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Cumulative social disadvantage and hospitalisations due to ambulatory care-sensitive conditions in Finland in 2011—2013: a register study

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ABSTRACT

Objectives To study the interplay between several indicators of social disadvantage and hospitalisations due to ambulatory care-sensitive conditions (ACSC) in 2011—2013. To evaluate whether the accumulation of preceding social disadvantage in one point of time or prolongation of social disadvantage had an effect on hospitalisations due to ACSCs. Four common indicators of disadvantage are examined: living alone, low level of education, poverty and unemployment.

Design A population-based register study.

Setting Nationwide individual-level register data on hospitalisations due to ACSCs for the years 2011–2013 and preceding data on social and socioeconomic factors for the years 2006—2010.

Participants Finnish residents aged 45 or older on 1 January 2011.

Outcome measure Hospitalisations due to ACSCs in 2011–2013. The effect of accumulation of preceding disadvantage in one point of time and its prolongation on ACSCs was studied using modified Poisson regression.

Results People with preceding cumulative social disadvantage were more likely to be hospitalised due to ACSCs. The most hazardous combination was simultaneously living alone, low level of education and poverty among the middle-aged individuals (aged 45–64 years) and the elderly (over 64 years). Risk ratio (RR) of being hospitalised due to ACSC was 3.16 (95% CI 3.03–3.29) among middle-aged men and 3.54 (3.36–3.73) among middle-aged women compared with individuals without any of these risk factors when controlling for age and residential area. For the elderly, the RR was 1.61 (1.57–1.66) among men and 1.69 (1.64–1.74) among women.

Conclusions To improve social equity in healthcare, it is important to recognise not only patients with cumulative disadvantage but also—as this study shows—patients with particular combinations of disadvantage who may be more susceptible. The identification of these vulnerable patient groups is also necessary to reduce the use of more expensive treatment in specialised healthcare.

Strengths and limitations of this study

- The individual-level register-based data allowed us to study simultaneously several indicators of social and socioeconomic disadvantage.
- The nationwide register data covered all hospitalisations due to ambulatory care-sensitive conditions (ACSCs) in Finland.
- We were able to study social disadvantage of the period preceding hospitalisations and its effect on being hospitalised due to ACSCs.
- Hospitalisations due to ACSCs is an indirect indicator of the effectiveness and quality of primary healthcare.
- While the study addressed associations between social disadvantage and hospitalisations due to ACSCs, the causality between morbidity and social disadvantage could not be studied.

BACKGROUND

Inadequate access to healthcare is one of the important determinants of social inequities in health.[1] Well-organised primary care has repeatedly been shown to promote population health and prevent ill health. There is also evidence that primary care (in contrast to specialist care) is associated with a more equitable distribution of health in populations through prevention and early management of health problems and through facilitating entry to the rest of the healthcare system.[2] The Finnish healthcare system provides a good case for examining equity as the system operates on the principle of universality and therefore, in general, supports equal access to health services according to need.[3] Simultaneously, studies from both Finland and some other countries with universal healthcare systems show systematic and persistent socioeconomic inequities in physician utilisation in relation to need.[2–5] Challenges in providing timely access to primary care are encountered in some areas[6] and there are indications of differences in primary healthcare quality between regions.[7] However,

Finland has—compared with most other European countries—a strong publicly funded primary healthcare.[8]

Hospitalisations due to ambulatory care-sensitive conditions (ACSC) are used to indirectly evaluate the effectiveness and quality of primary care.[9 10] They are defined as hospitalisations that could be prevented by primary care interventions. Earlier studies have used slightly different lists of conditions, but have usually examined three types of conditions: conditions that can be prevented by vaccination, acute conditions in which hospitalisation can be prevented by adequate (acute) management of the condition, and chronic conditions where good quality and timely primary care can prevent later admissions, for example, due to complications of diabetes. Several studies from the USA,[11–13] Canada,[14–18] Australia,[19–21] New Zealand[22] and European countries[23–29] have examined socioeconomic differences in ACSC and reported more ACSC hospitalisations among persons with lower socioeconomic background.

