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## The effect of municipality characteristics on disability retirement

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**Objectives:** In addition to individual-level characteristics also contextual factors may contribute to the large regional variation seen in disability retirement. We examined the associations of municipality-level characteristics and disability retirement due to all causes, musculoskeletal diseases, mental disorders and other diseases. **Methods:** A register-based study was conducted with a 20% random sample of the Finnish population aged 25–62 years. Municipalities were separately divided into quintiles by their proportion of manual workers, unemployed and industrial employees. Multilevel Poisson regression analysis was applied to examine associations between the three municipality characteristics and disability retirement during a 5-year follow-up. **Results:** All three municipality-level indicators were associated with disability retirement, but the association between the proportion of industrial workers and disability retirement disappeared after adjustment for age, gender, marital status, socioeconomic position, unemployment and industrial employee status at the individual level. The associations were particularly strong for disability retirement due to musculoskeletal diseases: in the municipalities with the highest proportion of manual workers, the risk for disability retirement due to musculoskeletal diseases was 2.5 times higher than in the municipalities with least manual workers. After adjustment for the individual-level factors, the risk was 1.5 times higher. Cross-level interactions showed that the risk of disability retirement increased with the increasing proportion of unemployment in the municipality only among those who had not experienced unemployment themselves. **Conclusions:** Municipality-level characteristics made an independent contribution to the probability of disability retirement in particular due to musculoskeletal diseases. Also, area-level characteristics should be considered when targeting disability retirement.

## Introduction

Considerable variation in disability retirement rates between geographical regions has been described. For instance, between Finnish counties, the proportion of pension recipients varies from 4.6 to 11.0%, and between municipalities, the differences are even larger, ranging from 2.7 to 20.1%.<sup>1</sup> Similar large differences have been reported elsewhere.<sup>2,3</sup> These differences are influenced by age structure and other composition of the population living in the areas, but in addition to individual-level characteristics also contextual factors of the areas may affect these differences.

The possible effect of contextual factors has attracted much attention in studies of morbidity and mortality.<sup>4,5</sup> A mass of studies have focused on socioeconomic structure of the areas, measured by average income, level of unemployment or some summary indicator of material or social deprivation. Although the

findings are not entirely consistent, many studies have found that area-level measures of socioeconomic disadvantage are associated with increased morbidity or mortality after controlling for various individual-level covariates. In Finland, socioeconomic composition and the level of unemployment in the area have been associated with overall mortality<sup>6</sup> and various specific causes of death.<sup>7–9</sup> As disability retirement requires a medical diagnosis of an illness reducing one's work ability, the effect of contextual factors could be one explanation for the geographical differences in disability retirement. However, few studies have examined the effect of contextual factors on disability retirement or other measures of functional health.

There may be also contextual factors that affect disability retirement rates in other ways than indirectly through health. Regional differences in disability retirement may be related to

differences in economic and industrial structures between the areas. At the individual level, unemployment history has been shown to be associated with increased risk of disability retirement,<sup>10</sup> and disability retirement rates over time also vary with unemployment rate in manners that imply that also social and cultural factors modify the level of disability retirement in society.<sup>11,12</sup> Because economic structures differ between areas, environmental factors such as unemployment might have different effects in some areas than others. Some studies have reported higher disability retirement rates in rural than in urban areas, which suggest that economic structures may influence the risk of disability retirement.<sup>11,13</sup> There may also be differences in the provision of services that affect the emergence or progress of area differences in health problems. Area differences in mental health problems have been explained by availability and utilization of mental health services.<sup>14</sup> A recent Finnish study found clear regional differences in disability retirement after a diagnosis of schizophrenia.<sup>15</sup>

