and became even more concentrated among them after at 3-month (difference with baseline: E=-0.011 [95% CI: -0.014; -0.008]). Similarly, the variable "Desire for surgery" was more concentrated among people with lower income at the baseline (E=-0.009) and became even more concentrated in this group at 3 months and (difference with baseline: E=-0.012 [-0.018; -0.005]). Conversely, the variable "Self-efficacy" was more concentrated among people with higher income at the baseline (E=0.058) and became even more concentrated at 3-month (difference with baseline: E=0.008 [0.004; 0.012]). Finally, the variable "Use of NSAIDs" was more concentrated among people with higher income at the baseline (E=0.068), but this concentration narrowed at the 3-month follow-up (E=-0.029 [-0.038; -0.021]).

Once comparing the baseline and 12-month follow-up, the variable "pain" was more concentrated among people with lower income at the baseline (E=-0.024) and became even more concentrated among them after at 12 months (difference with baseline: E=-0.017 [95% CI: -0.022; -0.012]). Similarly, the variable "Desire for surgery" was more concentrated among people with lower income at the baseline (E=-0.016) and became even more concentrated in this group at 12 months (difference with baseline: E=-0.012 [-0.022; -0.002]). Conversely, the variable "Self-efficacy" was more concentrated among people with higher income at the baseline (E=0.059) and became even more concentrated at 12 months (difference with baseline: E=0.016 [0.011; 0.021]).

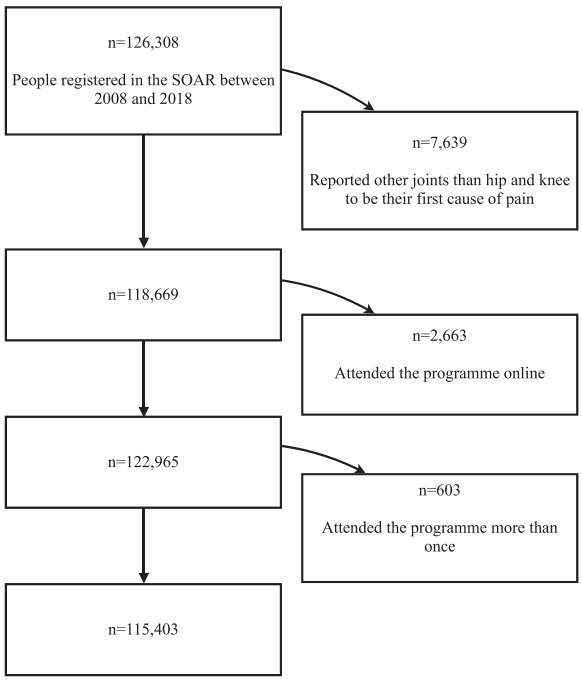

Fig 1 Selection of the study population.

Discussion

This study adopted a concentration-index approach to analyze income-related inequalities in different OA outcomes (ie, "Pain intensity", "Self-efficacy", "Desire for Surgery", and "Use of NSAIDs") before and after an OA first-line intervention. Pain and desire for surgery were more concentrated among people with lower income at the baseline. In comparison, self-efficacy and use of NSAIDs were more concentrated among people with higher income. At the different follow-ups, income-related inequalities widened in the variables pain, self-efficacy, and desire for surgery compared with the baseline while narrowing in the use of NSAIDs.

Previous evidence showed that people in Sweden in lower SEP experienced a higher disease burden, no matter the adopted socioeconomic index.[8,9] In the study by Unevik et al, people with lower educational attainment and foreign-born reported higher pain levels than their higher institutionally educated and non-foreign counterparts.[8] Kiadaliri et al found educational attainment and occupation inequalities also in the prevalence of knee pain among people with lower SEP.[9] Our study highlighted similar results using income as the measure of SEP. Zooming out from the Swedish scenario, similar effects of SEP on OA pain were found.[40-42]

The greater perceived pain intensity can be one of the reasons behind the higher concentration of the desire for surgery in people with lower income.[43,44] Hence, our results support those reported in Sweden and other European and non-European countries, showing an association between lower SEP and a stronger desire for surgery.[11,45,46] Another reason behind the higher willingness for surgery among those with lower income can be the lower level of self-efficacy. In OA first-line interventions, people with OA have an active role in their care process, and they share expertise, goals and responsibility with the health care providers, choosing and adopting self-management strategies that affect their lifestyle

