European Journal of Public Health, Vol. 27, Supplement 1, 2017, 107–114

doi:10.1093/eurpub/ckw217

The social determinants of inequalities in self-reported health in Europe: findings from the European social survey (2014) special module on the social determinants of health

Mirza Balaj[1], Courtney L. McNamara[1], Terje A. Eikemo[1], Clare Bambra[2]

1 Department of Sociology and Political Science, Norwegian University of Science and Technology, Trondheim, Norway
2 Institute of Health and Society, Faculty of Medical Sciences, Newcastle University, Newcastle upon Tyne, United Kingdom

Correspondence: Mirza Balaj, Department of Sociology and Political Science, Norwegian University of Science and Technology, Building 9, Level 5, Dragvoll, Trondheim, Norway, Tel: +4773591716, e-mail: mirza.balaj@ntnu.no

Background: Health inequalities persist between and within European countries. Such inequalities are usually explained by health behaviours and according to the conditions in which people work and live. However, little is known about the relative contribution of these factors to health inequalities in European countries. This paper aims to investigate the independent and joint contribution of a comprehensive set of behavioural, occupational and living conditions factors in explaining social inequalities in self-rated health (SRH). **Method:** Data from 21 countries was obtained from the 2014 European Social Survey and examined for respondents aged 25–75. Adjusted rate differences (ARD) and adjusted rate risks (ARR), generated from binary logistic regression models, were used to measure health inequalities in SRH and the contribution of behavioural, occupational and living conditions factors. **Result:** Absolute and relative inequalities in SRH were found in all countries and the magnitude of socio-economic inequalities varied considerably between countries. While factors were found to differentially contribute to the explanation of educational inequalities in different European countries, occupational and living conditions factors emerged as the leading causes of inequalities across most of the countries, contributing both independently and jointly with behavioural factors. **Conclusion:** The observed shared effects of different factors to health inequalities points to the interdependent nature of occupational, behavioural and living conditions factors. Tackling health inequalities should be a concentred effort that goes beyond interventions focused on single factors.

Introduction

Despite remarkable declines in morbidity and mortality rates in Europe over the last few decades, socioeconomic inequalities in health persist and in certain contexts have even risen.[1] People from a lower socioeconomic background (measured in terms of income, education or occupational class) have, on an average, worse rates of morbidity and mortality than those from a higher socioeconomic background. Several possible explanations for these inequalities have been suggested, including the unequal socio-economic distribution of risky health behaviours (e.g. smoking, alcohol consumption, and physical activity), life course events (e.g. divorce, homelessness, financial problems), material resources (e.g. access to jobs, health care, schools, transport, social care), physical working conditions (e.g. ergonomic or chemical hazards), psychosocial resources and stress related factors (such as control at work or social support).[2–4] Or put more simply, inequalities in the social conditions in which people from different socialeconomic backgrounds live and work.[5]

Several population-based studies have concluded that occupational,[6–9] behavioural,[9–11] psychosocial[12–14] and material[15,16] factors contribute independently (and to various degrees) to health inequalities. Additionally, some of these studies have suggested that the explanatory pathways of these factors are interrelated. For example, material factors might affect health inequalities indirectly through behavioural and psychosocial factors; occupational factors (i.e. employment status) might exert an indirect effect through material, behavioural and psychosocial factors; and psychosocial factors can act indirectly through behavioural factors. Commonly, a more substantial attenuation of inequalities has been reported when these factors were studied in combination.

Few other regions have made socioeconomic inequalities in health a more debated and researched topic than Europe.[17–19] This has led to an extensive body of knowledge examining different pathways to health inequalities. However, with few exceptions[12–14] much of this research has focused on single pathways to health inequalities,[11,20–24] examined only single countries,[6–10,15,16,25–30] or focused largely on mortality[9,31,32] because of the limited availability of health measures and social determinants.[33] The health module of the seventh round of European Social Survey (ESS) provides a unique opportunity to overcome such limitations and comparatively investigate the contribution of multiple factors in explaining socioeconomic inequalities in health across 20 European countries and Israel.

In this study, we start by reporting on the magnitude and variation of inequalities across countries. In doing so, we follow recommendations from earlier research that urges to interpret variations of relative inequalities in light of the absolute level of inequalities and of the overall prevalence level in the population.[34,35] Moreover, interpretation of inequality measures in cross-country comparison has been argued to be more meaningful when their populations share a similar level of health outcome.[36] By integrating these different perspectives in examining health inequalities, we aim to present a more nuanced account of the variation of health inequalities across countries.

The ESS enabled us to cover a large number of material, behavioural, occupational and psychosocial factors as suggested in the literature,[37] across a wide range of European countries. It is important to disentangle the different roles played by these factors, in order to provide guidance on whether countries should prioritize their interventions to change health behaviours, working conditions or material and psychosocial resources. Therefore, our

main objective in this study is to fill the gap in the knowledge of contributing factors associated with inequalities in self-reported health (SRH), by exploring different types of behavioural, occupational (i.e. the conditions in which people work) and living conditions (i.e. the conditions in which people live) factors, using a large sample size of national general populations by country, and exploring the differences according to educational groups.

Methods

Data and study sample

This study is based on the data of the seventh round of the ESS fielded in 2014 and 2015, comprising 40 185 respondents in 21 countries. Response rates ranged from 31% in Germany to 68% in the Czech Republic. For the purpose of this study, data have been restricted to 31 917 respondents aged 25–75. This sample restriction was applied in order to include only respondents that have completed their education and are more likely to have some degree of work experience. Our final study sample, after deleting cases listwise by each variable in our analysis, included 26 567 respondents across 21 countries. The largest share of missing data (2552) was observed for the behavioural factors, almost half of it deriving from alcohol measures.

