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The contribution of housing and neighborhood conditions to educational inequalities in non-communicable diseases in Europe: Findings from the European Social Survey (2014) special module on the social determinants of health

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Abstract

Background

Social gradients have been found across European populations, where less affluent groups are more often affected by poor housing and neighborhood conditions. While poor housing and neighborhood quality has been associated with a range of non-communicable diseases (NCDs), these conditions have rarely been applied to the examination of socioeconomic differences in NCDs. This study therefore asks ‘to what extent does adjusting for poor housing and neighborhood conditions reduce inequalities in NCDs among men and women in Europe’?

Methods

Our analysis used pooled-data from 20 European countries for women (n= 12,794) and men (n= 11,974), aged 25-75, from round 7 of the European Social Survey. Fourteen NCDs were investigated: heart/circulatory problems, high blood pressure, back pain, arm/hand pain, foot/leg pain, allergies, breathing problems, stomach/digestion problems, skin conditions, diabetes, severe headaches, cancer, obesity and depression. We used binary logistic regression models, stratified by gender, and adjusted rate ratios (ARRs) to examine whether educational inequalities in NCDs were reduced after controlling for poor housing and neighborhood quality.

Results

Overall, we find that adjusting for poor housing and neighborhood quality reduces inequalities in NCDs. While reductions were relatively small for some NCDs--for high blood pressure, reductions were found in the range of 0%-4.27% among women-- for other conditions reductions were more considerable. Controlling for both housing and neighborhood conditions for example, reduced inequalities by 16-24% for severe headaches and 14-30% for breathing problems.

Conclusions

Social gradients in poor housing and neighborhood quality could be an important contributor to educational inequalities in some NCDs.

Introduction

Housing is a core area of public health research and intervention^[1]. Poor housing, and the neighborhood in which housing is located, can impact health through direct exposure to risks for specific diseases, an association with socioeconomic status (SES), and psychosocial pathways^[1-5]. Damp housing for example, can lead to breathing diseases such as asthma; infested housing can lead to the rapid spread of infectious diseases; overcrowding can result in higher infection rates and is associated with an increased prevalence of household accidents.^[6] Expensive housing (e.g. as a result of high rents) can also have a negative effect on health, as expenditure in other areas (such as diet) is reduced.^[7] Housing costs may also impact on health as the burden of debt involved in home ownership or high rents may lead to anxiety and worry.^[8]

Likewise, neighbourhood conditions can impact on health in a variety of ways via the economic, social, and physical environment of a neighbourhood. Neighbourhood-level economic factors that influence health include area poverty rates, unemployment rates, wages, and types of employment in the area.^[6] Social factors at the neighborhood level include the services provided, publicly or privately, to support people in their daily lives such as child care or transport, food availability or access to a GP or hospital.^[9] Other social factors include collective social functioning and practices that are beneficial to health such as high levels of social cohesion and social capital, whilst more negative effects can come from the reputation (e.g. stigmatised places can result in discrimination against people living in such areas) and history of an area (e.g. if there has been a history of racial oppression) or from crime rates. Local cultural attitudes, say around smoking, can also influence health and health behaviours either negatively or positively.^[6] The physical environment is also an important determinant of health and health inequalities.^[10] There is a sizeable literature for example, on the positive health effects of access

to green space^[11], as well as the negative health effects of brownfield, neighbourhood safety, or contaminated land.^[12]

Previous work has associated poor housing and neighborhood quality with a range of NCDs including chronic pain ^[13-15], skin conditions ^[16], asthma and respiratory conditions ^[17-21], headaches ^[16,22], gastrointestinal problems ^[16], mental health ^[23,24], diabetes ^[25], obesity and cardiovascular health. ^[19-21] A social gradient has also been found across European populations, where less affluent population groups are more often affected by poor housing and poor neighborhood conditions.^[23] These social gradients may therefore contribute to the social gradient in health. Surprisingly however, housing and neighbourhood conditions have rarely been applied in studies examining socioeconomic differences in NCDs.^[29] This study therefore asks ‘to what extent does adjusting for poor housing and neighborhood conditions reduce inequalities in self-reported NCDs among men and women in Europe’?

Methods

This study is based on data from the seventh round of the European Social Survey (ESS) and the rotating module ‘Social inequalities in health and their determinants’ described in detail by Eikemo and colleagues^[30]. This module was fielded in 2014/15, comprising 37,623 respondents in 20 European countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Lithuania, Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland and the U.K.. Data was collected via face-to-face interviews with individuals aged 15 and over living in private households. In line with previous studies using earlier ESS rounds, we included only respondents aged 25-75.^[e.g. 31] We restricted our analyses to this target population since inclusion of all ages would have yielded selectivity problems: people younger than 25 have often not yet completed their education and people over the age of 75 represent a very selective group of relatively healthy individuals.^[31] Estonia and the

Czech Republic are not included in the analysis due to missing data on NCDs. After deleting cases listwise by each variable included in our analysis, we were left with 24,768 respondents. Details of the analytical sample are provided in Table 1.