Previous studies concerning contextual determinants of disability retirement are few. A study comparing administrative areas of Oslo, Norway, found a strong association between area-level measures of socioeconomic deprivation and the prevalence of disability pensioners.<sup>16</sup> A Swedish study among home-care workers found associations of various municipality-level demographic and socioeconomic factors and the incidence of disability pension.<sup>17</sup> However, these studies used ecological study design, which cannot separate true area effects from compositional effects. Certain areas may have high disability retirement rates only because the residents in these areas have individual characteristics that are associated with increased risk of disability retirement.<sup>18</sup> Studies based on multilevel data have found only weak effects between area-level indicators and disability retirement. A nationwide Norwegian study following 30–55-year-old inhabitants for 7 years found a small but statistically significant area effect on disability retirement. About 2% of the variation in disability retirement could be attributed to the municipality level.<sup>19</sup> A study comparing municipalities in one Norwegian county also found that a small but statistically significant proportion of the risk for disability pension could be attributed to the municipality of residence.<sup>20</sup> A study from another Norwegian county found no statistical dependence between municipality-level deprivation and the prevalence of disability pension.<sup>21</sup>

The aim of this study was to examine the associations of three municipality-level characteristics, the proportion of manual workers, unemployed and industrial employees, with disability retirement controlling for the same factors at the individual level. We use individual data on sociodemographic characteristics and disability retirement and aggregate these data to represent the 416 municipalities in Finland.

The specific aims of the study were:

- (i) to examine whether municipality-level characteristics are associated with disability retirement while individual-level characteristics have been controlled for;
- (ii) to examine whether the associations of municipality-level characteristics are similar for those retired due to musculoskeletal diseases, mental disorders and other diseases and
- (iii) to examine whether the effects of municipality-level characteristics are similar for varying levels of the corresponding individual-level characteristics.

## Methods

The data were derived from the registers of the Finnish Centre for Pensions. The study was restricted to a 25–62-year-old non-retired population who had a Finnish home municipality at the end of 2006. There were 416 municipalities in Finland at the end of 2006.

The follow-up for disability retirement was started from January 2007 and continued until the end of 2011. Those who had their 63rd birthday, retired due to old age or some early retirement pension

scheme or died were censored at that point. The mean follow-up time was 4.6 years. The data on retirement included all permanent and temporary disability pensions and full-time and part-time disability pensions from the earnings-related retirement system. The primary medical diagnosis of the retirement was classified according to the 10<sup>th</sup> revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) into retirements due to diseases of the musculoskeletal system and connective tissue (ICD-10 Chapter M), mental and behavioural disorders (ICD-10 Chapter F) and other diseases.

## Independent variables

Individual-level variables included age (classified in 5-year age-groups), gender, marital status (living alone/with some other adult), social class and experience of unemployment and employment sector. In general, the measures were based on the situation at the end of the year 2006, but for unemployment data, the whole year was used. To derive social class, we first separated all self-employed and farmers based on the type of employment insurance they had in the registers of the Finnish Centre for Pensions. Wage earners were classified according to their occupational title derived from Statistics Finland into manual workers, lower non-manual employees and upper non-manual employees, following the classification of Statistics Finland.<sup>22</sup> If the information for the end of 2006 was missing, data on previous employment periods during the year were used. Information on unemployment was derived from the database of social security benefits that give entitlement to a pension. Experience of unemployment was classified as no unemployment, less than 1 month, up to 6 months and >6 months of unemployment. Data on employment sector were divided into industrial enterprises, other private sector and public sector. The most common industries in Finland are metal industry, electronics industry, forest industry, chemical industry and food industry.<sup>23</sup>

The individual-level data on occupational social class, unemployment and employment sector were further used to create three aggregated municipality-level variables: the proportion of manual workers, the proportion unemployed (for at least 1 month in 2006) and the proportion of industrial employees in the municipality. The municipality-level variables were divided into quintiles.