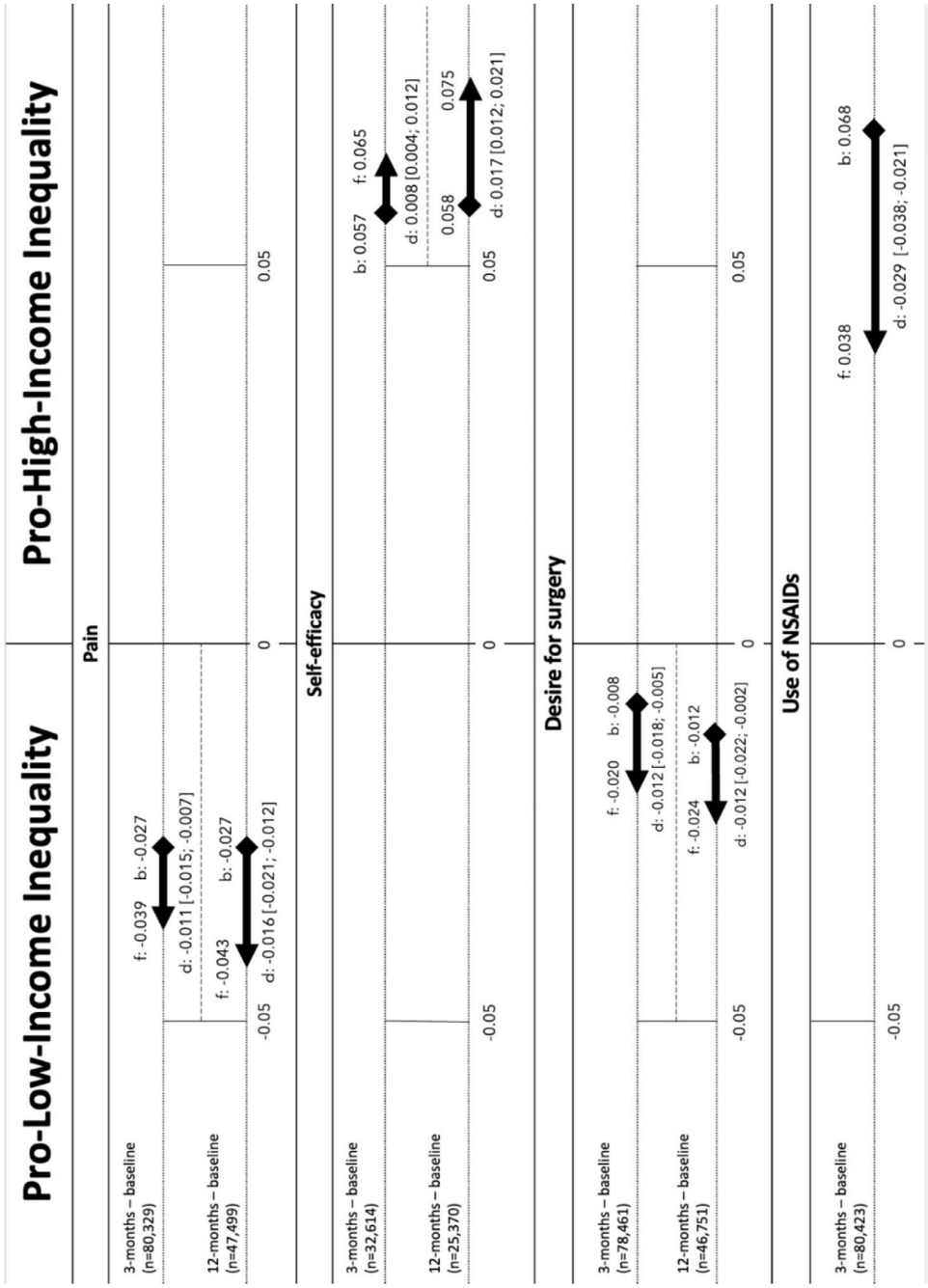

Fig 2 Weighted estimates of the concentration index values and changes throughout timepoints. Abbreviations: n, number; b, baseline value; d, the difference between baseline and reported follow-up; f, follow-up value.

behavior.[43] Therefore, people with higher income and higher self-efficacy might be more confident in their ability to tackle the burden of their disease by adopting active treatments rather than surgery.