NCDs

Data were analysed for 14 self-reported NCDs: heart/circulatory problems, high blood pressure, back pain, arm/hand pain, foot/leg pain, allergies, breathing problems, stomach/digestion problems, skin conditions, diabetes, severe headaches, cancer, obesity and depression. Data was collected on the first 11 of these conditions by providing participants with a list of conditions and asking them to indicate which they had experienced in the previous 12 months. For obesity, self-reported height and weight were converted to BMI. Obesity was categorized as a BMI greater than 30. A depression scale was created by using an eight-item version of the Center for Epidemiological Studies Depression Scale (CES-D scale)^[32]. For this paper, we used a dichotomized measure of depression, as outlined in Huijts et al.^[33]

Socioeconomic status

Education was used as the indicator of SES. Seven categories are used by the ESS to measure respondents' highest educational level, reflecting the International Standard Classification of Education (ISCED). A low (ISCED I and II), medium (ISCED II, III and IV) and high (ISCED V) education group were constructed from these categories. This categorization was used because the proportion of respondents with less than secondary education (i.e. ISCED I) is very low, and ISCED I may not fully capture, on its own, the lowest educated groups in these countries.

Housing and Neighborhood Quality

Housing and neighborhood quality were each measured by one ESS item. Data was collected on housing conditions by providing participants with a list of poor housing conditions (i.e. mould or

rot in windows, doors or floors; damp walls or leaking roof; lack of indoor flushing toilet; lack of bath and shower; overcrowding; extremely hot or extremely cold) and asking them to indicate which apply to their accommodation. Respondents indicating one or more of these conditions were characterised as having poor housing quality.

Neighborhood quality was assessed by asking respondents how safe they feel walking in their neighborhood at night (very safe, somewhat safe, somewhat unsafe, very unsafe). Respondents indicating that they feel somewhat unsafe or very unsafe were characterized as having poor neighborhood quality.

Analysis

To ascertain the contribution of housing and neighborhood quality to inequalities in NCDs, we calculated age-controlled adjusted risk ratios (ARR) on a pooled European sample using predicted probabilities generated by means of binary logistic regression.^[34] We chose to calculate ARRs rather than odds ratios, as the latter are likely to be artificially high for non-rare conditions.^[35] Moreover, ARRs are calculated from predicted probabilities, which are a preferred estimation method for cross-national comparisons of health inequalities.^[36] This is because they do not rely on the assumption that error variance across countries is the same. Data were weighted using population weights which are reported in the ESS and combined with a post-stratification weight which uses information on age-group, gender, education, and region to reduce the sampling error and potential non-response bias of the survey. We accounted for the nesting of individuals within countries by estimating clustered standard errors. STATA 14.1 was used for all analyses.

To measure the extent of inequalities, we included in our base model, Model A, the NCD as the dependent variable, socioeconomic status as the main independent variable and controlled for age. Our analyses separately compared the low and medium education group with the high

education group. To assess the impact of controlling for housing and neighborhood quality, we then separately added housing and neighborhood quality to the base model in Models B and C. In our final model, Model D, we controlled both for housing and neighborhood quality. To calculate the percentage reduction in adjusted risk between models we used the formula $[(ARR \text{ Model A} - ARR \text{ Model B, C, or D}) / (ARR \text{ Model A} - 1)] * 100$ for conditions with ARR > 1.0 and the formula $[(ARR \text{ Model A} - ARR \text{ Model B, C, or D}) / (ARR \text{ Model A})] * 100$ for conditions with ARR < 1.0.

Results

As expected in the age-only adjusted analysis (Models A), the ARRS were larger among those with lower SES (Table 2). In Models B, which additionally controlled for poor housing conditions, socioeconomic differences were reduced to varying degrees for different NCDs. Controlling for poor housing had no effect on inequalities in high blood pressure for women. By contrast, controlling for poor housing reduced the ARRs among women in the low education group by 7.94% for depression, 9.68% for foot/leg pain and by 12.12% for severe headaches. Among women in the medium education group, the largest reductions in ARRs after controlling for poor housing conditions were found for depression (4.76%), severe headaches (4.00%) and breathing problems (4.00%). Among men in the medium education group, controlling for poor housing had no effect on inequalities in hand/arm pain, obesity, nor high blood pressure. Among men in the low education group, controlling for poor housing reduced inequalities in hand/arm pain by only 1.82% and in obesity by 1.64%. By contrast, controlling for poor housing reduced the ARRs among men in the low education group by 16.67% for breathing problems and by 11.23% for depression. Among men in the medium education group, the largest reductions in ARRs were found for severe headaches (9.68%).