Most earlier studies examining socioeconomic differences in ACSC have used ecological data of single socioeconomic indicators, mainly income[12 14 15 24 25 28] or deprivation indices based on ecological data,[19–23 25 27 29] whereas few studies have focused on the individual-level socioeconomic indicators. The socioeconomic position is, however, a complex construct reflecting different dimensions of the individuals' standing in the social hierarchy.[30] The persistence of health inequalities has led researchers to point out that we need to analyse multiple social circumstances simultaneously in order to assess their impact on health and healthcare.[31] We found few studies utilising this approach with ACSCs. One study, which examined elderly Medicare beneficiaries in the USA, and another study from Ontario, Canada, utilising survey data linked to administrative databases, used multiple individual-level indicators of socioeconomic position but they did not examine them simultaneously.[11 17] A study from Stockholm County in Sweden[26] and a study from Canada[18] analysed several individual-level socioeconomic variables simultaneously. Additionally, a study from Ontario, Canada, examined trends and regional differences in acute diabetes complications and accounted for income and education at the community level.[16]

In addition to social position, social relationships may also contribute to outcomes of healthcare.[32 33] Social relationships can be measured using self-reported measures of social isolation or loneliness. Using register data, it is possible to study living arrangements and to use living alone as a proxy measure for social isolation. Although previous studies have found a strong association between living alone and social isolation and loneliness,[34] these conditions are distinct. However, also living alone has been found to increase the use of health services[35 36] and living alone has been applied as a measure of social isolation.[37] Social isolation has been identified as a risk factor for avoidable hospitalisation in one interview study from rural Australia.[38] In contrast, a study using area-level measures of social deprivation detected lower admission rates for several chronic diseases in areas with higher proportions of elderly individuals living alone in London.[29] A study in the USA found no association between living alone and hospitalisations due to ACSCs among retirement age (65+ years) individuals.[39] The population studied was, however, a sample of participants having access to an integrated delivery system with a preventive approach in the management of services and thus representing healthier residents than the general population.

A cumulative disadvantage may refer to two distinct social processes. On the one hand, it may imply the accumulation of individual forms of disadvantage cross-sectionally. On the other hand, a cumulative disadvantage may be observed with one or several forms of disadvantage persisting over time. The above-mentioned studies have not examined how these social risk factors cumulate at an individual-level either at one point of time or during a longer time period and whether the accumulation is associated with the risk of being hospitalised due to ACSCs. In recent literature, researchers have suggested that the effects of risk factors accumulate over time and thus increase socioeconomic disparities in health outcomes.[40 41] A large number of studies have found associations between cumulative disadvantage and health. However, the relationship between the accumulation of social disadvantage and healthcare in terms of effectiveness and quality has received relatively little attention.

Social risk factors may have different impacts on the outcomes of healthcare. Accumulation of the risk factors may also increase the risk of poor outcomes. Additionally, the effect of accumulation may vary depending on the combination of the risk factors and the persistence of accumulation. The main aim of this study is to examine whether the preceding accumulation of social disadvantage increases inequities in outcomes of healthcare. We study hospitalisations due to ACSCs as an outcome of healthcare and as a study population, we examine Finns aged 45 and over. The more specific study questions are: (1) What is the univariate effect of each risk factor on the risk of being hospitalised due to ACSCs if an individual has no other risk factors? (2) What combination of social disadvantage in one point of time is the most hazardous in terms of hospitalisations due to ACSCs? (3) Does the prolongation of cumulative disadvantage in time have an effect on hospitalisations due to ACSCs? We examine four common indicators of social disadvantage: living alone, poverty, low level of education and unemployment. We use comprehensive individual-level register data on sociodemographic and social factors and hospitalisations between 2006 and 2013.

MATERIALS

The study population included non-institutionalised Finnish residents aged 45 years or older on 1 January 2011. For this population, annual individual-level information on sociodemographic factors in 2006–2010 was obtained from different administrative registers

maintained by Statistics Finland. These exposure factors included information on gender, age and region of residence as well as factors that were used to define risk factors for disadvantage: living arrangements, income, education and annual number of unemployment months within a calendar year. Register data on hospitalisations due to ACSCs for the population at risk were individually linked to the sociodemographic data. Hospitalisations due to ACSCs in 2011–2013 were used as an outcome measure. Information on hospitalisations was obtained from the Care Register for Health Care maintained by the Finnish Institute for Health and Welfare. The UK definition of ACSCs was applied with addition of unspecified pneumonia (The International Statistical Classification of Diseases- 10th revision (ICD-10) code J18.9) and influenza (J09)[10] (online supplementary file 1). ACSCs were categorised as acute, chronic or vaccine-preventable conditions as suggested by previous studies.[42] Both emergence and elective inpatient hospital admissions, at least one-night length of stay, were included.

