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Complex sociodemographic inequalities in consultations for low back pain: lessons from multilevel intersectional analysis

Ali Kiadaliri[a,b,*], Juan Merlo[c,d], Martin Englund[a]

Abstract

Sociodemographic inequalities in the occurrence of low back pain (LBP) are well-studied. This study aimed to examine complex sociodemographic inequalities in the risk of LBP consultation in the population from a socioeconomical intersectional perspective. Using register data, we identified 458,852 individuals aged 35 to 75 years residing in Skåne in 2013, with no previous LBP consultation since 2006. We created 108 strata using categories of age, sex, education, income, and nativity. With individuals nested within strata, we modelled the absolute risk of LBP consultation during 2014 in a series of multilevel logistic regression models. We quantified discriminatory accuracy (DA) of these variables by computing the variance partition coefficient and area under the receiver operating characteristic curve (AUC). We identified 13,657 (3.0%) people with an LBP consultation. The absolute risk ranged from 2.1% (95% credible interval: 1.9%-2.3%) among young native men with high education and high income to 4.8% (4.3%-5.5%) among young foreign-born women with medium education and low income (2.3-fold relative difference). Discriminatory accuracy of intersectional strata was very low (variance partition coefficient 1.1% (0.7-1.6); and AUC 0.56 [0.55-0.56]). Sex (35.6%) and nativity (19.2%) had the largest contributions in explaining the initially small between-strata variation in risk of LBP. The low DA of the intersectional strata indicates the existence of limited intersectional inequalities in LBP consultation. Therefore, interventions to reduce LBP risk should be universal rather than targeted to specific socioeconomic groups with a higher average risk. Before planning targeted intervention, other risk factors with higher DA need to be identified.

Keywords: Low back pain, Inequality, Intersectionality, Register, Sweden

1. Introduction

Low back pain (LBP) is the most common musculoskeletal complaint with a global lifetime prevalence of about 39%[23] and an incidence that oscilates betweeen 0.024% and 7%.[18] By accounting for 7.6% of total years lived with disability globally, LBP is the leading cause of disability.[20] Sociodemographic characteristics such as socioeconomic position, age, sex, and ethnicity have been reported as predictors of LBP occurrence, intensity, and disability.[6,8,12,13,17,19,22,24,35,48] However, most studies have been focused on the independent association between LBP and single sociodemographic dimensions (eg, sex, age, and education) alone or mutually adjusted.

However, such unidimensional approach has been questioned because it does not reflect the fact that these characteristics are interdependent, simultaneous, dynamic, mutually constitutive, and reinforce one another.[2,47] Recognizing those drawbacks, there has been a growing interest in the application of the intersectionality theory to investigate health inequalities.[2,4,16,27,37] The intersectionality framework, initially developed by theorists including Crenshaw,[11] represents new ways to understand the complex nature of health inequalities and brings attention to significant heterogeneity of health experiences existing in the population. The intersectional perspective supports the creation of numerous intersectional strata defined by the combination of several sociodemographic dimensions (eg, age, sex, income, and ethnicity).[1,37] This approach provides an improved mapping of disadvantage that better illustrates the sociodemographic distribution of health in the population. Such improved mapping fits well with the current movement towards precision public health[28] and supports the implementation of proportionate universalism[7,36] for resource allocation. In addition, intersectionality has an intrinsic multilevel perspective[37] whereby the intersectional strata can be considered as social contexts. This contextual conceptualization prevents the peril of excessive individualistic reductionism threatening current precision public health.[10]

There is a growing recognition in public health and epidemiology on the importance of complementing traditional measures of average association between the exposure and the disease

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(eg, odds ratio [OR], relative risk, and absolute risk [AR] difference) with measures of discriminatory accuracy (DA).[38] Such measures inform on the capacity of the exposure to correctly discriminate between individuals with from those without the outcome (eg, LBP).[38] If DA is low, the exposure categorisations used in the analysis should be questioned (in relation to the specific outcome under study) to avoid undertreatment and overtreatment and ineffective public health interventions.[40]

To accomplish the conceptual and methodological exigencies described above, the so-called "Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA)" has recently been suggested as an improved tool for investigating intersectional health inequalities.[37] The intersectional MAIHDA is a two-level hierarchical model in which the individuals are nested within their intersectional strata defined by the unique combinations of all sociodemographic variables under investigation.[16,37] This study aimed to apply, for the first time, intersectional MAIHDA to investigated inequalities in the risk of LBP consultation and to provide a more nuanced understanding of these inequalities.