Measures

As the dependent variable, SRH was assessed using the following question: 'How is your health in general?'. Eligible responses were 'very good', 'good', 'fair', 'bad' and 'very bad'. We dichotomized the variable into 'very good or good' health vs. 'less than good' health ('fair', 'bad' and 'very bad').

Socioeconomic position was determined by the respondent's education level. Several reasons have guided our decision to focus on education as the stratifying measure. From a methodological perspective, education is often considered as a more comparable measure of socioeconomic status for cross-country studies[38] and less prone to reverse causation compared with income and occupation.[39] Educational attainment in meritocratic societies precedes over the achievement of other markers of social status and it affects health by providing labour market resources such as working conditions and income. In addition, education is also related to the distribution of non-labour market resources such as coping and control beliefs, cognitive skills and social network[40] that influences individuals' perception in regards to life course disadvantages.[41] In the ESS, respondents' highest completed level of education was measured with country-specific education items, which were later harmonized according to the International Standard Classification of Education (ISCED).[42] From the seven ISCED categories, an educational variable with three categories was created: respondents with less than upper secondary education (ISCED I and II) are contrasted with respondents with upper secondary education (ISCED IIIa, IIIb and IV) and with respondents with tertiary education (ISCED V and VI).

Behavioural factors (for variable operationalization see Additional File 1) included BMI, physical activity, fruit and vegetable consumption, smoking behaviour, frequency of alcohol consumption and whether individuals remain under the recommended units of alcohol consumption. *Occupational factors* included material hazards and ergonomic hazards at work, job control and if respondents participate in the labour force. *Living conditions* have been conceptualized as a life course combination of material and psychosocial factors. Perceived financial strain, financial difficulties experienced during childhood and housing conditions were used to represent the material factors while experiencing household conflicts while growing up and ties to social networks were used to represent psychosocial factors.

Statistical analysis

First, the association between SES and SRH, between SES and all factors and between these factors and SRH were studied using Chi-square test. Next, to measure health inequalities in SRH, marginal standardization method was used to predict probabilities (PP) generated from stepwise binary logistic regression models. This statistical method has several advantages: it adequately reflects the confounder distribution in the studied population, allowing inference to the total population; together with the post stratification weighting, it allows for reliable comparison across models, samples and groups; and compared with odds ratios, estimates deriving from PP are more reliable especially for non-rare outcomes.[43–45] Inequalities in reporting less than good health were measured by means of adjusted rate differences (ARD) and relative adjusted rate risks (ARR) of low vs. high level of education. A baseline model for each country was constructed to analyse the association between SES and SRH adjusting for gender and age. Higher educated respondents were used as the reference group. Subsequently, each social determinant was added separately and only determinants which reduced relative inequalities by more than 5% were retained in final model. After examining the contribution of each behavioural, occupational and living condition factor individually, combinations of these conditions were examined to ascertain independent and shared effects on educational differences in health. Following earlier studies,[10,26] the contribution of each determinant to the explanation of educational inequality in SRH was estimated with the formula $(RR_{\text{model 1}} - RR_{\text{extended model}})/(RR_{\text{model 1}} - 1)$. Analysis was performed using STATA (14.1).

Results

Inequalities in the prevalence of self-rated health

The overall prevalence of SRH varied from 16% in Ireland to 53% in Portugal (see Additional File 2). All factors were significantly associated with SRH (see Additional File 3) and in all countries we observed a strong association between education and SRH, with the low education group having a higher risk of reporting less than good health. Regarding the association of factors with education, significant social inequalities were found for most variables except for unmet medical need which, after a sensitivity analysis by country, was eventually excluded from further analysis (see Additional File 4).

Figure 1 illustrates absolute and relative inequalities (measured by ARD and ARR) per country. Both absolute and relative educational inequalities were observed in all countries, although they varied considerably (see figure 1). Countries have been sorted in an ascending order of predicted probability (PP) of reporting less than good health from the low education group. Through this approach, it was possible to distinguish four groups of countries, with countries in each group sharing similar levels of prevalence rates and PP in reporting less than good health for low educated, but with variations in terms of absolute and relative inequality.

The first group of countries consists of Ireland and Switzerland. In these two countries, the lowest prevalence levels of less than good health was observed, from 16% in Ireland to 17% in Switzerland, and the lowest predicted probabilities of reporting less than good health among the low education group (i.e. below 25%). Compared with other groups of countries, in terms of relative inequalities as measured by ARR, this group is the most homogenous as both countries share among the highest level of relative inequalities ranging between 2.20 [CI 1.42–3.39] in Ireland and 2.47 [CI 1.53–4.00] in Switzerland. Absolute educational inequalities ranged from 0.11 [CI_{Ireland}0.05–0.16] to 0.15 [$CI_{\text{Switzerland}}$ 0.07–0.22], indicating between 11 and 15 percentage point differences in less than good health between those in the high and low education group. As a