The data were divided into two age groups: individuals aged 45–64 years (the middle-aged) and 65 years and older (the elderly) and these age groups were studied separately in all analyses. This allowed us to study whether there were differences between the middle-aged and the elderly in the association between ACSC hospitalisations and cumulative disadvantage and enabled us to include unemployment as a risk factor in the analysis in the younger age group. In addition, there are structural differences in access to ambulatory care services between the working-age population and others due to occupational healthcare.[3] Men and women were studied mainly separately due to differing levels of hospitalisations due to ACSCs[7] and the effects of risk factors. Hospital districts were used as an indicator of the region of residence. This allowed us to adjust for the differences in the incidence of hospitalisations due to ACSCs between regions. The division of these 20 regions is based on an administrative division of the Finnish hospital care system.

The situation of living arrangements on December 31 in each year was used to define a dichotomous variable indicating whether an individual had lived alone during the year. We studied disposable family net income as an indicator of income. The family income was adjusted for family size using the The Organisation for Economic Co-operation and Development (OECD) modified equivalence scale. Poverty was defined as net family income lower than 60% of the median family income.[43] Data on the level of education was used to categorise the risk factor related to education. Low level of education was defined as having no degrees after comprehensive school which is 9 years of schooling. We defined the individual as being unemployed for that year if being unemployed for 6–12 months during the year. For the older age group in this study, we did not use unemployment as a risk factor as they are rarely in paid labour in Finland.

Patient and public involvement

Patients were not involved in the design or the implementation of the study.

Statistical methods

ACSC hospitalisations were treated as a binary outcome variable, combining those with one and several ACSC hospitalisations into one category and the modified Poisson regression method was used in analysing the data.[44] Our main interest was the effect of preceding social and socioeconomic factors on hospitalisations due to ACSCs in 2011–2013. The studied social and socioeconomic risk factors were living alone, poverty and low level of education (and also unemployment for the younger age group) and these explanatory variables were also included in the model as binary variables. All analyses throughout the study were adjusted for the region of residence and age, age treated as a categorical variable by 5 year age groups. The modest correlations between the explanatory variables were taken into account by creating composite variables (Cramer's V was 0.06–0.34 among middle-aged men and 0.06–0.29 among middle-aged women. Among the elderly, the values were 0.09–0.37 and 0.08–0.45).

Objective 1

We aimed to study the univariate effect of each social risk factor on hospitalisations due to ACSCs by analysing separately each risk factor including only that variable as an explanatory variable in the model in addition to age and region. In these analyses we assessed the effect of each social risk factor separately for those who had experienced only that social disadvantage in 2006–2010 (at least in 1 year) compared with individuals who had none of the risk factors during the whole period. Additionally, the differences in the univariate effects of the risk factors were tested by creating a composite variable made up of all social risk factor variables.

Objective 2

We aimed to identify the most hazardous combination of social disadvantage in terms of hospitalisations due to ACSCs for the combinations of two and three (and four among the younger age group) risk factors. This was done by creating composite variables of different combinations of the risk factors in 2006–2010 and these composite variables were modelled separately as the explanatory variables. If this risk factor was present at least in 1 year, then it was considered as a risk factor and the prolongation was not taken into consideration in these analyses. Those who had none of the social risk factors during the years served as the reference group.

Objective 3

The effect of prolongation of cumulative disadvantage on hospitalisations due to ACSCs was studied for the most hazardous combination of the risk factors found in the analyses of objective 2. We studied how the prolongation of the cumulative disadvantage modified the risk by

categorising the number of years (0–5 years) of cumulative disadvantage during the period and treating this categorical variable as an explanatory variable. For instance, if an individual had simultaneously all studied risk factors in each year between 2006 and 2010, he/she was categorised as having 5 years of prolonged cumulative disadvantage. Again, those who had none of the risk factors in 2006–2010 served as the reference group. Additionally, we performed pairwise comparison tests to study whether the number of years of prolongation of cumulative disadvantage had an effect on the RRs among those who had experienced cumulative disadvantage.

Men and women were studied separately but in the additional analyses gender differences in the associations of risk factors (as univariate, cumulative and prolonged cumulative) and hospitalisations due to ACSCs were tested in the same model. This was done by including an interaction term between gender and risk factors.

Sensitivity analyses

We conducted additional analyses for analyses concerning objective 2. In these additional analyses, we included only incident hospitalisations due to ACSCs and excluded those patients who had preceding hospitalisation due to ACSCs in 1987–2010. Otherwise, the assumptions and definitions were similar to the main analyses.

We used SAS (SAS Institute) V.9.4 to analyse the data.