The proportion of manual workers in the municipality was positively correlated with the proportion of industrial employees ( $r=0.55$ ,  $P<0.001$ ) and the proportion of the unemployed ( $r=0.34$ ,  $P<0.001$ ) in the municipality. However, the correlation between the proportion of industrial employees and the proportion of the unemployed was negative ( $r=-0.12$ ,  $P=0.02$ ).

## Statistical methods

In the analyses, we used a 20% random sample of the data. The data thus included 502 819 persons, of whom 22 130 retired due to disability during the follow-up.

Multilevel Poisson regression analysis was applied to analyse the associations of the municipality-level variables and disability retirement, controlling for the individual-level variables. SAS Glimmix procedure was used in the analyses (SAS Institute Inc., Cary, NC). For each municipality-level variable, we first calculated the unadjusted effect and then included all individual-level variables simultaneously. Similar analyses were then repeated for disability retirement due to musculoskeletal disorders (7681 retirees), mental disorders (6227 retirees) and all other diseases (8111 retirees). We also calculated the cross-level interactions between the three municipality-level variables and the corresponding (dichotomized) variables at the individual level. We examined whether the associations between the municipality-level variables and disability retirement were similar irrespective of one's own status in these dimensions.

## Results

Table 1 shows descriptive information of the individual-level factors by the municipality-level indicators. Substantial differences between municipalities existed in the proportion of manual workers, unemployed and industrial employees. The proportion of manual workers varied from 20% in the lowest quintile to 40% in the highest quintile. The incidence on disability retirement was nearly twice as high in the quintile with most manual workers compared with the quintile with least manual workers. Also, the proportion of married, unemployed and industrial employees was higher in the municipalities with more manual workers. The proportion of unemployed varied from 10% in the lowest quintile to 24% in the highest quintile. The incidence on disability retirement increased with increasing proportion of the unemployed in the municipality. The proportion of manual workers was higher and the proportion of married lower in the municipalities with more unemployed, but no clear differences were seen in the proportion of industrial workers by the unemployment rate of the municipality. The proportion of industrial employees also varied widely between the municipalities. The incidence of disability retirement was slightly higher in the municipalities with more industrial employees. The proportion of manual workers and the married was also higher in the municipalities with more industrial employees.

Table 2 shows the risk of disability retirement by the proportion of manual workers, unemployed and industrial employees in the municipality. Each of the municipality-level indicators showed a graded association with disability retirement. The association was strongest for the proportion of manual workers and weakest for the proportion of industrial employees. In the quintile with the highest proportion of manual workers, the risk of disability retirement was 1.79 times higher than in the quintile with least manual workers. Adjustment for age, gender, marital status, individual-level socioeconomic position, unemployment and industrial employee status considerably attenuated the associations. The associations between the proportion of industrial employees in the municipality and disability retirement disappeared after the adjustments.

The proportion of manual workers in the municipality was strongly associated with disability retirement due to musculoskeletal diseases (table 3). Even after adjustment for the individual-level covariates, the risk of disability retirement due to musculoskeletal disorders was 1.55 times higher in the quintile with the highest proportion of manual workers compared with that with the lowest. Also, proportion of the unemployed and that of industrial

employees were associated with disability retirement due to musculoskeletal diseases. The associations were attenuated by the adjustments, but both remained statistically significant. The proportion of manual workers or that of industrial employees in the municipality was not associated with disability retirement due to mental disorders. However, the proportion of the unemployed was associated with disability retirement due to mental disorders, but this association disappeared after adjustments. For disability retirement due to other diseases, the associations between the municipality-level variables and disability retirement were similar to but weaker than for musculoskeletal diseases.