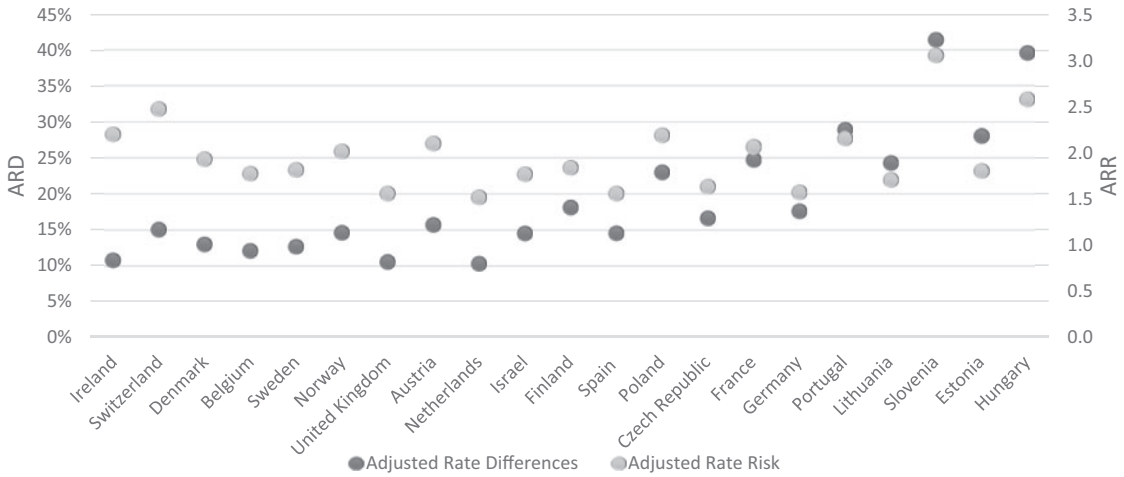

Figure 1 Prevalence level of less than good health per country. Absolute (ARD) and relative (ARR) inequalities by education in 21 European countries. *Note*: ARD and ARR estimates are based on (baseline) model adjusted for age, sex and permanent sickness/disability. All values are statistically significant at $P<0.01$

result, despite similar prevalence rates, health distribution is more unequal in Switzerland in both absolute and relative terms.

The second group of countries consists of, Denmark, Belgium, Sweden, Norway, the UK, Austria, Netherlands and Israel. In these countries, the predicted probabilities of reporting less than good health among the low education group were between 27% in Denmark and 33% in Israel and the overall prevalence of less than good health ranged from 21% in Sweden to 28% in Israel. However, despite comparable performance in these measures, educational inequalities varied considerably between countries in this group. In Norway, Denmark and Austria, the ARDs ranged from 13% [$CI_{Denmark}$ 0.04–0.21] to 15% [$CI_{Austria}$ 0.07–0.23], with the low education group being roughly twice more likely to report less than good health compared with the high education group ($ARR_{Denmark}$ 1.93 [CI 1.30–2.8515], $ARR_{Austria}$ 2.10 [CI 1.39–3.17]). Belgium and Sweden displayed a slightly better health distribution with ARDs of 12 and 13 percentage point differences and ARRs of 1.77 [CI 1.31–2.40] and 1.81 [CI 1.21–2.72], respectively. In the United Kingdom and Netherlands, in contrast, the share of less than good health was more equally distributed among education levels with ARDs of around 10% [CI 0.04–0.16] and the lowest level of ARRs compared with all other countries in this study, 1.56 [CI 1.21–2.02] and 1.52 [CI 1.16–1.98], respectively.

The third group of countries consists of Finland, Spain, Poland, the Czech Republic, France and Germany. In these countries, the predicted probabilities of reporting less than good health among the low education group ranged from 40% in Finland to 48% in Germany, while overall prevalence levels were found to be between 31% in Finland and 40% in Germany. Similar to the second group of countries, and despite the fact that comparable levels of health were found in terms of overall prevalence in these populations and among their lower educated, the magnitude of both absolute and relative inequalities varied substantially across countries. In Spain, the Czech Republic and Germany, ARDs ranged from 15 [CI_{Spain} 0.08–0.21] to 18 [$CI_{Germany}$ 0.07–0.27] percentage points differences. These countries were also found to be among the countries with low relative inequality in our study. ARRs ranged from 1.56 [CI_S1.25–1.95] in Spain to 1.63 [CI 1.13–2.73] in the Czech Republic. In Finland, Poland and France, both absolute and relative inequalities were found to be more pronounced with ARDs of 18–25 ([$CI_{Finland}$ 0.09–0.26, CI_{France} 0.14–0.34]) percentage point differences and ARRs between 1.84 [CI1.40–2. 41] in Finland and 2.19 [CI 1.60–2.99] in Poland.

The fourth group of countries consists of Portugal, Lithuania, Slovenia, Estonia and Hungary. These countries were found to have the highest overall prevalence of less than good health between 44% and 53%, and the highest probability of reporting less than good health among the low education group, ranging from 54% in Portugal to 65% in Hungary. While we observed comparable high levels of less than good reported health among the low education group across these countries, health distributions were found to be far more equitable in Lithuania and Estonia compared with Portugal, Slovenia and Hungary. In Lithuania and Estonia, ARDs varied between 24 [CI 0.17–0.39] and 28 [CI 0.20–0.42] percentage point differences and ARRs were 1.71 [CI1.37–2.13] and 1.80 [CI 1.48–2.20], respectively.

This can be contrasted with ARDs of over 40 percentage point differences observed in Hungary [CI 0.29–0.49] and Slovenia [CI 0.29–0.53] and ARRs ranging from 2.15 [CI 1.43–3.25] in Portugal to 3.05 [CI 2.09–4.44] in Slovenia. In contrast with other groups of countries, this fourth cluster shares a very steep educational gradient both in terms of absolute and relative inequalities.

Factors underpinning educational inequalities in SRH

Different factors were found to contribute to the explanation of educational inequalities in different European countries. Figure 2 presents the individual contribution of each set of factors in reducing relative educational inequalities in health across countries. Occupational factors were found to explain the largest share of educational inequalities in 8 out of the 21 countries. In the Czech Republic, Austria, Denmark, Belgium and Germany, occupational factors were not only found to be the largest contributor but they were also found to explain more than half of the educational inequalities in health. Behavioural factors were found to be the largest single contributor to educational inequalities in the UK, Norway, Ireland, Spain and Sweden, attenuating between 43% and 56% of health inequalities. Living conditions factors explained the largest reduction in inequalities in the last eight countries (IL, HU, CH, NL, FR, LT, PT, PL) countries with substantial effect especially for Israel, Hungary and Switzerland.