RESULTS

In the study period 2011–2013, the population at risk comprised altogether 1 530 397 (50% men) individuals aged 45–64 years and 927 152 (42% men) individuals aged 65 years or over. In 2011–2013, 4% (29 275/760 139) of middle-aged men and 3% (20 846/770 258) of middle-aged women had been hospitalised due to ACSCs. Among the elderly, the proportions were 16% (60 110/387 970)

Table 1 Characteristics of the study population by social and socioeconomic risk factors in 2006–2010 and hospitalisations due to ACSCs in 2011–2013 by age and gender in Finland

	Men aged 45–64 years (n=760 139)		Women aged 45–64 years (n=770 258)	
Risk factor	% of having risk factor in 2006–2010	% of having hospitalisations due to ACSCs in 2011–2013	% of having risk factor in 2006–2010	% of having hospitalisations due to ACSCs in 2011–2013
Living alone				
Yes	30	5.4	28	3.8
No	70	3.2	72	2.3
Poverty				
Yes	25	6.2	23	4.3
No	75	3.1	77	2.2
Low level of education				
Yes	27	5.3	22	4.1
No	73	3.3	78	2.3
Unemployment				
Yes	19	4.5	16	3.0
No	81	3.7	84	2.7
	Men aged ≥65 years (n=387 970)		Women aged ≥65 years (n=539 182)	
Living alone				
Yes	29	19.7	55	16.8
No	71	13.8	45	9.7
Poverty				
Yes	31	21.4	47	18.3
No	69	12.9	53	9.4
Low level of education				
Yes	56	18.3	62	16.1
No	44	11.9	38	9.6

If an individual had the risk factor at least in 1 year in 2006–2010, he/she was categorised as having the risk factor.
If an individual did not had the risk factor in any of the years 2006–2010, he/she was categorised as not having the risk factor.
ACSC, ambulatory care-sensitive condition.

Table 2 Univariate effects of the risk factors in 2006–2010 on hospitalisations due to ambulatory care-sensitive conditions by age and gender in Finland in 2011–2013

	Men aged 45–64 years		Women aged 45–64 years	
	RR	95% CI	RR	95% CI
Living alone	1.39	1.34–1.44	1.20	1.15–1.26
Poverty	1.53	1.46 –1.61	1.54	1.46–1.62
Low level of education	1.42	1.37–1.47	1.55	1.49–1.62
Unemployment	1.18	1.12–1.24	1.15	1.08–1.23
	Men aged ≥65 years		Women aged ≥65 years	
Living alone	1.17	1.14–1.21	1.12	1.08–1.16
Poverty	1.27	1.21–1.32	1.31	1.24–1.38
Low level of education	1.26	1.23–1.29	1.30	1.27–1.34

The reference category is those individuals who had none of the risk factors during the period 2006–2010. RRs were estimated from separate models for each risk factor.
Adjusted for age and region of residence.
RR, risk ratio.

and 14% (73 231/539 182). Of those men, who had ACSC hospitalisations, 75% had only one ACSC hospitalisation during the study period among the middle-aged individuals and 64% among the elderly. Among women, the corresponding proportions were 79% and 67%.

Living alone was the most common risk factor of the studied social risk factors among the middle-aged individuals. Thirty per cent of men and 28% of women had lived alone at least in 1 year in 2006–2010 (table 1). Among the elderly, a low level of education was the most common risk factor, with 56% of the men and 62% of the women having a low level of education. For each risk factor, the proportion of hospitalisation due to ACSCs in 2011–2013 was clearly higher among those who had the risk factor compared with those who had not experienced the risk factor in any of the years 2006–2010.

Results concerning the objective 1

All the studied social and socioeconomic risk factors had a univariate effect on hospitalisations due to ACSCs after controlling for the area of residence and age (table 2). Each of the risk factors increased significantly the risk of being hospitalised due to ACSCs after adjustment for age and area of residence compared with individuals who had none of the risk factors in 2006–2010. Poverty and low level of education had the strongest univariate effect on ACSCs among both age groups and genders. The univariate effect of unemployment was statistically significantly smaller than the effect of all the other studied risk factors among middle-aged men (p<0.0001). Among middle-aged women, the univariate effect of unemployment was statistically smaller than the effect of poverty and low level of education (p<0.0001). The univariate effect of living alone was statistically significantly smaller than the low level of education among the elderly (p<0.001). The effect of living alone was significantly larger for men among the middle-aged individuals (p value for interaction between gender and living alone <0.0001) and the effect of poverty and low level of education was greater for women among the elderly (p values for interaction <0.01).