2. Methods

2.1. Data sources

Our study is based on register data for entire population of Skåne, the southernmost region in Sweden with 1.27 million inhabitants in the year 2013 (13.2% of the total Swedish population). We linked data from the Swedish Population Register, the Longitudinal Integration Database for Health Insurance and Labour Market Studies (LISA by Swedish acronym) administered by Statistics Sweden, and the Skåne Healthcare Register (SHR). The SHR is a regional legislative, mandatory register covering all health care providers in the region with diagnostic codes based on the *International Classification of Diseases-10* system. We linked these registers using the unique personal Swedish identification number, which was replaced with an arbitrary code by the Swedish authorities to ensure the anonymity of the subjects. Ethical approval to link these registers and to conduct the study was given by the Lund University Ethics committee (Dnr 2014/276).

2.2. Study population

From the Swedish Population Register, we identified 626,112 individuals aged 35 to 75 resided in Skåne at the baseline date of December 31, 2013. To have reliable data on previous LBP consultation, we excluded 67,937 individuals who immigrated to Skåne after December 31, 2005. Since we were investigating the incidence (ie, new consultations) of LBP, we then excluded 91,934 individuals with a previous LBP consultation (primary or secondary diagnoses in the SHR) from January 1, 2006. We also excluded 2486 individuals with missing information on any of the sociodemographic variables. Finally, we excluded 2616 individuals who died and 2287 individuals who emigrated from Skåne during 2014. These resulted in a final sample of 458,852 individual aged 35 to 75 years with no previous LBP consultation since 2006 and with complete 1-year follow-up as well as without missing information on sociodemographic variables (**Fig. 1**).

2.3. Dependent variable

We identified new cases of LBP consultation based on the presence of following diagnostic codes (*International Classification of Disease-10* codes) as primary diagnosis in the SHR between January 1, 2014, and December 31, 2014: lumbago with sciatica (M54.4), LBP (M54.5), other dorsalgia (M54.8), and dorsalgia unspecified (M54.9).[26]

2.4. Sociodemographic variables

We included 5 variables measured at the baseline as follow: (1) sex was coded as man or woman, (2) age was categorized into 3 groups (35-49, 50-64, and 65-75 years), (3) we categorized individuals into 3 income groups based on the tertiles of 5-year average of household individualized disposable income, that is calculated by dividing the total disposable income of a family by its size, adjusting for the different consumption weights of adults and children (according to Statistics Sweden), (4) education was defined based on years of schooling: low (0-9 years), medium (10-12 years), and high (>12 years), and (5) nativity was dichotomized as immigrant (born outside Sweden) and native (born in Sweden). Using the possible unique combinations of these variables, we constructed 108 intersectional social strata ($108 = 2 \times 3 \times 3 \times 3 \times 2$).

2.5. Statistical analysis

We conducted an intersectional MAIHDA as a two-level hierarchical regression model with individuals (level 1) nested within their intersectional social strata (level 2).[16,37] We performed 3 successive multilevel logistic regression models[1] (a detailed description of the statistical analysis is available in supplement, available at http://links.lww.com/PAIN/B179). The first ("null" or "empty") model was a simple variance components model with only a random intercept for the intersectional strata. From this model, using their shrunken residuals (μ_j), we calculated the predicted ARs and 95% credible intervals (CIs) of LBP for each intersectional stratum. These ARs capture both the main and interaction effects of the variables defining the intersectional strata.[1]

We quantified the DA of this null model by calculating the variance partition coefficient (VPC) as the share of the total individual variation in the propensity of consulting for LBP that is attributable to intersectional stratum level. The theoretical range of the VPC is from 0% to 100%. A higher VPC indicates the greater relevance of intersectional strata for understanding individual differences in the risk of LBP consultation. In other word, higher VPC indicates the existence of larger intersectional inequalities in the population. We used the latent response formulation of the logistic regression model to calculate the VPC as:

$$\text{VPC} = \frac{\sigma_u^2}{\sigma_u^2 + 3.29} \times 100\%.$$

In this equation, σ_u^2 represents the between strata variance and 3.29 is individual-level variance according the standard logistic distribution.[21]

We also applied the area under the receiver operating characteristic curve (AUC) for random effects as a further measure of DA.[39] The AUC takes a value between 0.5 and 1.0 where values closer to 1 corresponds to greater DA of social intersectional strata. Although there is no official established guidance for interpreting the magnitude of the VPC or AUC as measures of DA in assessing social inequalities, we applied the grading based on previous studies[1,40]: "absent or very low" (VPC: 0-5; AUC: 0.5-0.6), "small" (VPC: >5 to ≤10, AUC: >0.6 to