In addition, the contribution of single explanatory factors among occupational factors varied across countries. *Ergonomic hazards* emerged as the leading contributor in educational inequalities explaining between 17 and 39% in 12 countries (AT, CZ, DE, DK, EE, LT, SE, CH, FR, HU, ES, IL) while *material hazards* remained an important contributor in the Czech Republic, Austria and Portugal. Adjusting for *job control*, reduced inequalities by a quarter in Germany, the Netherlands, Belgium, Slovenia and the UK. *Labour force status* was especially relevant for the Danish, Finnish and the Norwegian context.

Figure 2 Percentage change of educational inequalities from the individual contribution of behavioural, occupational and living conditions factors based on ARR of Models 1–4, Additional file 5. *Note*: All values are statistically significant at $P<0.1$ Except for occupational factors in Czech Republic and Denmark, and living conditions factors in Israel

Among the behavioural factors, there were very low to insignificant educational differences in Hungary, Poland, Slovenia and, with the exception of smoking (19%), in Estonia. Across all countries, excluding the former, *BMI* explained up to one-third of educational inequalities. The second most common explanation was found to be *smoking*, which was particularly significant in Germany, Belgium, Switzerland, France, Finland and Ireland, followed by *fruit and vegetable consumption* which emerged as an important factor contributing to health inequalities in Norway, Denmark, Sweden and Lithuania. *Physical activity* was found to be the main explanatory factor in Austria and the UK and found to be of some relevance in few other countries like Finland, Norway, Sweden and Ireland. Educational inequalities in alcohol consumption were insignificant in most of the countries. Nevertheless, alcohol consumption explained roughly a quarter of inequalities in the Czech Republic and remained a considerable explanatory factor in Belgium, Germany, Poland, Ireland, Spain and Norway.

Regarding living conditions factors, *financial strain* was found to be the leading single contributor to inequalities in all of the countries in this study (16–52%) with exception of Lithuania, Denmark and Finland, where it still had a considerable impact (10–20%). Furthermore, financial strain was found to be the highest contributing factor across all studied factors in Belgium, Switzerland, the Czech Republic, France, UK, Netherlands, Poland, Portugal, Hungary, Sweden and Israel. *Childhood financial difficulties* were the leading contributor for Lithuania, Denmark and Finland. *Childhood financial difficulties*, in general, emerged as an important pathway to inequalities in all the countries where financial strain was a prominent explanation with the exception of Norway, Sweden, Slovenia, Estonia and Poland.

Childhood household conflicts, housing and social networks were relevant in explaining inequalities in only a few countries. *Housing* attenuated between 8% and 14% of inequalities in Austria, Germany, Spain, Lithuania and Hungary, while *social networks* explained between 10% and 18% of inequalities in Austria, Belgium, Switzerland, France, Spain and the Netherlands. Lastly, *childhood household conflict explained inequalities to a* considerable degree in Israel, Lithuania and Hungary (14–18%).

For most of the countries, we observed that relative inequalities were either substantially reduced or became insignificant when a combination of two sets of factors was considered. Results from the total contribution in reducing educational inequalities in less than good health from two sets of factors distinguish three groups of countries (figure 3).

In a first group of countries (consisting of Denmark, Austria, the Czech Republic, Germany, Norway, Finland, Netherlands, Lithuania, Sweden, and Estonia), the largest reduction in inequalities arose from the combination of behavioural and occupational factors. In more than half of these countries, out of the combined contribution, the direct effect from occupational factors was substantially stronger than the direct effect of behavioural factors. A comparable direct effect from both factors was identified in Germany, Netherlands and Lithuania, while for Norway and Sweden, the direct effect of behavioural factors was stronger. For all the countries, the direct effect either of occupational or of behavioural factors was larger than their indirect effect. Nonetheless, the shared effect of occupation and behavioural factors remained considerable in all these countries (12–22%) except for Lithuania (4%), Slovenia (3%) and Estonia (7%) suggesting that behavioural and occupational factors are two independent pathways to health inequalities in these three countries.

Belgium, Hungary, Switzerland, France and Poland exhibited the highest attenuation of educational inequality from the combination of occupational and living condition factors. For Switzerland and Hungary, the direct effect of living conditions factors was nearly twice the direct effect of occupational factors. Nonetheless, in both countries, and in France, the direct effect of living conditions was comparable with the shared effect (24–33%) with occupational factors indicating a particularly interdependent pathway between these factors and educational inequalities. In Belgium, the strongest direct effect on educational inequalities in health was achieved by controlling for occupational factors. While Poland was the only country in this group displaying an equally strong direct contribution from both factors.

A combination of living conditions and behavioural factors achieved the highest reduction of educational inequalities in Israel, the UK, Ireland, Spain and Portugal. The direct effect of behavioural factors was substantial in the UK, Ireland, and Spain, while living conditions factors directly explained close to half of the inequalities in Israel and Portugal. Generally, shared effects were considerable (11–22%) in this group with the exception of Portugal (5%). This suggests the presence of two unrelated mechanisms to health inequalities in the latter.

The final models (see figure 4) which assessed the simultaneous contribution of behavioural, occupational and living condition factors revealed that for most of the countries in our study, differences in health become either insignificant or were significantly reduced.