Results concerning the objective 2

Next, we studied the associations between different combinations of cumulative disadvantage and hospitalisations due to ACSCs (table 3). All combinations of two and three (and four among the middle-aged individuals) risk factors increased significantly the risk of being hospitalised due to ACSC compared with the reference group who had none of the risk factors. The only exception was the combination of living alone and unemployment, which was not statistically significant among middle-aged women. Among the middle-aged individuals, the most hazardous combination of two risk factors was living alone and poverty among both genders; the RR was 2.62 (95% CI 2.52–2.73) among men and 2.53 (2.41–2.65) among women. Those risk combinations that included unemployment had the smallest RRs. The most hazardous combination of three risk factors was living alone, poverty and low level of education with RR of 3.16 (3.03–3.29) among men and 3.54 (3.36–3.73) among women. The effect of cumulative disadvantage on hospitalisations due to ACSCs was larger for women among the middle-aged ones (p value for interaction between gender and cumulative disadvantage 0.02). When all the four risk factors were present, the RRs were 2.24 (2.10–2.39) and 1.98 (1.80–2.18), respectively, and the effect was larger for men (p value for interaction between gender and cumulative disadvantage 0.009). Among elderly men, the most hazardous combination of two risk factors was living alone and poverty: the RR was 1.49 (1.44–1.56). Among elderly women, the presence of poverty and low level of education was the most hazardous combination of two risk factors: the RR was 1.48 (1.42–1.53). When all the three risk factors (living alone, poverty and low level of

Table 3 The effect of different combinations of the risk factors in 2006–2010 on hospitalisations due to ambulatory care-sensitive conditions in Finland in 2011–2013

Living alone	Poverty	Low level of education	Unemployment	Men aged 45–64 years RR	Men aged 45–64 years 95% CI	Women aged 45–64 years RR	Women aged 45–64 years 95% CI
Combinations of two risk factors							
X	X	–	–	2.62	2.52–2.73	2.53	2.41–2.65
X	–	X	–	1.70	1.62–1.79	1.57	1.47–1.68
X	–	–	X	1.39	1.28–1.51	1.08	0.94–1.23
–	X	X	–	2.02	1.92–2.13	2.52	2.38–2.66
–	X	–	X	1.61	1.49–1.74	1.52	1.39–1.65
–	–	X	X	1.24	1.16–1.33	1.27	1.17–1.37
Combinations of three risk factors							
X	X	X	–	3.16	3.03–3.29	3.54	3.36–3.73
X	X	–	X	2.11	2.00–2.23	1.75	1.62–1.90
X	–	X	X	1.40	1.23–1.59	1.39	1.17–1.67
–	X	X	X	1.78	1.63–1.95	1.83	1.66–2.02
All four risk factors							
X	X	X	X	2.24	2.10–2.39	1.98	1.80–2.18
				Men aged ≥65 years		Women aged ≥65 years	
Combinations of two risk factors							
X	X	–		1.49	1.44–1.56	1.43	1.38–1.48
X	–	X		1.40	1.36–1.44	1.36	1.32–1.41
–	X	X		1.31	1.28–1.35	1.48	1.42–1.53
All three risk factors							
X	X	X		1.61	1.57–1.66	1.69	1.64–1.74

The reference category is those individuals who had none of the risk factors during the period 2006–2010. RRs were estimated from separate models for each combination of risk factors.
Adjusted for age and region of residence.
RR, risk ratio.

education) were present, the RRs were 1.61 (1.57–1.66) and 1.69 (1.64–1.74), respectively.

Results concerning the objective 3

The effect of prolonged cumulative disadvantage between 2006 and 2010 on ACSCs in 2011–2013 was examined for the most hazardous combination of the risk factors, that is, simultaneously living alone, experiencing poverty and low level of education. All RRs for being hospitalised due to ACSCs for those experiencing ≥1 years of cumulative disadvantage were statistically significant compared with those individuals who had none of the risk factors during the period 2006–2010 among both genders and age groups (table 4). The RR for being hospitalised was 3.91 (3.70–4.12) for those middle-aged men who had all the three risk factors in each year compared with those who had none of the risk factors between 2006 and 2010. Among middle-aged women, the corresponding RR was 4.75 (4.44–5.07). For the elderly, the RR was 1.66 (1.61–1.71) for men and 1.72 (1.67–1.78) for women.

Among middle-aged men and women, the prolongation of the cumulative disadvantage increased gradually the risk of being hospitalised due to ACSCs. The RR for those who had experienced prolonged cumulative disadvantage in 1, 2, 3 or 4 years was statistically smaller than if an individual had experienced cumulative disadvantage in each year. Among the middle-aged individuals, the effect of prolongation of cumulative disadvantage on hospitalisations due to ACSCs was statistically different between men and women only for those who had experienced it for 3 or 5 years (p values for interaction between gender and prolonged cumulative disadvantage <0.05).