In Models C, which controlled for age and poor neighborhood quality, socioeconomic differences were also reduced by varying degrees, but to a slightly larger degree than when poor housing conditions were controlled for. Among women, controlling for poor neighborhood conditions had the smallest effect on inequalities in obesity, with reductions of just 1.79% for the medium education group and 2.27% for the low education group. Among women in the medium education group, the largest reductions were found for inequalities in breathing problems (16.00%), diabetes (13.51%), depression (13.10%), and hand/arm pain (12.5%). Among women in the low education group, the largest reductions were found for inequalities in severe headaches (12.12%) (here the CI contains 1), depression (11.21%) and breathing problems (10.67%). Among men, controlling for poor neighborhood quality had the smallest attenuating effect on inequalities in hand/arm pain, with reductions of just 2.33% for the medium education group and 3.64% for the low education group. Among men in the medium education group, by contrast, the largest reductions were found for inequalities in severe headaches and depression with respective reductions of 9.68% and 12.38%. Among men in the low education group, the largest reductions were found for depression and obesity with respective reductions of 17.65% and 16.67%. Notable reductions were also observed among men in the low education group for obesity (9.84%) and high blood pressure (9.09%).

For allergy, skin and stomach/digestion problems, which demonstrated an inverse social gradient, adjusting for poor housing and neighborhood generally increased the inverse inequalities (between 1.30% and 5.06%), which is to say that overall, risks became even lower among the lower education groups after adjustment.

Adjusting for both poor housing and neighborhood conditions (Models D) reduced inequalities to a larger extent for many of the NCDs. For example, controlling for both

conditions reduced inequalities among women by more than 10% for all NCDs except for obesity and high blood pressure. Notably, inequalities in breathing problems were reduced by 20.00% among women in the medium education group and inequalities in depression were reduced by 17.76% among women in the low education group. Among men, after controlling for both conditions, the largest reductions in inequalities were also found for depression, severe headaches and breathing problems. Among men in the low education group for example, inequalities in breathing problems were reduced in Model D by 30.00% and in depression by 27.27%.

Discussion

Our results suggest that for both European women and men, adjusting for poor housing and neighborhood quality significantly reduces SES differences in NCDs. While these reductions are relatively small for some NCDs, such as high blood pressure, for other conditions reductions are more considerable, especially for breathing problems, severe headaches and depression. These results suggest that the social gradient in poor housing and neighborhood quality could be an important contributor to social gradients in at least some NCDs. The association between poor housing and neighborhood conditions and depression also suggests that psychosocial factors may be one of the more likely pathways linking these conditions to health outcomes. However, it may also be that respondents with depressive symptoms are more likely to negatively evaluate their housing and neighborhood quality.

Between poor housing and poor neighborhood quality, controlling for the latter seemed to reduce inequalities to a larger degree. This again might suggest that psychosocial pathways are one of the more likely pathways between poor housing and poor neighborhood conditions, as our measure of poor neighborhood quality captured respondents' feelings of safety. Reductions were

sometimes larger among the low versus medium education group. This differential reduction between educational groups may relate to differential vulnerability to adverse housing and neighborhood conditions.^[37] Those in higher education groups for instance, may have greater resources which allow them to overcome these poor conditions to a larger degree.

This study provides an initial overview of the extent to which poor housing and neighborhood conditions reduce social inequalities in NCDs among men and women in Europe. We identified variations between NCDs with regard to the extent poor housing and neighborhood conditions attenuate inequalities. A limitation of this work was that our operationalization of housing and neighborhood conditions was fairly limited. We did not have data for example, on important dimensions of housing relating to costs and tenure. Since these conditions have previously been shown to strongly associate with both SES and health^[38], our results likely underestimate the role of housing conditions in reducing inequalities. Moreover, our operationalization of neighborhood conditions focused on individuals' feelings of safety, there is however, a much larger range of neighborhood conditions which has been found to both associate with SES and health.^[1,6] Further, in light of the study's cross-sectional design, causal interpretations cannot be drawn. This work is also limited since it relies on self-reported data, rather than clinical diagnosis. However, while self-reports may depend on characteristics of respondents other than the clinical presence of a condition, substantial accuracy has been found between physician reported medical histories and self-reports for many conditions.^[39] Future work should further consider these findings in relation to specific country/regional contexts as results may differ from our pooled analysis. Future work should also consider other social determinants which may have an additional role in explaining inequalities in NCDs.