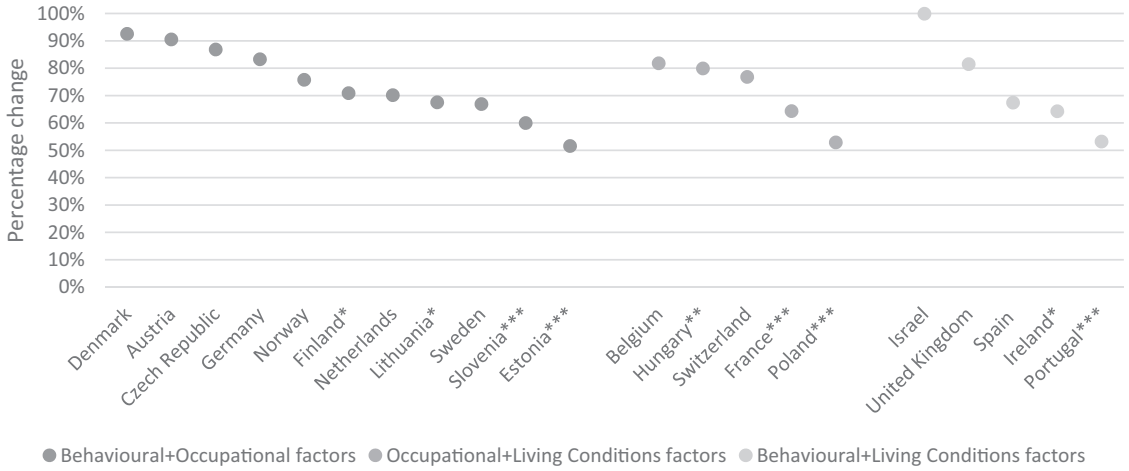

Figure 3 Percentage change of educational inequalities from the combined contribution of primary sets of factors per country based on ARR of Models 5–7, Additional file 5. *Note*: Relative inequalities remain significant in countries denoted with asterisk. *** $P<0.01$, ** $P<0.05$, * $P<0.1$

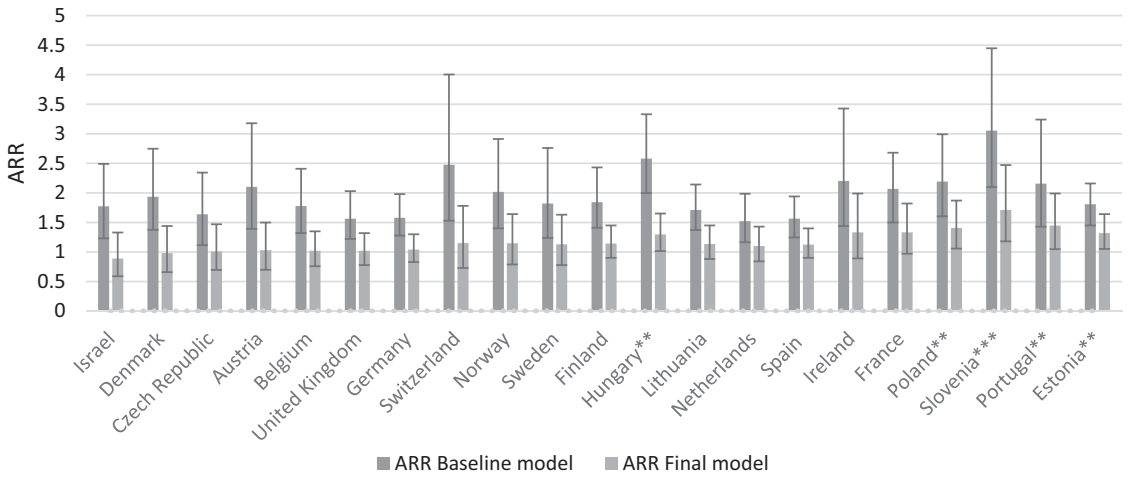

Figure 4 Rate ratios for baseline and final model for 21 countries. *Note*: Relative inequalities remain significant in countries denoted with asterisk. *** $P<0.01$, ** $P<0.05$, * $P<0.1$

Discussion

This is the first study to comprehensively investigate the contribution and relative importance of behavioural, occupational and living conditions factors in 21 countries using for the first time a comprehensive and comparable data set from the health module of the seventh round of ESS. The aim of the study was to examine the magnitude and variation of health inequalities across countries and particularly to unveil the extent to which socio-economic distributions of behavioural, occupational and living conditions factors are responsible for the observed social inequalities in SRH. This study initially tested these factors separately in order to disentangle which set of factors captures more of the variation in health inequality and subsequently in combination in order to identify the highest synergic effect between these factors in explaining health inequalities.

Our results demonstrated social inequalities in SRH in all countries, with significant social inequalities found for all explanatory factors except for unmet need. The absence of social inequalities in unmet need has been examined by[59,60] where they argue that inequalities in unmet need emerge only when reasons for not accessing health care or different types of medical care needs are taken in consideration.

Our analysis of educational inequalities in SRH found considerable variation among countries. However, similar to earlier research, no distinct patterned was observed across regions.[17,18] In addition, our comparative analysis of absolute and relative social inequalities placed countries within groups sharing comparable prevalence rates and levels of health for the lowest socioeconomic group. Through this approach, it was possible to evaluate in which countries health was more unequally distributed given similar health levels. Switzerland, Austria, Poland, and Slovenia were found to be the countries with highest inequalities in their respective groups.