Among elderly men, the prolongation of the cumulative disadvantage did not increase the risk of being hospitalised due to ACSC, that is, experiencing ≥1 years of cumulative disadvantage did not change the risk compared with those individuals who had experienced cumulative disadvantage in each of the 5 years. Only the difference between 4 and 5 years of cumulative disadvantage was statistically significant (pairwise comparison p value <0.001). Among elderly women, the differences experiencing 1 or 2 years of a cumulative disadvantage compared with 5 years were statistically significant (pairwise comparison p values <0.003). Among the elderly, the prolongation of cumulative disadvantage had also

Table 4 The effect of prolonged cumulative disadvantage in 2006–2010 on ambulatory care-sensitive conditions in Finland in 2011–2013 for the combination of living alone, poverty and low level of education

The number of years of cumulative disadvantage*	Men aged 45–64 years			Women aged 45–64 years		
	RR	95%	n†	RR	95%	n†
0	1.00	Ref‡	311 927	1.00	Ref‡	339 402
1	2.47	2.28–2.69	9304	2.45	2.20–2.74	7031
2	2.74	2.49–3.01	6088	2.57	2.25–2.92	4368
3	2.72	2.46–3.01	4767	3.35	2.95–3.80	3434
4	3.06	2.77–3.39	4163	3.60	3.16–4.09	2999
5	3.91	3.70–4.12	12 432	4.75	4.44–5.07	9189
	Men aged ≥65 years			Women aged ≥65 years		
0	1.00	Ref‡	116 197	1.00	Ref‡	91 452
1	1.59	1.51–1.67	6063	1.56	1.49–1.64	15 941
2	1.56	1.47–1.66	4220	1.60	1.51–1.69	10 308
3	1.59	1.51–1.68	5296	1.68	1.59–1.76	12 744
4	1.47	1.39 –1.54	6341	1.67	1.59–1.75	16 167
5	1.66	1.61–1.71	26 598	1.72	1.67–1.78	96 202

Adjusted for age and region of residence.
*In these analyses, those individuals who had experienced disadvantage of one risk factor or cumulative disadvantage related to the combination of two risk factors were excluded.
†The total number of individuals in the category.
‡The reference category is those individuals who had none of the risk factors during the period 2006–2010.
RR, risk ratio.

statistically different effect on hospitalisations due to ACSCs among men and women for those who had experienced it for ≥3 years (p values for interaction between gender and prolonged cumulative disadvantage <0.004).

Results concerning the sensitivity analyses

The risk of being hospitalised due to ACSC for those with a cumulative disadvantage compared with those without any of the examined risk factors decreased when including only incident ACSC hospitalisations. For the most hazardous combination of cumulative disadvantage (living alone, poverty and low level of education), the RR was 2.50 (2.37−2.64) among middle-aged men and 2.72 (2.54–2.92) among middle-aged women when excluding all individuals who were hospitalised due to ACSC before 2011 from the analyses. For the elderly, the RR was 1.53 (1.48–1.59) and 1.57 (1.50–1.64).

DISCUSSION

This population-based register study found strong associations between preceding cumulative social disadvantage and hospitalisations due to ACSCs. The study population included all Finnish residents aged 45 years or older in 2011—2013 and for this population, we used comprehensive data from several administrative registers to examine their hospitalisations in 2011—2013 and preceding social and socioeconomic risk factors in 2006—2010. We defined cumulative social disadvantage as a combination of several simultaneous risk factors for disadvantage preceding the study period: living alone, poverty, low level of education and unemployment. The risk of being hospitalised due to ACSCs was markedly elevated if an individual had lived alone and had experienced poverty during the preceding years and also had poor education. The same combination of the risk factors for social disadvantage was the most hazardous for both age groups (45—64 and over 64 years) among both genders. Additionally, we found that prolongation of cumulative disadvantage in time increased further the risk of being hospitalised due to ACSCs among the middle-aged (aged 45—64). Among the middle-aged individuals, the prolongation of the accumulation of risks was even more hazardous for women than for men.

Strengths and limitations

The lack of nationwide comprehensive register data on the use of primary healthcare is a common limitation in health services research. Hospitalisations due to ACSCs provide an indirect measure of the effectiveness and quality of primary healthcare. Some studies have questioned the accuracy of this indicator to reflect access to primary care. However, the studies concluding that hospitalisations due to ACSCs are not associated with poor access to healthcare, have used area-level data and have not been able to take into account the need for care at the individual level.[45–47] Thus, conclusive evidence that more efficient or more accessible primary care could not prevent a notable proportion of hospitalisations due to ACSCs is lacking.