Figure 1 shows the cross-level interactions of the proportion of manual workers, unemployed and industrial employees in the municipality and the corresponding variables at the individual level. Adjusting for the individual-level covariates, the risk of disability

**Table 2** Rate ratios (RRs) and 95% confidence intervals (95% CIs) for disability retirement by the proportion of manual workers, the proportion of unemployment and the proportion of industrial employees in the municipality

Quintiles of municipality-level indicators	Model 1 RR (95% CI)	Model 2 RR (95% CI)
Manual workers		
Low	1.00	1.00
2	1.34 (1.12–1.59)	1.16 (1.00–1.34)
3	1.53 (1.30–1.80)	1.19 (1.04–1.37)
4	1.67 (1.42–1.96)	1.21 (1.05–1.40)
High	1.79 (1.52–2.09)	1.27 (1.10–1.46)
Unemployed		
Low	1.00	1.00
2	1.16 (1.04–1.30)	1.10 (1.01–1.21)
3	1.26 (1.14–1.39)	1.18 (1.08–1.27)
4	1.39 (1.26–1.54)	1.24 (1.14–1.34)
High	1.52 (1.39–1.67)	1.26 (1.17–1.36)
Industrial workers		
Low	1.00	1.00
2	1.06 (0.94–1.18)	1.04 (0.94–1.15)
3	1.13 (1.01–1.25)	1.04 (0.95–1.15)
4	1.26 (1.13–1.40)	1.06 (0.97–1.16)
High	1.31 (1.17–1.45)	1.08 (0.98–1.18)
Random effects		
Empty model variance (SE)	0.049 (0.0069)	
Manual workers variance (SE)	0.028 (0.0051)	0.018 (0.0040)
Unemployed variance (SE)	0.028 (0.0046)	0.014 (0.0033)
Industrial employees variance (SE)	0.040 (0.0061)	0.030 (0.0081)

Model 1 includes each of the municipality-level variables separately; model 2 is adjusted for the individual-level confounders.

**Table 1** Descriptive information of the distribution of the individual-level factors by quintiles of the municipality-level indicators

Municipality-level indicators	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Manual workers (% range)	20 (8–24)	27 (25–29)	31 (29–33)	35 (33–37)	40 (37–50)
Retirement incidence/1000 PY	6.8	8.5	9.7	10.9	12.2
% Women	49	50	50	51	51
% Married	47	52	55	56	56
% Unemployed	12	15	16	19	20
% Industrial workers	8	12	14	16	21
Unemployed (% range)	10 (2–12)	13 (12–14)	16 (15–18)	19 (18–20)	24 (20–41)
Retirement incidence/1000 PY	7.5	8.1	9.7	10.6	12.0
% Women	50	49	51	50	51
% Married	58	48	55	52	53
% Manual workers	24	24	30	29	32
% Industrial workers	13	12	17	15	15
Industrial workers (% range)	9 (1–12)	14 (12–16)	18 (16–19)	21 (19–23)	28 (23–43)
Retirement incidence/1000 PY	8.4	8.8	9.2	10.6	10.9
% Women	49	50	50	51	51
% Married	46	56	51	56	57
% Manual workers	22	23	27	31	35
% Unemployed	15	14	17	18	17

**Table 3** Rate ratios (RRs) and 95% confidence intervals (95% CIs) for disability retirement by the proportion of manual workers, the proportion of unemployment and the proportion of industrial employees in the municipality<sup>a</sup>