Behavioural, occupational and living conditions factors played a major role in explaining social inequalities in health. However, the social patterning of these factors differed between countries leading to marked variation in their explanatory power across countries. Our analysis of combined factors confirmed results from existing literature of countries where extensive research on the contribution of social determinants of health has taken place. Similar to our findings, studies from[24,31] identified a substantial contribution from occupational factors in Netherlands. While compared with,[29] we observed a substantial increase in the relative contribution of behavioural factors, which might be due to rapid changes observed in behavioural factors among lower social groups.[46,47]

Moreover, our study provided evidence of additional leading pathways to social inequalities in health by examining previously not investigated factors for several countries. For instance, social inequalities in health have been a prominent topic in the North European countries addressed both in cross-sectional and

prospective designs. Most of these studies have been influenced by the three main theories, cultural-behavioural, material and psychosocial, which have traditionally dominated the health inequality debate. These explanations, as confirmed from our analysis, remain the most relevant both in the UK[48,49] and in Ireland.[50] Whereas for the Nordic countries, in line with earlier studies,[30,51,52] these factors could only explain roughly half of social inequalities. Our study showed that in Nordic countries instead of living conditions factors (consisting of material and psychosocial factors), the combination of occupational and behavioural factors were the leading explanations of social inequalities in health. Our study therefore suggests that behavioural and occupational factors are more important causes of the Nordic public health puzzle than material or psychosocial ones.[4] Our findings suggest that the 'Nordic public health puzzle' may be less of a *puzzle* than previously thought, as the determinants of health inequalities which the Nordic welfare states most seek to address (i.e. material and psychosocial) are less important than those which might be seen as more amenable to the effects of public health regulation than the traditional Nordic welfare state domains of cash benefits and welfare services.

Ours is not the first study to investigate occupational factors in Nordic countries. Examining a subset of the occupational factors included in our study, Borg et al. (2000) for Denmark, and Shaw at al. (2014) reporting for all Nordic countries, both identified a large contribution from occupational factors. However, since explanations of health inequalities are not mutually exclusive, only by including competing explanations it is possible to affirm their relative dominant contribution. Indeed, in our study, differences in the relative contribution of behavioural and occupational factors were observed between Nordic countries. Behavioural factors were more prominent in Norway and Sweden while occupational factors prevailed in Denmark and Finland.

Previous research on social inequalities in health in Portugal, France, Switzerland and Israel has mainly focused on occupational[6,8] and behavioural factors.[25,53,54] While we were able to confirm the relative importance of these factors, we found that in these countries living conditions factors emerged as the leading explanation. Similarly for Spain, the contribution of living conditions and occupational factors was comparable with earlier studies[15] but on the other hand, behavioural factors explained most of the association between health and social position.

Furthermore, our study provided evidence on countries where, to our knowledge, investigation of social inequalities in self-reported health has been less systematic. In Belgium, Austria and Germany, the driving factor behind social inequalities, showing some of strongest direct effect in our study, was found to be occupational factors. Whereas in Eastern European countries, leading explanations included both occupational and living conditions factors. Occupational factors reduced most of the association for Estonia, Lithuania and reaching to a striking 50% in Slovenia and the Czech Republic. For Hungary and Poland, in line with an earlier study,[55] the unequal distribution of living conditions factors explained most of the inequalities in health. In contrast with the rest of the countries in our study, in Eastern European countries, the behavioural explanation was only a minor pathway to health inequalities.

Generally, our results reveal several important aspects of social inequalities in self-reported health in Europe. First, the significant reduction of health inequalities across all countries, after adjusting for the three set of factors simultaneously, indicates that these three groups of social determinants continue to be major contributors to health inequalities.[2,3] Additionally, the considerable shared effects found across each combination of factors points toward the complex interplay of behavioural, occupational, material and psychosocial mechanisms.[12,29] This suggests that strategies to tackle health inequalities should identify health equality as a cross-cutting public policy dimension. Second, our study provides evidence that dominant mechanisms linking education and health vary across countries. This suggests that in different countries less ambitious strategies to reduce health inequalities should prioritize different mediating paths and different interventions. Lastly, despite behavioural explanations having dominated the health inequality discourse,[56] our study demonstrated that in the majority of the countries, occupational and living conditions factors were responsible for most of the social inequalities in health.

Limitations

SRH is considered a consistent predictor of morbidity and mortality.[57] Nonetheless, different styles in reporting health have been observed across countries calling for cautious in comparing health inequalities[58] in cross-country studies. Our study, due to sample size limitations could not report separately for each gender even though this is a common practice in social epidemiological studies. A sensitivity analysis (results available on request) was conducted on pooled Europe-wide data for each gender separately. Occupational factors retain a leading role in explaining social inequalities in health for both genders; however, lifestyle determinants explain considerably more of the educational inequalities among women while living conditions factors where slightly more pronounced in men. Additionally, to maintain statistical power for our analysis, some variables needed to be dichotomized leading to a loss of more detailed information when the categories were combined.

Studies using cross-sectional data are prone to limitation in drawing conclusions about causality. It remains especially unclear, if behavioural factors are a consequence or a cause of poor SRH. Even so, our aim was to examine if behavioural, occupational and living conditions' factors were mediators of the educational level and SRH relationship, independent of the casual direction.[25] Despite these limitations, our study has provided additional evidence on the role of social distribution of health determinants by giving a comprehensive overview of the explanation of educational health inequalities in a number of European countries. For future research, the health module of ESS provides an unprecedented opportunity to examine by means of multilevel modelling, individual-level data alongside macro-level data about countries' main institutions and policies that shape distributions of health.

Supplementary data

Supplementary data are available at *EURPUB* online.

Acknowledgements

Terje A. Eikemo, Clare Bambra and Tim Huijts led the design of the ESS special module on the social determinants of health in coordination with Rory Fitzgerald of the ESS.

Funding

This article is part of the HiNEWS Project—Health Inequalities in European Welfare States—funded by NORFACE (New Opportunities for Research Funding Agency Cooperation in Europe) Welfare State Futures programme (Grant no. 462-14-110). For more details on NORFACE, see http://www.norface.net/11.

Conflicts of interest: None declared.

References

1 Hu Y, van Lenthe FJ, Borsboom GJ, et al. Trends in socioeconomic inequalities in self-assessed health in 17 European countries between 1990 and 2010. *J Epidemiol Community Health* 2016; 70, 644–652.