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Table 1. Sample Characteristics, women and men

		Women (12,794)		Men (11,974)	
		No.	%	No.	%
Age	25-59	8,993	70.29	8,303	69.34
	60-75	3,801	29.71	3,671	30.66
Education	High	3,564	27.86	2,994	25.00
	Med	6,203	48.48	6,185	6.65
	Low	3,027	23.66	2,795	23.34
Poor Housing Conditions	No	10,976	85.79	10,444	87.22
	Yes	1,818	14.21	1,530	12.78
Poor Neighborhood Conditions	No	9,700	75.82	10,883	90.89
	Yes	3,094	24.18	1,091	9.11

Source: European Social Survey (2014)

Table 2. Inequalities in reporting NCDs among European Women and Men (aged 25-75), before and after adjustment for poor housing and neighborhood quality

NCD		Model A: Age-Adjusted			Model B: Age + Housing			% Red.	Model C: Age + Neighborhood			% Red.	Model D: Age+ Housing +Neighborhood			% Red.
		ARR	CI (95%)		ARR	CI (95%)			ARR	CI (95%)			ARR	CI (95%)		
Heart Circulation																
Women	Med	1.57	1.25	1.97	1.56	1.24	1.96	1.75	1.53	1.21	1.93	7.02	1.52	1.21	1.92	8.77
	Low	1.70	1.42	2.03	1.67	1.39	2.00	4.29	1.64	1.36	1.98	8.57	1.62	1.34	1.95	11.43
Men	Med	1.61	1.08	2.40	1.60	1.07	2.39	1.64	1.59	1.08	2.35	3.28	1.58	1.07	2.35	4.92
	Low	1.68	1.30	2.19	1.66	1.25	2.20	2.94	1.64	1.27	2.12	5.88	1.63	1.24	2.14	7.35
High Blood Pressure																
Women	Med	1.74	1.44	2.10	1.74	1.44	2.11	0.00	1.71	1.43	2.05	4.05	1.71	1.43	2.06	4.05
	Low	2.17	1.81	2.59	2.17	1.80	2.60	0.00	2.12	1.77	2.53	4.27	2.12	1.77	2.54	4.27
Men	Med	1.35	1.22	1.50	1.35	1.22	1.49	0.00	1.34	1.21	1.49	2.86	1.34	1.21	1.49	2.86
	Low	1.22	1.01	1.47	1.21	1.00	1.47	4.55	1.20	1.01	1.43	9.09	1.19	1.00	1.43	13.64
Breathing Problem																
Women	Med	1.25	1.10	1.43	1.24	1.09	1.42	4.00	1.21	1.05	1.39	16.00	1.20	1.05	1.38	20.00
	Low	1.75	1.36	2.26	1.71	1.33	2.20	5.33	1.67	1.28	2.19	10.67	1.64	1.25	2.15	14.67
Men	Med	1.18	0.94	1.49												
	Low	1.30	1.12	1.51	1.25	1.07	1.46	16.67	1.25	1.09	1.43	16.67	1.21	1.05	1.39	30.00
Allergies																
Women	Med	0.91	0.81	1.02												
	Low	0.79	0.65	0.96	0.76	0.63	0.92	3.80	0.75	0.61	0.92	5.06	0.73	0.59	0.89	7.59
Men	Med	0.77	0.66	0.89	0.76	0.65	0.89	1.30	0.76	0.66	0.88	1.30	0.76	0.65	0.88	1.30
	Low	0.55	0.45	0.67	0.54	0.44	0.65	1.82	0.54	0.44	0.66	1.82	0.53	0.43	0.65	3.64
Skin																
Women	Med	0.87	0.77	1.00												
	Low	0.66	0.55	0.79	0.65	0.53	0.79	1.52	0.64	0.55	0.76	3.03	0.63	0.53	0.76	4.55
Men	Med	0.93	0.65	1.33												
	Low	0.52	0.38	0.71	0.50	0.36	0.67	3.85	0.50	0.35	0.70	3.85	0.48	0.34	0.67	7.69
Back/Neck Pain																
Women	Med	1.13	1.01	1.27	1.13	1.00	1.27	0.00	1.12	0.99	1.26	7.69	1.11	0.99	1.26	15.38
	Low	0.95	0.85	1.07												
Men	Med	1.15	0.99	1.34												
	Low	1.03	0.85	1.24												
Hand/Arm																
Women	Med	1.24	1.10	1.39	1.23	1.09	1.39	4.17	1.21	1.08	1.36	12.50	1.20	1.07	1.36	16.67
	Low	1.68	1.54	1.84	1.64	1.50	1.80	5.88	1.63	1.50	1.78	7.35	1.60	1.47	1.75	11.76
Men	Med	1.43	1.16	1.78	1.43	1.15	1.77	0.00	1.42	1.14	1.77	2.33	1.42	1.13	1.77	2.33
	Low	1.55	1.27	1.90	1.54	1.25	1.89	1.82	1.53	1.25	1.87	3.64	1.51	1.23	1.86	7.27
Foot/Leg																
Women	Med	1.09	1.00	1.19												
	Low	1.31	1.20	1.44	1.28	1.16	1.41	9.68	1.28	1.18	1.40	9.68	1.26	1.14	1.38	16.13
Men	Med	1.12	0.98	1.28												