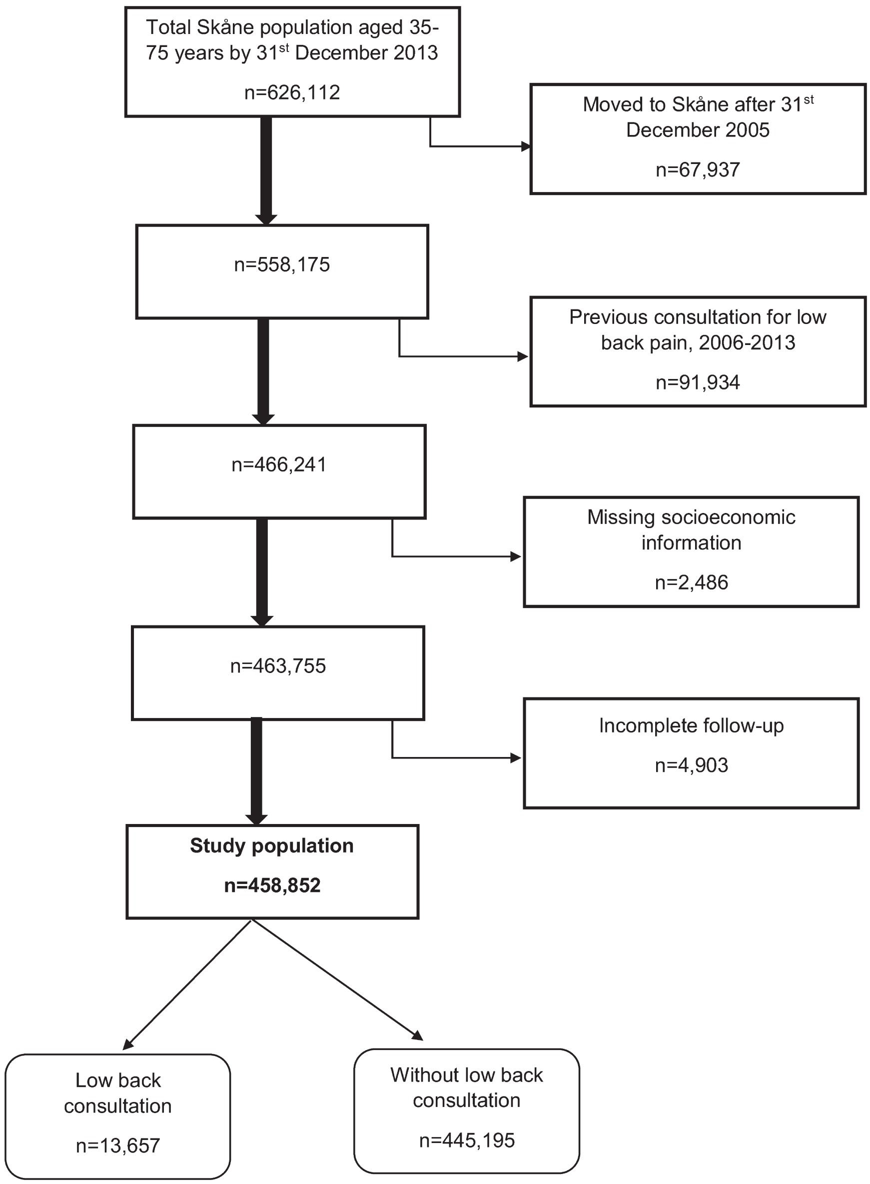

Figure 1. Flowchart of the study population selection.

≤0.65, "good" (VPC: >10 to ≤20, AUC: >0.65 to ≤0.75), "very good" (VPC: >20 to ≤30, AUC: >0.75 to ≤0.85), and "excellent" (VPC: >30, AUC: >0.85).

In the second, partially adjusted models, we expanded the "null model" by adding 1 sociodemographic variable at a time. Using these models, we quantified to what extent each variable contributed to the between-stratum variance observed in the "null model" by computing the proportional change in the between-stratum variance (PCV):

$$\text{PCV} = \frac{\sigma^2_{\text{u(null model)}} - \sigma^2_{\text{u(second model)}}}{\sigma^2_{\text{u(null model)}}} \times 100\%.$$

A larger PCV indicates more importance of the sociodemographic variable in question for explaining the between-stratum variation in the propensity of LBP consultation.

Finally, we estimated an "intersectional interaction model" where all 5 variables defining the social intersectional strata were included simultaneously as fixed main effects. Although stratum-level residuals (μj) in the "null model" conflate the additive and interactions effects of the variables defining the social intersectional strata, stratum-level residuals in this model capture the intersectional interaction effects. Therefore, if between-stratum variation in the risk of LBP consultation is only due to the additive main effects, the stratum-level residual for all strata and VPC obtained from this model will be zero. Otherwise, a positive (negative) stratum-specific interaction indicates that individuals in that stratum have higher (lower) risk than expected based on the additive main effects. We also reported adjusted ORs for the main effects of all sociodemographic variables. The PCV for this model indicates the proportion of the between-stratum variance observed in the "null model" that is explained by the additive main effects.

All models were estimated using Markov chain Monte Carlo procedures with diffuse priors in MLwiN version 3.02.[5,42] We called MLwiN from within Stata version 15 using the "runmlwin" command.[30] Quasi-likelihood methods were used to provide the Markov chain Monte Carlo procedure with initialization values. For all models, a burn-in of 5000 iterations and total length of 50,000 iterations were used.