2 Mackenbach JP. The persistence of health inequalities in modern welfare states: the explanation of a paradox. *Soc Sci Med* 2012;75:761–9.

3 Wilkinson RG, Marmot MG. *Social determinants of health: the solid facts*: World Health Organization; 2003.

4 Bambra C. Health inequalities and welfare state regimes: theoretical insights on a public health 'puzzle'. *J Epidemiol Community Health* 2011;65:740–5.

5 Marmot M, Friel S, Bell R, Health CoSDo, et al. Closing the gap in a generation: health equity through action on the social determinants of health. *The Lancet* 2008;372:1661–9.

6 Hämmig O, Bauer GF. The social gradient in work and health: a cross-sectional study exploring the relationship between working conditions and health inequalities. *BMC Public Health* 2013;13:1–13.

7 Lahelma E, Laaksonen M, Aittomaki A. Occupational class inequalities in health across employment sectors: the contribution of working conditions. *Int Arch Occup Environ Health* 2009;82:6.

8 Niedhammer I, Chastang JF, David S, Kelleher C. The contribution of occupational factors to social inequalities in health: findings from the national French SUMER survey. *Soc Sci Med* 2008;67:007.

9 Niedhammer I, Bourgkard E, Chau N. Occupational and behavioural factors in the explanation of social inequalities in premature and total mortality: a 12.5-year follow-up in the Lorhandicap study. *Eur J Epidemiol* 201126:1–12.

10 Skalicka V, van Lenthe F, Bambra C, et al. Material, psychosocial, behavioural and biomedical factors in the explanation of relative socio-economic inequalities in mortality: evidence from the HUNT study. *Int J Epidemiol* 2009;38:1272–84.

11 Molarius A, Berglund K, Eriksson C, et al. Socioeconomic conditions, lifestyle factors, and self-rated health among men and women in Sweden. *Eur J Public Health* 2007;17:125–33.

12 Aldabe B, Anderson R, Lyly-Yrjanainen M, et al. Contribution of material, occupational, and psychosocial factors in the explanation of social inequalities in health in 28 countries in Europe. *J Epidemiol Community Health* 2011;65:1123–31.

13 Schutte S, Chastang JF, Parent-Thirion A, et al. Association between socio-demographic, psychosocial, material and occupational factors and self-reported health among workers in Europe. *J Public Health* 2014;36:194–204.

14 Moor I, Rathmann K, Stronks K, et al. Psychosocial and behavioural factors in the explanation of socioeconomic inequalities in adolescent health: a multilevel analysis in 28 European and North American countries. *J Epidemiol Community Health* 2014;68:912–21.

15 Borrell C, Muntaner C, Benach J, Artazcoz L. Social class and self-reported health status among men and women: what is the role of work organisation, household material standards and household labour? *Soc Sci Med* 2004;58:1869–87.

16 Laaksonen M, Rahkonen O, Martikainen P, Lahelma E. Socioeconomic position and self-rated health: the contribution of childhood socioeconomic circumstances, adult socioeconomic status, and material resources. *Am J Public Health* 2005;95:047969.

17 Eikemo TA, Huisman M, Bambra C, Kunst AE. Health inequalities according to educational level in different welfare regimes: a comparison of 23 European countries. *Sociol Health Illn* 2008;30:565–82.

18 Mackenbach JP, Stirbu I, Roskam A-JR, et al. Socioeconomic inequalities in health in 22 European countries. *N Engl J Med* 2008;358:2468–81.

19 Eikemo TA, Huisman M, Perlman F, Ringdal K. Educational health inequalities in former Yugoslavia: evidence from the South-East European social survey project. *Eur J Public Health* 2010;20:640–6.

20 Bambra C, Lunau T, Van der Wel KA, et al. Work, health, and welfare: the association between working conditions, welfare states, and self-reported general health in Europe. *Int J Health Serv* 2014;44:113–36.

21 Shaw RJ, Benzeval M, Popham F. To what extent do financial strain and labour force status explain social class inequalities in self-rated health? Analysis of 20 countries in the European Social Survey. *PLoS One* 2014;9:e110362.

22 Toch M, Bambra C, Lunau T, et al. All part of the job the contribution of the psychosocial and physical work environment to health inequalities in Europe and the European health divide. *Int J Health Serv* 2014;44:285–305.

23 Bambra C, Eikemo T. Welfare state regimes, unemployment and health: a comparative study of the relationship between unemployment and self-reported health in 23 European countries. *J Epidemiol Community Health* 2008;63:92–98.

24 Monden CW. Current and lifetime exposure to working conditions. Do they explain educational differences in subjective health? *Soc Sci Med* 2005;60:2465–76.

25 Hämmig O, Gutzwiller F, Kawachi I. The contribution of lifestyle and work factors to social inequalities in self-rated health among the employed population in Switzerland. *Soc Sci Med* 2014;121:74–84.

26 van Oort FV, van Lenthe FJ, Mackenbach JP. Material, psychosocial, and behavioural factors in the explanation of educational inequalities in mortality in The Netherlands. *J Epidemiol Community Health* 2005;59:214–20.

27 Murcia M, Chastang JF, Cohidon C, Niedhammer I. Contribution of occupational factors to social inequalities in self-reported health among French employees. *Int Arch Occup Environ Health* 2013;86:541–52.

28 Borg V, Kristensen TS. Social class and self-rated health: can the gradient be explained by differences in life style or work environment? *Soc Sci Med* 2000;51:1019–30.

29 Stronks K, Mheen HD, Looman CW, Mackenbach JP. Behavioural and structural factors in the explanation of socio-economic inequalities in health: an empirical analysis. *Sociol Health Illn* 1996;18:653–74.