	Low	1.12	0.93	1.34												
Severe Headaches																
Women	Med	1.25	1.04	1.49	1.24	1.03	1.48	4.00	1.22	1.00	1.48	12.00	1.21	0.99	1.47	16.00
	Low	1.33	1.06	1.68	1.29	1.01	1.65	12.12	1.29	1.00	1.66	12.12	1.25	0.96	1.64	24.24
Men	Med	1.31	1.04	1.64	1.28	1.01	1.60	9.68	1.28	1.01	1.63	9.68	1.25	0.98	1.59	19.35
	Low	1.15	0.89	1.49												
Stomach/Dig																
Women	Med	0.81	0.77	0.85	0.81	0.77	0.85	0.00	0.78	0.74	0.83	3.70	0.78	0.74	0.82	3.70
	Low	0.90	0.74	1.10												
Men	Med	0.97	0.83	1.14												
	Low	0.89	0.69	1.16												
Diabetes																
Women	Med	1.37	1.15	1.62	1.36	1.14	1.61	2.70	1.32	1.14	1.53	13.51	1.31	1.14	1.52	16.22
	Low	2.37	1.81	3.11	2.31	1.81	2.95	4.38	2.26	1.78	2.86	8.03	2.21	1.79	2.73	11.68
Men	Med	2.24	1.59	3.16	2.21	1.56	3.14	2.42	2.20	1.58	3.08	3.23	2.18	1.55	3.06	4.84
	Low	2.41	1.53	3.78	2.35	1.49	3.69	4.26	2.34	1.49	3.67	4.96	2.28	1.45	3.60	9.22
Obesity																
Women	Med	1.56	1.18	2.07	1.55	1.17	2.05	1.79	1.55	1.16	2.06	1.79	1.54	1.16	2.05	3.57
	Low	2.32	1.62	3.33	2.28	1.58	3.28	3.03	2.29	1.59	3.30	2.27	2.26	1.56	3.26	4.55
Men	Med	1.41	1.32	1.51	1.41	1.31	1.51	0.00	1.38	1.30	1.48	7.32	1.38	1.29	1.48	7.32
	Low	1.61	1.27	2.04	1.60	1.27	2.03	1.64	1.55	1.22	1.98	9.84	1.55	1.22	1.98	9.84
Depression																
Women	Med	1.84	1.60	2.11	1.80	1.58	2.05	4.76	1.73	1.54	1.93	13.10	1.70	1.53	1.88	16.67
	Low	3.14	2.46	4.01	2.97	2.36	3.75	7.94	2.90	2.33	3.62	11.21	2.76	2.24	3.42	17.76
Men	Med	2.05	1.48	2.83	1.97	1.47	2.64	7.62	1.92	1.40	2.63	12.38	1.84	1.39	2.45	20.00
	Low	2.87	2.18	3.79	2.66	2.11	3.36	11.23	2.54	1.99	3.24	17.65	2.36	1.91	2.91	27.27
Cancer																
Women	Med	1.18	1.06	1.32	1.18	1.06	1.32	0.00	1.17	1.05	1.31	5.56	1.17	1.05	1.31	0.85
	Low	1.25	1.02	1.53	1.25	1.02	1.53	0.00	1.23	1.00	1.51	8.00	1.23	1.00	1.52	1.60
Men	Med	1.27	1.01	1.61	1.28	1.02	1.62	-3.70	1.26	0.97	1.62	3.70	1.27	0.99	1.62	0.00
	Low	1.19	0.98	1.44												

Bold indicates that CI (95%) does not include one; % Red. = per cent reduction, shaded = results not displayed because of insignificant results in Model A