Quintiles of municipality-level indicators	Musculoskeletal diseases		Mental disorders		Other diseases	
	Model 1 RR (95% CI)	Model 2 RR (95% CI)	Model 1 RR (95% CI)	Model 2 RR (95% CI)	Model 1 RR (95% CI)	Model 2 RR (95% CI)
Manual workers						
Low	1.00	1.00	1.00	1.00	1.00	1.00
2	1.61 (1.23–2.11)	1.32 (1.03–1.68)	1.07 (0.86–1.33)	1.03 (0.84–1.26)	1.28 (1.08–1.52)	1.12 (0.97–1.29)
3	2.10 (1.63–2.69)	1.45 (1.15–1.82)	1.00 (0.81–1.23)	0.95 (0.78–1.15)	1.42 (1.21–1.66)	1.12 (0.97–1.29)
4	2.37 (1.85–3.02)	1.49 (1.18–1.87)	0.96 (0.78–1.19)	0.88 (0.72–1.08)	1.63 (1.39–1.90)	1.20 (1.04–1.37)
High	2.53 (1.99–3.23)	1.55 (1.24–1.94)	1.02 (0.83–1.25)	0.94 (0.76–1.14)	1.75 (1.50–2.04)	1.25 (1.08–1.43)
Unemployed						
Low	1.00	1.00	1.00	1.00	1.00	1.00
2	1.26 (1.06–1.49)	1.17 (1.01–1.35)	0.91 (0.76–1.07)	0.90 (0.76–1.05)	1.24 (1.07–1.43)	1.15 (1.02–1.29)
3	1.36 (1.17–1.58)	1.25 (1.10–1.42)	1.09 (0.94–1.26)	1.06 (0.92–1.22)	1.25 (1.10–1.42)	1.16 (1.04–1.28)
4	1.56 (1.34–1.82)	1.37 (1.20–1.56)	1.22 (1.05–1.41)	1.14 (0.98–1.31)	1.30 (1.14–1.49)	1.15 (1.03–1.28)
High	1.83 (1.59–2.11)	1.47 (1.30–1.65)	1.19 (1.04–1.37)	1.04 (0.91–1.19)	1.41 (1.25–1.60)	1.18 (1.07–1.30)
Industrial employees						
Low	1.00	1.00	1.00	1.00	1.00	1.00
2	1.14 (0.91–1.38)	1.09 (0.93–1.26)	0.99 (0.84–1.14)	1.03 (0.88–1.19)	1.02 (0.89–1.17)	1.00 (0.88–1.14)
3	1.25 (1.04–1.47)	1.08 (0.94–1.24)	0.99 (0.85–1.13)	1.01 (0.87–1.16)	1.12 (0.98–1.27)	1.03 (0.90–1.16)
4	1.53 (1.28–1.79)	1.17 (1.01–1.35)	0.94 (0.81–1.09)	0.95 (0.81–1.10)	1.24 (1.09–1.39)	1.04 (0.91–1.17)
High	1.63 (1.38–1.89)	1.20 (1.04–1.38)	0.88 (0.75–1.02)	0.90 (0.76–1.05)	1.31 (1.16–1.47)	1.07 (0.94–1.21)
Random effects						
Empty model variance (SE)	0.109 (0.0151)		0.032 (0.0118)		0.044 (0.0092)	
Manual workers variance (SE)	0.054 (0.0110)	0.045 (0.0094)	0.031 (0.0116)	0.025 (0.0103)	0.015 (0.0061)	0.009 (0.0005)
Unemployed variance (SE)	0.069 (0.0108)	0.037 (0.0082)	0.023 (0.0105)	0.026 (0.0109)	0.032 (0.0076)	0.010 (0.0052)
Industrial employees variance (SE)	0.087 (0.0131)	0.064 (0.0109)	0.035 (0.0087)	0.020 (0.0083)	0.038 (0.0082)	0.012 (0.0046)

Model 1 includes each of the municipality-level variables separately; model 2 is adjusted for the individual-level confounders. a By diagnosis of disability retirement.

retirement was clearly higher among manual workers than among non-manual employees, but in both groups, the risk increased similarly with the increasing proportion of manual workers in the municipality. The risk of disability retirement was lower among those working in the industry than those working in other fields, but in both groups, the proportion of industrial employees in the municipality was similarly associated with the risk of disability retirement. However, between the municipality-level and individual-level unemployment, a significant cross-level interaction was found ( $P < 0.001$ ). Among those who had not experienced unemployment themselves, the risk of disability retirement increased with increasing level of unemployment in the municipality. Among the unemployed, this risk of disability retirement was much higher, but not affected by the level of unemployment in the municipality.