30 Granström F, Molarius A, Garvin P, et al. Exploring trends in and determinants of educational inequalities in self-rated health. *Scand J Public Health* 2015;43:677–86.

31 Schrijvers CT, van de Mheen HD, Stronks K, Mackenbach JP. Socioeconomic inequalities in health in the working population: the contribution of working conditions. *Int J Epidemiol* 1998;27:1011.

32 Hoffmann R, Eikemo TA, Kulhánová I, et al. The potential impact of a social redistribution of specific risk factors on socioeconomic inequalities in mortality: illustration of a method based on population attributable fractions. *J Epidemiol Community Health* 2013;67:56–62.

33 Arendt JN, Lauridsen J. Do risk factors explain more of the social gradient in self-reported health when adjusting for baseline health? *Eur J Public Health* 2008;18:131–7.

34 Eikemo TA, Skalická V, Avendano M. Variations in relative health inequalities: are they a mathematical artefact? *Int J Equity Health* 2009;8:1–5.

35 Dudal P, Bracke P. Absolute and relative educational inequalities in depression in Europe. *Int J Public Health* 2016;1–9:787.

36 Houweling TA, Kunst AE, Huisman M, Mackenbach JP. Using relative and absolute measures for monitoring health inequalities: experiences from cross-national analyses on maternal and child health. *Int J Equity Health* 2007;6:1–9.

37 Mantzavinis GD, Pappas N, Dimoliatis IDK, Ioannidis JPA. Multivariate models of self-reported health often neglected essential candidate determinants and methodological issues. *J Clin Epidemiol* 2005;58:436–43.

38 Eikemo TA, Huisman M, Bambra C, Kunst AE. Health inequalities according to educational level in different welfare regimes: a comparison of 23 European countries. *Sociol Heath Illn* 2008;30:01073.

39 Geyer S, Hemström Ö, Peter R, Vågerö D. Education, income and occupational class cannot be used interchangeably in social epidemiology. Empirical evidence against an unquestioned practice. *J Epidemiol Community Health* 2006;60:041319.

40 Bracke P, van de Straat V, Missinne S. Education, mental health, and education–labor market misfit. *J Health Soc Behav* 2014;55:442–59.

41 Siegrist J, Marmot M. Social inequalities in health: new evidence and policy implications. 2006.

42 Schneider SL. The international standard classification of education 2011. *Comp Soc Res* 2013;30:365–79.

43 Mood C. Logistic regression: why we cannot do what we think we can do, and what we can do about it? *Eur Sociol Rev* 2010;26:67–82.

44 Witt M, Spagnola K. Using predictive marginals to produce standardized estimates. Paper presented at Proceedings of the Survey Research Methods Section, American Statistical Association, 2009.

45 Tajeu GS, Sen B, Allison DB, Menachemi N. Misuse of odds ratios in obesity literature: an empirical analysis of published studies. *Obesity* 2012;20:1726–31.

46 Schokker DF, Visscher TLS, Nooyens ACJ, et al. Prevalence of overweight and obesity in the Netherlands. *Obes Rev* 2007;8:101–7.

47 Raho E, van Oostrom SH, Visser M, et al. Generation shifts in smoking over 20 years in two Dutch population-based cohorts aged 20–100 years. *BMC Public Health* 2015;15:142

48 Stringhini S, Dugravot A, Shipley M, et al. Health behaviours, socioeconomic status, and mortality: further analyses of the British Whitehall II and the French GAZEL Prospective Cohorts. *PLoS Med* 2011;8:e1000419.

49 Stansfeld SA, Head J, Fuhrer R, et al. Social inequalities in depressive symptoms and physical functioning in the Whitehall II study: exploring a common cause explanation. *J Epidemiol Community Health* 2003;57:361.

50 Niedhammer I, Kerrad S, Schutte S, et al. Material, psychosocial and behavioural factors associated with self-reported health in the Republic of Ireland: cross-sectional results from the SLAN survey. *BMJ Open* 2013;3:002797.

51 Laaksonen M, Roos E, Rahkonen O, et al. Influence of material and behavioural factors on occupational class differences in health. *J Epidemiol Community Health* 2005;59:163–9.

52 Kurtze N, Eikemo TA, Kamphuis CBM. Educational inequalities in general and mental health: differential contribution of physical activity, smoking, alcohol consumption and diet. *Eur J Public Health* 2013;23:223–9.

53 Fuhrer R, Shipley M, Chastang J, et al. Socioeconomic position, health, and possible explanations: a tale of two cohorts. *Am J Public Health* 2002;92:1290–4.

54 Antunes RJ. The social space of health inequalities in Portugal. *Soc Theory Health* 2011;9:393–409.

55 Pikhart H, Bobak M, Rose R, Marmot M. Household item ownership and self-rated health: material and psychosocial explanations. *BMC Public Health* 2003;3:38.

56 Carlisle S. Inequalities in health: contested explanations, shifting discourses and ambiguous policies. *Crit Public Health* 2001;11:267–81.

57 Idler EL, Benyamini Y. Community studies reporting association between self-rated health and mortality. *Res Aging* 1999;21:392–401.

58 Jürges H. True health vs. response styles: exploring cross-country differences in self-reported health. *Health Econ* 2007;16:163–178.

59 Fjaer EL, Balaj M, Stornes P, Todd A, McNamara CL, Eikemo TA. Exploring the differences in general practitioner and health care specialist utilisation according to education, occupation, income and social network in Europe:findings from the European social survey (2014) special module on the social determinants of health. *European Journal of Public Health* 2017;27:73–81.

60 Fjær EL, Stornes P, Borisova LV, et al. Subjective perceptions of unmet need for health care in Europe among social groups: Findings from the European social survey (2014) special module on the social determinants of health. *Eur J Public Health* 2017;27:82–89.