The higher benefit experienced by people with higher income might also explain the reduction of pro-rich inequality in the use of NSAIDs. Before the intervention, the distribution of those using NSAIDs was higher in people with higher income. This tendency could be explained by the fact that people with higher income may have greater access to health care services, resulting in more opportunities to receive prescriptions for NSAIDs. However, these pro-rich inequalities narrowed at the follow-ups. Previous evidence on the association between NSAIDs use and income is controversial. A study by Bonnesen et al found that the lowest-income group had a lower probability of getting additional NSAID prescriptions than those in the highest ones.[47] Nielsen et al found that having a low against high income was slightly associated with prescription of NSAID but not with over-the-counter NSAID use.[48] Finally, Fosbøl et al found no differences in NSAID patterns among those in the highest or lowest income categories.[49] All of these studies dichotomized or categorized income instead of using it as a continuous variable. Dichotomizing or categorizing data might lead to several flaws in the statistical analysis, such as a reduction in the statistical power due to lost information.[50] Moreover, they also adopted average association measures (eg, OR)

that reduce the possibility of detecting differences in the distribution of NSAID use in the whole population.[13]

Considering that there is no society without inequalities, it is essential to find new strategies to reduce them in OA care. Our results suggest the presence of income-related intervention-generated inequalities in this Swedish OA first-line intervention. Past evidence also showed that people in socially disadvantaged backgrounds might not even be reached (referred to) this intervention, though delivered in a public health care system.[51] Therefore, there is a need to evaluate the systemic, institutional, and power-related harms of health care procedures by adopting a health-equity approach to make these interventions accessible to underserved populations. Upstream interventions (ie, health-policy level strategies) are necessary to tackle the root causes of health disparities.[21] These interventions involve political, social, and economic policies,[21] and they seem to have a tangible effect on changing people's lifestyle-related behaviors.[52] Hence, there is a pressing need to shift focus upstream in managing rheumatic and musculoskeletal diseases (including OA), considering the insufficient attention they have received in research.[53] Conversely, downstream interventions (ie, individual-level strategies), like one-to-one education sessions to change people's behaviors, play a limited (to no) role in reducing inequalities and should not be the main focus of decision-making related to health inequalities.[21] Furthermore, there have been recent doubts about the effectiveness of downstream interventions in making a tangible effect on changing people's lifestyle behaviors.[52]

Study limitations

Several limitations of this study merit acknowledgment. Firstly, the individuals registered in the SOAR exhibited higher SEP than the general Swedish population.[51] Consequently, our findings may underestimate the extent of inequalities generated by OA first-line interventions, potentially masking a more significant effect on individuals with lower SEP. Secondly, Sweden is characterized by universal health coverage, where health care system welfare and health-related policy-making are high-quality and focus on reducing inequality among Swedish citizens. These characteristics may contribute to the relatively small magnitude of income-related inequality we observed.

Thirdly, we did not analyze the data from those who decided to do the digital version of this intervention. Variations in income within this subgroup may exist, and future studies should consider analyzing inequalities using data from the digital intervention. Fourthly, a few variables were missing, and differences between those with and without missing data were highlighted. However, we used entropy balance to adjust our results. It is also important to note that our data were collected between 2008 and 2018, and they may not accurately reflect the current situation, as circumstances and conditions may have changed since then. Additionally, Erreygers claimed their concentration index to measure relative and absolute inequalities.[35] However, Wagstaff commented that Erreygers is more of an absolute inequality measure.[54] Moreover, interpreting concentration indices can be less intuitive, as no predefined thresholds indicate a meaningful effect. These indices can quantify inequality in health variables at a descriptive level but do not elucidate which specific factors contribute to the inequalities, such as sex, age, or educational attainment. Furthermore, our study lacked a control group for the Swedish intervention, making it challenging to attribute observed changes in inequalities solely to the intervention itself, as other factors like the placebo effect, regression to the mean and other concurrent treatments may also play a role. Despite these limitations, our primary focus was on changes in concentration indices between 2 time points rather than measuring the magnitude of inequality or its contributing factors.

Future research should explore the underlying factors behind these inequalities, employing measures that consider intersecting aspects of identity, such as ethnicity, gender, sex, and age. Additionally, future research should explore how social policies and environmental factors affect the health outcomes of different income groups and how these factors intersect with other dimensions of inequality. By taking a more intersectional approach, we can gain a more nuanced understanding of the complex social and structural factors contributing to health disparities and develop more effective policies and interventions to address them in OA interventions.

Conclusions

Considering the concentration indices' values in our study, people with lower income were already experiencing higher levels of pain and desire for surgery and lower levels of self-efficacy than their higher counterparts at the beginning of the intervention, a trend that worsened thereafter. Instead, people with higher income were keener on using NSAIDs, but after the intervention, this tendency narrowed. Our results suggest the potential existence of income-related intervention-generated inequalities in the SOAR. However, further studies with alternative designs, such as randomized controlled trials, are required to ascertain the actual causes of these observed changes.

Suppliers

a. Stata Statistical Software: Release 18; StataCorp LLC

Keywords

Epidemiology; Health Policy; National Health Programs; Personal Health Services; Physical Therapy Specialty; Rehabilitation

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