A universal list of ACSCs does not exist as hospitalisation criteria vary between countries and healthcare systems.[10] We applied the UK definition with some minor modifications to maintain international comparability. However, the main purpose of this study was to examine social disadvantage as a risk factor for hospitalisations due to ACSCs within Finland and not to compare countries. We expect there to be no differences in coding practices between socioeconomic groups in the administrative regions of Finland. Thus we assume that there is no considerable inconsistency in using this ACSC definition list for our purposes.

In this study, both emergency and elective hospital admissions were included, whereas some earlier studies have included only emergency admissions.[9 25] In regard to social and socioeconomic differences, the use of both emergency and elective hospitalisations is likely to somewhat diminish these differences as social disadvantage might increase the risk of emergency hospitalisations while acting as a barrier to elective care.[48] Additionally, the majority of the hospital admissions due to ACSCs in our data were emergency admissions. Thus, we presume our results of social inequity would be even greater, had we studied only emergency hospital admissions.

With register data, we were not able to measure social isolation directly and thus we used living alone as a crude proxy. This measure excludes the individual's social networks outside their home. Living alone does not always denote social isolation or loneliness, although they are interrelated and overlapping. Despite these limitations, we detected strong associations between living arrangements and hospitalisations due to ACSCs and our results suggest that living arrangements reflect social support relatively accurately. Another limitation is that we were not able to take into account ill health, morbidity or disease severity, which is an evident shortage when utilising merely register data on the use of hospital care. Thus, we cannot make direct conclusions about what part of the differences between social groups in hospitalisations due to ACSCs would be explained by the different health status of individuals.

Our results of univariate effects of the socioeconomic risk factors on hospitalisations due to ACSCs are in line with the results found in several earlier studies reporting that disadvantaged socioeconomic position is associated with increased risk of being hospitalised due to ACSCs.[15 24 27] These previous studies examined only one socioeconomic factor or used small area-based deprivation indices in assessing socioeconomic position. Few studies have examined several socioeconomic factors at the same time. Blustein *et al*[11] found that poorer and less-educated individuals were likely to be hospitalised due to ACSCs in the USA in the early 1990s, but they modelled education and income separately. A study from Sweden detected that individuals with lower income and those not gainfully employed had a higher risk of becoming hospitalised due to ACSCs in the mid-2000s.[26] Booth *et al*[16] studied the effect of education and income at the community level on acute diabetes complications in Canada in the late 1990's and found that only low neighbourhood income increased the risk of being hospitalised. De Prophetis *et al*[17] detected that the risk of being hospitalised due to ACSCs was highest for those who jointly had the lowest levels of life satisfaction and low household income. The study by Wallar and Rosella[18] saw that individuals among the two lowest income quintiles were at greatest risk of being hospitalised due to ACSCs when adjusting for education and health behavioural factors. However, these studies did not examine how the accumulation of individual-level socioeconomic risk factors affects the risk of being hospitalised due to ACSCs. A higher prevalence of morbidity among individuals with a low socioeconomic position is likely to partly explain inequalities in hospitalisation due to ACSCs. Although primary healthcare obviously cannot prevent all ACSC events leading to hospital admissions, an efficient healthcare system should diminish differences between socioeconomic groups which may also be partly due to higher morbidity among the lower socioeconomic groups.

We evaluated the effect of living alone as a proxy for social isolation on hospitalisations due to ACSCs. We found that the univariate effect of living alone was significant and increased the risk of being hospitalised due to ACSCs and the effect was greater for middle-aged men than for middle-aged women. Living alone was as hazardous as poverty and low level of education among middle-aged men. The strong association between living alone and the risk of being hospitalised due to ACSC suggests that the absence of adequate social support might also play a role in seeking care especially among men with low socioeconomic position. Using interview data, Longman *et al*[38] have reported a similar finding concerning social isolation as a contributory factor in avoidable hospital admissions in Australia. Ennis *et al*[39] studied the association of living alone and hospitalisations due to ACSCs in the USA and concluded that living alone in later life did not increase hospitalisation risk. Their study cohort included about 2600 selected participants who were presumably healthier than the general population. Thus, the results might not be applicable to broader population groups. Saxena *et al*[29] found a significant negative association between asthma, hypertension and chronic obstructive pulmonary disease hospitalisations and proportion of elderly living alone in London. Their interpretation of this finding was that the support structures in the affluent areas prevent hospitalisations among the elderly.