## Discussion

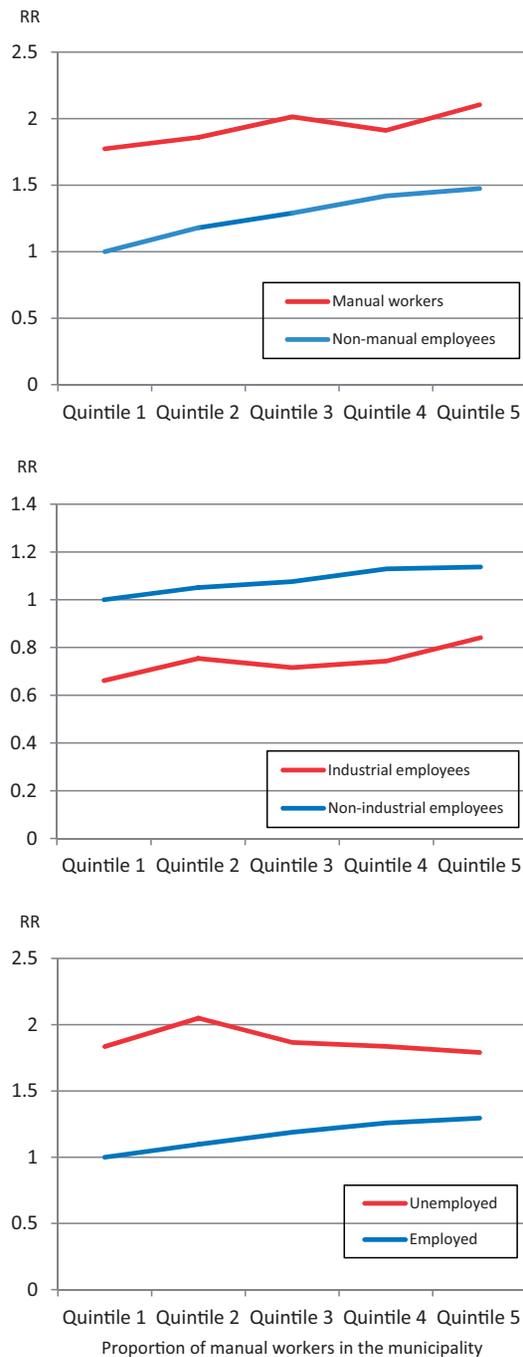
This study shows that those living in municipalities with a high proportion of manual workers and unemployed have higher risk of disability retirement independently of individual-level characteristics. In contrast, the proportion of industrial employees was unrelated to the risk of disability retirement. These associations were partly explained by compositional differences of individuals living in these areas. The associations were strongest for disability retirement due to musculoskeletal diseases. Unemployment level of the municipality was associated with disability retirement only among those who had not experienced unemployment themselves.

Low socioeconomic structure and high level of unemployment have been commonly used as measures of area-level deprivation. Most studies have focused on health outcomes like mortality, cardiovascular diseases and self-rated health.<sup>4,5</sup> Our study adds to previous research on contextual determinants of health by focusing on disability retirement, which can be seen to reflect work ability and functional health more broadly. We found socioeconomic structure and unemployment level of the municipality to be strongly associated with disability retirement, especially due to

musculoskeletal diseases and other physical diagnoses. The proportion of industrial employees in the municipality was less strongly associated with disability retirement, despite its strong positive correlation with the proportion of manual workers in the municipality. In the industrial occupations, the proportion of manual workers is relatively high, but they have lower risk of disability retirement than other manual workers. Due to increased automation, manual occupations in the industrial workplaces may not be particularly physically demanding anymore. Our findings are in accordance with a UK study finding that a summary measure of area deprivation was associated with physical functional health, whereas the association between area deprivation and mental functional health was weak.<sup>24</sup>

A requirement for a disability pension in Finland is an illness that reduces one's work ability. The evaluation of work ability is based on an overall assessment where also social factors such as age and work experience are taken into account. Even if the same legislation applies to the whole country, in the socially deprived areas, possibilities for continued working may be considered differently than in the more advantageous areas. In the areas with much manual work or much unemployment, finding a suitable job may be more problematic. Those who retire due to disability are often elderly workers from manual jobs who would need a less physically demanding job. A diverse economic structure and good employment situation create better opportunities also for those whose work ability is restricted.