3. Results

We identified 13,657 (3.0%) people with a primary diagnosis of LBP during the year 2014 in our sample (87.6% diagnosed by a physician or a physiotherapist). The proportion of people with LBP consultation (**Table 1**) was higher in women (3.3%) than in men (2.6%); it was comparable across age groups, decreased with increased income and education, and was higher among immigrants (3.5%) than among natives (2.9%).

Model 1 ("null model") had a VPC of 1.12% (95% CI: 0.76%-1.61%) (**Table 1**), with an AUC of 0.558 (95% CI: 0.553-0.562), (**Fig. 2**), both indicating very low DA of intersectional strata. The stratum with the lowest predicted AR of LBP comprised young native men with high education and high income (2.07%, 95% CI: 1.85%-2.30%), while young foreign-born women with medium education and low income had the highest predicted AR (4.85%, 95% CI: 4.27%-5.48%), indicating a 2.3-fold relative difference (**Table 2**, for full results, see Table S1 in supplement, available at http://links.lww.com/PAIN/B179).

Among the 10 strata with the lowest risk of LBP, all included natives, 9 included men, 6 included high education, 5 included ages 35 to 49 years, and 4 included high income (**Table 2**). By contrast, among the 10 strata with the highest risk of LBP, only 1 included men or natives or high income, none included high education, and 6 included ages 35 to 49 years. These complex associations between sociodemographic variables and the risk of LBP would not be captured by looking at ORs of simple socioeconomic dimensions alone in **Table 1**. Exploring the AR for intersectional strata (**Fig. 3**) also revealed that the educational disparity in the risk of LBP generally attenuated with age.

The PCV of partially adjusted model (model 2) showed that sex and nativity explained 35.6% and 19.2% of between-stratum variance in the risk of LBP consultation, respectively. On contrary, age had no contribution in explaining between-stratum variation. Model 3 had a VPC of 0.23% (95% CI: 0.09-0.41) and a PCV of near 80%, suggesting that about 20% of the between-stratum variation in the risk of LBP was not explained away by additive main effects of variables used to construct intersectional strata. Of course, it should be noted that this was 20% of a very small VPC (1.1% in model 1). Consistent with this, only 3 of 108 strata had a stratum-specific interaction effects that did not include 0 (**Fig. 4**). All these 3 strata had a positive (hazardous) interaction effects. That is, they had between 0.3% and 0.6% higher AR than expected based on the additive effects alone. The ORs from model 3 indicate that, on average, the risk of LBP consultation was higher in women than in men, individuals with low and medium education compared with individuals with high education, as well as in immigrants than in natives.

4. Discussion

In this large cohort study, for the first time, we applied intersectional MAIHDA to explore complex sociodemographic inequalities in the risk of LBP consultation. We found that, on average, LBP consultations were higher among women, low educated, and immigrants. However, there was substantial individual heterogeneity in the risk of LBP consultations that could not be explained by the combined information on age, sex, education, income, and nativity. Only 1.1% of the individual differences in the propensity of consulting for LBP were at the intersectional strata level. About 20% of this tiny between-stratum variation in the risk of LBP consultation was due to intersectional interaction effects. However, since our study is observational, this interaction effect could be confounded by an omitted variable associated to both specific strata and LBP.

The observed association between sociodemographic variables and the risk of LBP consultation in our study is consistent with previous studies.[13,24,25,34] Disparities in psychosocial factors (eg, stress and anxiety), occupational factors (physical demands of work and job dissatisfaction), coping strategies, behavioural (physical

Table 1

Results from the multilevel analysis of individual heterogeneity and discriminatory accuracy in relation to low back pain (LBP).

Variable	Categories	No. of individuals (% with LBP)	Model 1	Model 2, OR (95% CI)					Model 3, OR (95% CI)
				Sex	Age	Income	Education	Nativity	
Sex	Men	231,501 (2.6)		Ref					Ref
	Women	227,351 (3.3)		1.27 (1.17-1.37)					1.26 (1.20-1.33)
Age, y	35-49	177,956 (2.9)			Ref				Ref
	50-64	170,083 (3.0)			1.04 (0.93-1.15)				1.03 (0.97-1.10)
	65-75	110,813 (3.0)			0.98 (0.87-1.09)				1.00 (0.93-1.06)
Income	Low	151,290 (3.2)				1.12 (1.00-1.24)			1.05 (0.98-1.13)
	Medium	153,736 (3.0)				1.11 (0.99-1.23)			1.07 (1.00-1.15)
	High	153,826 (2.7)				Ref			Ref
Education	Low	82,938 (3.2)					1.20 (1.08-1.33)		1.21 (1.12-1.30)
	Medium	206,917 (3.2)					1.20 (1.08-1.32)		1.20 (1.13-1.28)
	High	168,997 (2.6)					Ref		Ref
Nativity	Immigrant	69,602 (3.5)						1.19 (1.09-1.29)	1.19 (1.12-1.26)
	Native	389,250 (2.9)						Ref	Ref
BSV (SE)			0.04 (0.01)	0.02 (0.01)	0.04 (0.01)	0.03 (0.01)	0.03 (0.01)	0.03 (0.01)	0.01 (0.00)
VPC (95% CI), %			1.1 (0.7-1.6)	0.7 (0.5-1.1)	1.1 (0.7-1.6)	1.0 (0.7-1.5)	0.9 (0.6-1.4)	0.9 (0.6-1.3)	0.2 (0.1-0.4)
PCV, %			—	35.6	0.0	6.5	17.4	19.2	79.9