We found the univariate effect of unemployment and its effect as a cofactor in the accumulation of risk factors to be smaller than the effect of the other risk factors. This finding is likely to reflect at least to some extent the fact that long-term unemployment is difficult to measure using register data. It is possible that our indicator does not properly capture all people suffering from long-term unemployment as it is based on statistics that include people registered as active job applicants. Further, the study took place during a severe recession with a high

prevalence of unemployment resulting in the unemployed becoming more heterogeneous and being unemployed less stigmatising than in times when the economy is booming. Thus, due to the recession, unemployment in our study may have represented less of a risk factor for social deprivation and less severe health consequences. Alternatively, the finding of the small effect of unemployment may derive from a homogeneous unemployed population. Especially in the beginning of unemployment the Finnish welfare state is relatively generous in buffering against the economic effect resulting from the loss of a job. An unemployed is entitled to earning-related benefits for 14–23 months, depending on the length of the employment history. Thus, it is only after a longer period of time that the effects of unemployment regarding the loss of earnings will take place. As we could not disentangle those still enjoying the subsidies from those that no longer did, the effects among the latter 'hard-core' unemployed group are potentially downplayed.

The higher risk of being hospitalised due to ACSCs among individuals with several simultaneous risk factors for social disadvantage found in our study is probably due to multiple causes. The inequalities found in hospitalisations due to ACSCs certainly partly reflect differences in access to and quality of primary healthcare. Earlier studies have found that individuals with higher socioeconomic positions have clearly more annual visits to physicians than those with lower positions after controlling for health status.[4 49] There is area-level evidence that low socioeconomic position and fewer physicians are associated with poorer access to care in addition to higher hospitalisations due to ACSCs.[50] Moreover, earlier studies have suggested that, for instance, continuity of primary care is associated with reduced risk of avoidable hospitalisations.[51 52] Especially a long-term relationship between a patient and a physician effectively reduces the risk.[53] It is likely that there are differences between socioeconomic groups in the continuity of care in the treatment of many common chronic conditions. The increased risk of being hospitalised due to ACSCs among individuals with cumulative disadvantage may also be caused by inadequate resources in primary healthcare to recognise the needs of people with simultaneous social and physical health problems and inability to treat and prevent these diseases from worsening. Socioeconomic inequalities in the use of healthcare are likely to be explained at least partly also by differences in seeking the care needed.[13]

The finding that the prolongation of cumulative disadvantage increased further the risk of being hospitalised for ACSCs among the middle-aged individuals is likely to reflect the interplay of social disadvantage and health problems over time. Prolongation of cumulative disadvantage worsens further social and physical health problems gradually. However, among the elderly (aged over 64 years), the prolongation of cumulative disadvantage did not increase the risk further. This may be because chronic conditions potentially leading to ACSC are relatively common among older age groups. Additionally, selective mortality may play a role by diminishing differences between socioeconomic groups.

The sensitivity analyses included only those individuals who had no previous hospitalisations due to ACSCs. They detected that cumulative disadvantage increases the risk of being hospitalised due to ACSCs somewhat less than when including all individuals. This suggests that the accumulation of social disadvantage can have worse effects for those who have chronic conditions and/or recurring hospitalisations. In contrast, this finding supports the conclusion that persons without previous avoidable hospitalisations have an increased risk of being hospitalised due to ACSCs after experiencing social disadvantage.

To our knowledge, this is the first study to assess exhaustively the relationship between the accumulation of social disadvantage and hospitalisations due to ACSCs. The use of comprehensive individual-level register data enabled us to avoid ecological bias that is common in studies using area-level socioeconomic and social disadvantage variables. We were also able to study a rather long period of time and thus evaluate the effect of prolongation of accumulating social disadvantage; the retrospective follow-up time was 8 years at longest. In our data, avoidable hospitalisations were derived from the Care Register for Health Care, which has been found to be of good quality and coverage in general.[54] The methodological approach of the study allowed us to study simultaneously several risk factors that are to some extent dependent on each other.

CONCLUSIONS

The results of our study underline the importance of improving coordination of care across the system between social and healthcare, as well as primary and secondary care. Also, primary prevention in the management of care should be emphasised. Universalism is not enough; the recognition of patients with chronic conditions and simultaneous particular combinations of cumulative disadvantage is important to diminish these extensive differences between social groups to improve social equity in healthcare. The identification of these vulnerable patients groups—who may be more susceptible—is also necessary to reduce the use of more expensive treatment in specialised healthcare. Treating people with multiple chronic conditions and social problems in primary care requires more attention and active means and for instance, strengthening continuity of care is even more significant for these vulnerable patients groups.

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