Despite large geographical differences in disability retirement, previous studies have shown that only a small proportion of the variation in disability rates between areas can be attributed to the area level.<sup>19–21</sup> This is plausible due to the notable individual variation in disability retirement. Also in our study, the municipality-level characteristics had relatively weak effects compared with the individual-level factors. A Norwegian study reported an age-adjusted municipality-level variance of 0.086 among men and 0.065 among women,<sup>19</sup> which are somewhat higher than what was found in our study for disability retirement due to all diagnoses (0.049). However, we found considerably larger municipality-level variance in disability



**Figure 1** Rate ratios (RRs) for disability retirement by the proportion of manual workers, the proportion of unemployed and the proportion of industrial employees in the municipality and the corresponding variables at the individual level

retirement due to musculoskeletal diseases than due to mental disorders or other diseases. Irrespective of the diagnosis that led to disability retirement, accounting for the municipality-level characteristics and the individual-level factors considerably attenuated the municipality level variance. The Norwegian study also found that after adjusting for age, education and occupation at the individual level, unemployment rate of the municipality had stronger association with disability retirement than industrial structure or urbanity, measured by centrality and residential density.<sup>19</sup> This finding is largely congruent to our study, further showing that the associations for municipality-level manual workers and unemployment remain even after adjusting the same variables at the individual level.

The proportion of manual workers and that of industrial employees were similarly associated with disability retirement among those who were and those who were not manual workers or industrial employees themselves. However, unemployment level of the municipality was associated with disability retirement only among those with no experience of unemployment. High rates of unemployment often go hand-in-hand with work disability.<sup>25</sup> In the areas of high unemployment, the economic structure may be narrower, which may promote exit from work through disability retirement. The effect of own unemployment may be so strong that the unemployment level of the area does not have an effect beyond that. Socioeconomic position and working in industry are more stable characteristics than experience of unemployment, which may more easily change from year to year. It is possible that in the areas of high unemployment also those who were employed at the time of the measurement of the exposure are more likely to be unemployed at some other time. In Finland, the level of unemployment was relatively low in 2006 but increased thereafter, increasing also the probability of unemployment experience for those employed in 2006.

### Methodological considerations

Our study was based on large, nationally representative register data, providing sufficient power to estimate municipality-level associations and to examine cross-level interactions with the individual-level variables. To ensure an efficient adjustment for the compositional effect, the municipality-level associations were controlled for the corresponding variable at the individual level. Thus our study provides strong evidence that the associations of municipality-level socioeconomic position and unemployment with disability retirement are not explained by own socioeconomic position and unemployment. Yet, even if a range of other covariates were also controlled for, residual confounding by other individual-level covariates cannot be ruled out. Area differences may emerge due to selective migration of the more healthy individuals to the more advanced areas, and such selection would also create an apparent association between area characteristics and disability retirement.

### Conclusion

In summary, we have found that municipality-level socioeconomic structure and the level of unemployment are associated with disability retirement due to physical reasons independently of individual-level characteristics. Policies and interventions may want to consider also area-level possibilities when targeting disability retirement.

*Conflicts of interest:* None declared.

### Key points

- Large regional differences exist in disability retirement. In addition to individual-level characteristics also contextual factors of the areas may contribute to these differences.
- Municipality-level socioeconomic position and unemployment were associated with disability retirement, in particular due to musculoskeletal diseases, after controlling for the same factors at the individual level.
- Also area-level characteristics should be considered when targeting disability retirement.

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