Model 1: a variance components model with only a random intercept for the intersectional strata.
Model 2: partially adjusted models with adjustment for only 1 sociodemographic variable at a time as fixed main effect.
Model 3: an "intersectional interaction model" where all 5 variables defining the social intersectional strata were included simultaneously as fixed main effects.
CI, credible interval; BSV, between-stratum variance; LBP; low back pain; OR, odds ratio; PCV, proportional change in the between-stratum variance; VPC, variance partition coefficient.

Table 2

The 10 intersectional strata with the lowest and highest predicted absolute risk of being diagnosed with low back pain.

Sex		Age, years			Income			Education			Nativity		No. of individuals	No. of cases	Predicted absolute risk (%)	95% credible intervals
Men	Women	35-49	50-64	65-75	Low	Med	High	Low	Med	High	Immigrant	Native				
The 10 strata with the lowest predicted absolute risk																
X		X					X			X		X	14,218	283	2.07	1.85-2.29
X				X	X				X			X	3454	65	2.17	1.77-2.61
X		X			X					X		X	6156	125	2.19	1.87-2.53
X			X				X			X		X	16,081	350	2.23	2.02-2.45
X		X				X				X		X	9532	210	2.29	2.02-2.58
X			X			X				X		X	5117	119	2.45	2.08-2.85
X		X					X		X			X	13,476	325	2.46	2.21-2.71
	X	X					X			X		X	7779	189	2.50	2.19-2.84
X				X	X			X				X	3965	94	2.51	2.10-2.96
X				X		X		X				X	6673	164	2.54	2.20-2.90
The 10 strata with the highest predicted absolute risk																
	X	X					X		X		X		288	16	3.73	2.69-5.00
	X	X			X			X				X	2432	97	3.75	3.12-4.45
	X	X				X			X		X		1236	54	3.84	3.04-4.76
	X		X			X			X		X		2011	84	3.85	3.16-4.62
X			X		X			X			X		1336	58	3.86	3.07-4.72
	X		X		X			X			X		2353	100	3.94	3.27-4.66
	X	X				X		X			X		320	20	3.98	2.88-5.37
	X		X		X				X		X		3123	133	4.01	3.41-4.65
	X	X			X			X			X		2194	110	4.51	3.79-5.30
	X	X			X				X		X		4270	220	4.84	4.27-5.48

inactivity and smoking), and health seeking pattern are potential explanations for sociodemographic inequalities in LBP.[25,31,44] Much of previous research, however, examined the effect of a single variable with limited investigation of two-way interaction(s) between these variables (eg, sex–socioeconomic position interaction showed stronger association between socioeconomic position and LBP in men than in women[22,25,43]). A major drawback of this approach is failing to capture the complexity of inequalities in the risk of LBP. For example, although low income and education have been reported as risk factors for LBP,[25,46] our findings showed that native men aged 35 to 49 years with high education are among strata with the lowest risk of LBP consultation regardless of their income. Moreover, among immigrants, the strata with the lowest AR included men aged 35 to 49 years with low income and high education, while immigrant women aged 65 to 75 years with high income and high education had a high risk of consulting for LBP (ranked 16th strata with the highest LBP risk). These examples indicate the complex multidimensionality of health inequalities and the critical value of intersectional approach in capturing such complexities.

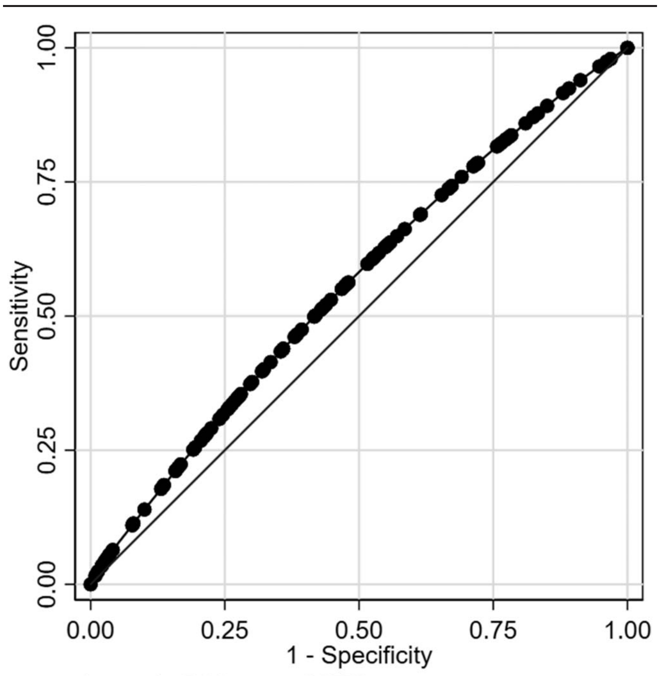

Figure 2. Receiver operating characteristic (ROC) curve based on predicted probabilities obtained from the random intercept model ("null model").

A more fundamental drawback of previous studies as well as social/medical/health research, in general, is heavy reliance on the average to understand the effects of sociodemographic variables on health outcomes. This drawback is evident even in studies applying conventional fixed effect approach to examine intersectional inequalities.[16] This mean-centred approach seeks to identify risk factors through comparing the group averages and disregards within-group variations which can lead to misleading conclusions about the importance of sociodemographic variables for individual health outcomes.[38,45] For example, looking at ORs from our analyses, one might conclude that women (OR = 1.26), low educated (OR = 1.21), and immigrant (OR = 1.19) are at higher risk of LBP and policies tailored toward these groups should be implemented. However, accounting for variations within and between groups through intersectional MAIHDA, we obtained a VPC of 1.1%, meaning that there was substantial individual variation in risk of LBP consultation that could not be explained by 5 sociodemographic variables included in our study. In other words, these 5 variables were rather irrelevant for understanding individual differences in the risk of LBP in our sample. A previous systematic review also reported that individual risk factors including age, sex, and educational attainment were only weak predictors of persistent back pain.[9]

Consistent with "proportionate universalism" concept,[36] our findings of a low DA for the intersectional strata suggest that any intervention to reduce disparities in LBP must be universal, not targeted, but with a scale and intensity that is proportionate to the degree of disadvantage. In other words, sole targeting of the strata with the highest average risk will leave many individuals with LBP without intervention because they belong to strata with low average risk.

A recent study[41] applied conventional regression model to assess intersectional effects of sex, race, age, and poverty on the presence

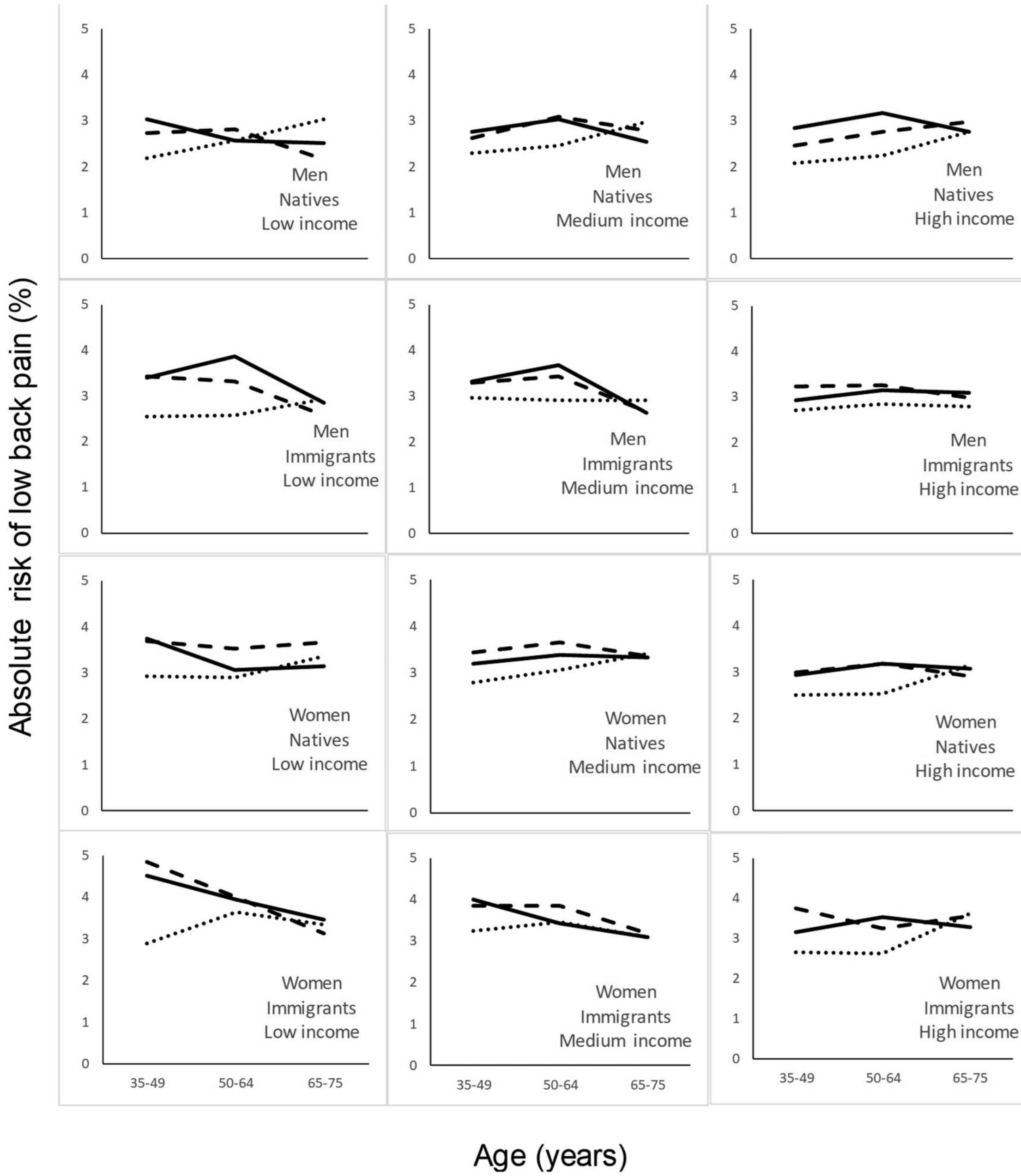

Figure 3. Predicted absolute risk of credible for low back pain by sex, age, income, nativity, and high (dots), medium (dashed), and low (solid) education.

of pain in at least 1 body site in a US population. They found a statistically significant three-way interaction between sex, race, and poverty, but individual variation within groups was disregarded which limit usefulness of findings for policy-making. In contrast to intersectional MAIHDA, estimating "intersectional interaction effects" for reference categories (eg, young white men) or those at the intersection of reference and nonreference categories (old white women) from conventional approach is not straightforward.[15,16] It should be noted that interaction effects estimated from conventional approach and intersectional MAIHDA are fundamentally different.[14] In the latter, interaction effect represents the difference between each stratum's total predicted value and the value expected for it based on the additive effects, while in former, the interaction measures how total predicted values for a given stratum differ from predicted values for other strata without computation of stratum-specific interaction effect.[14,15] In addition to detecting strata-specific interaction effects, the intersectional MAIHDA (compared with conventional regression models) systematically provides (1) an improved mapping of how disease risk is distributed across the intersectional strata in the population. When doing so, (2) the method provides reliability-weighted strata-specific risks and, thereby, can handle strata with small number of individuals. In addition, (3) it provides measures of DA that can be used when interpreting the observed differences in average disease risk across strata.[14–16,37] Simulation analyses have also shown that intersectional MAIHDA outperformed conventional regression models in terms of goodness of fit (particularly as the number of interactions increases) and erroneous detect of statistically significance interactions just by chance alone.[3,16]

We previously investigated intersectional inequalities in other musculoskeletal disorders (ie, osteoarthritis, rheumatoid arthritis, gout, and spondyloarthritis) using intersectional MAIHDA among individuals aged 40 to 65 years in Skåne.[29] The lower VPC estimated for LBP

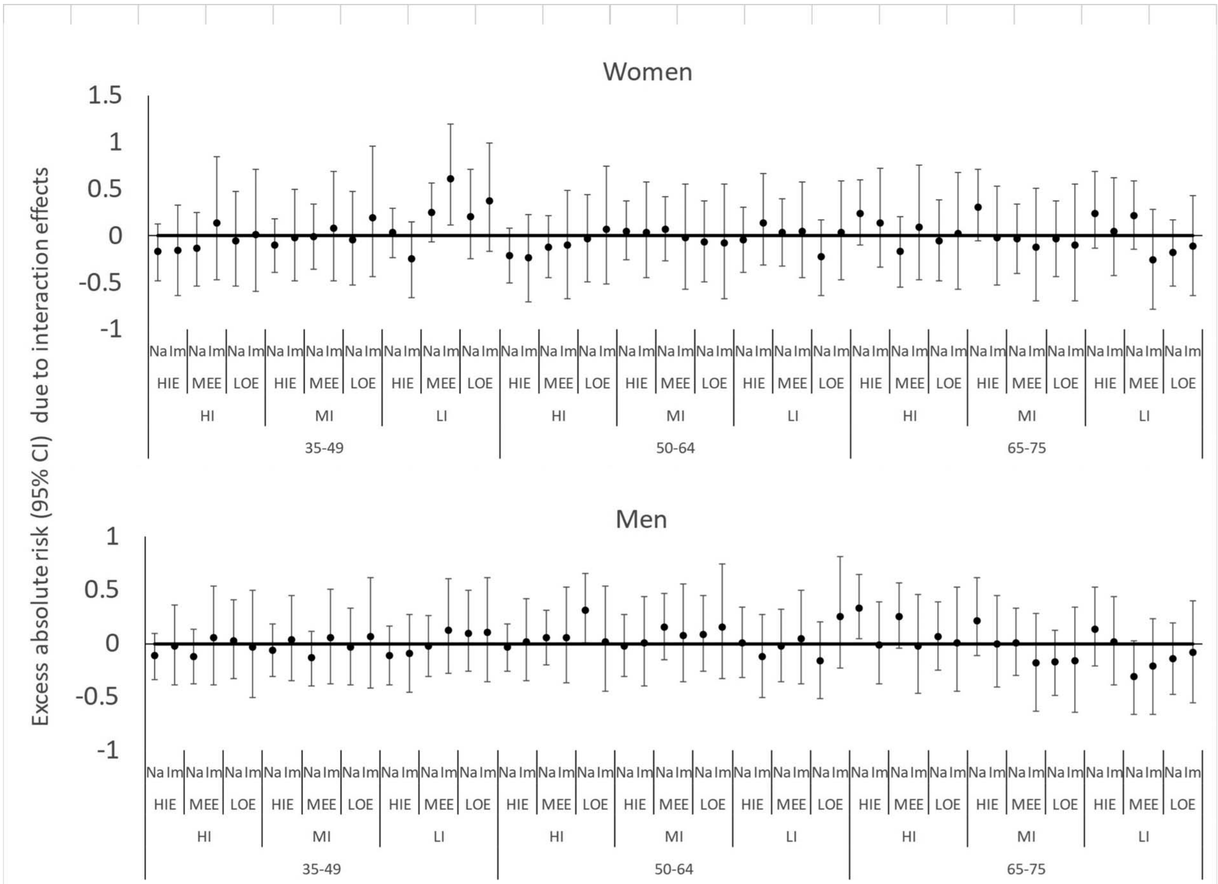

Figure 4. The stratum-level residual (95% credible interval) representing the excess risk of low back pain consultation due to interaction effects. HI, high income; HIE, high education; Im, immigrant; LI, low income; LOE, low education; MI, medium income; MIE, medium education; Na, native.

indicates smaller between-strata inequalities and greater within-strata heterogeneity for LBP compared with those diseases (except spondyloarthritis) in this population. Moreover, although either sex or age explained over half of between-stratum variance for those diseases, these variables had lower contributions for LBP.

Our study is not without limitations. Inherent problems to administrative register data including misdiagnosis and coding errors are of concern. Although nearly 100% of inpatient visits and outpatient physician visits in public care have an assigned diagnosis in the SHR, the proportion for other health professionals is lower (eg, about 60% of visits to a physiotherapist had a diagnosis code in 2014).[33] Patients with self-referral to physiotherapy tend to be younger and more educated.[32] In our sample, we observed overrepresentation of women, aged 65 to 75, natives, and high educated among patients who were solely identified by a physiotherapist than those identified by other health professionals. This means that the predicted AR of LBP is likely underestimated for intersectional strata with higher likelihood of exclusive visit to a physiotherapist or chiropractor for LBP. Although this might bias the estimated ORs and VPC, considering very low VPC and the small proportion of LBP cases who have not been captured due to missing diagnostic codes from nonphysician health professionals, we do not expect meaningful impact on our findings. Moreover, although diagnosis codes within private care are not captured by the SHR, the user fee for both private and public care in Sweden is the same, and therefore, nonrandom missing by sociodemographic variables is unlikely to be substantial. The study was conducted in Skåne region in year 2014, and our findings might not be generalizable to the entire Swedish population or/and the current situation, although the social identities included in our analysis reflect social context that can be slow to change. It should be noted that no national primary care data are available in Sweden, meaning that conducting a national study will be limited to hospitalised LBP cases. Because of lack of data, we did not include some important axes of inequality such as race/ethnicity, sexual orientation, and disability. To have reliable data on LBP diagnosis, we excluded those who relocated to Skåne after the year 2005, and therefore, our results might not be generalizable to those who lived in the region for a shorter period. Moreover, most foreign-born individuals in our study were from the Nordic (17.5%) or other European (51.3%) countries, and our findings might not generalize to more culturally diverse immigrant populations.

5. Conclusions

This study is among few studies investigating intersectional inequalities in LBP and, to the best of our knowledge, the first application of intersectional MAIHDA to provide a detailed mapping of the risk of LBP consultation in a population. Our results showed that despite between-group average differences in the risk of LBP consultation, there was substantial within-group heterogeneity which could not be explained by additive and interactive effects of sex, age, education, income, and nativity. Our study emphasizes the crucial importance of incorporating individual variation into health inequality research and usefulness of intersectional MAIHDA to do so. Our findings suggest that any intervention to reduce the burden of LBP should be universal, not targeted, and further research is needed to understand the distribution of LBP consultations in the population.

Conflict of interest statement

M. Englund received honorarium as an advisory board member from Pfizer, outside the submitted work. The remaining authors have no conflicts of interest to declare.

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Appendix A. Supplemental digital content

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