Health Disadvantage and Educational Level in European Welfare States: Longitudinal Results from the SHARE Study

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Abstract

Socioeconomic status is associated with health in many European populations, but the magnitude and pathways of this association may vary across countries. In this paper, we use longitudinal data to explore the impact of educational level on changes in health among Europeans aged 50+ in 11 countries, controlling for potential confounders and mediators. Our analyses are performed separately for Northern, Western and Southern Europe, as these regions broadly represent different welfare state regimes. We find that lower education is associated with higher incidence of poor self-rated health, chronic diseases and disability, but it is less consistently associated with new events of longstanding illness. After controlling for educational differences in wealth, income, consumption, health behaviours, labour force status and baseline health, the impact of educational level on health transitions remains significant for most outcomes in Western and Southern Europe, but it is substantially attenuated and non-significant after adjustment in Northern Europe.

Keywords: Education, health, welfare states, longitudinal data, cross-national analysis

Introduction

Despite long welfare traditions, socioeconomic status is consistently associated with health in many western European countries. On average, Europeans with a low educational level, income or occupational class can expect to live 2 to 5 years less than Europeans with a high socioeconomic status (Bronnum-Hansen et al. 2004). Research on the explanation of these disparities has focused on the role of individual-level risk factors such as smoking and obesity, and has typically found that risk factors explain less than half of the impact of socioeconomic status on health (Fuhrer et al. 2002, Marmot et al. 1997). However, less is known about the role of factors at the country-level that may influence the magnitude of socioeconomic inequalities in health (Borrell et al. 2007). Although studies have examined socioeconomic inequalities in mortality in Europe, no study has focused on morbidity using comparable data across countries, and examining changes in health outcomes across time in a longitudinal design.

Recent hypotheses suggest that countries with different political traditions may exhibit different levels of socioeconomic inequalities in health (Borrell et al. 2007). Based on different classifications of welfare states that build upon the Esping-Anderson typology (Esping-Andersen 1990, 1999), existing studies have examined cross-sectional associations between socioeconomic status and self-rated health across welfare regimes. A study based on the first wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) concluded that the association between socioeconomic status and health is stronger in Late Democracies (Spain and Greece) than in social-Democratic (Sweden, Denmark and Austria) or Christian-democratic states (France, Germany, Italy and the Netherlands) (Espelt et al. 2008). Similarly, data from the European Social Survey indicates that educational level is more strongly associated with poor self-rated health in South European Welfare regimes than in any other welfare states, but variations in these inequalities across other states are inconsistent (Eikemo et al. 2008a). Data from the European Community Household Panel showed no clear pattern of variations in morbidity inequalities across Europe, with only Greece having consistently larger inequalities than other European countries (Huisman et al. 2008). On the one hand, the above studies on self-rated health are consistent with mortality studies, which have found little evidence that socioeconomic inequalities in health are smaller in the Scandinavian countries, despite their strong emphasis on egalitarian policies (Huisman et al. 2008, Kunst et al. 1998a, 1998b, Mackenbach et al. 2008). However, whereas studies on

self-rated health have found larger inequalities in southern European countries, mortality studies have typically found smaller health inequalities in Southern European states such as Spain and Italy Kunst et al. 1998a, 1998b, Mackenbach et al. 1997, 2000, 2008). These contradictions have led to confusion on the interpretation of cross-country variations, and highlight the need for further research on the role of welfare states in buffering the impact of socioeconomic status on health.

A possible explanation of discrepancies between mortality and morbidity reports is that both types of studies have faced several caveats. Firstly, international studies on morbidity have primarily relied on cross-sectional associations (Espelt et al. 2008, Eikemo et al. 2008a, 2008b, Huisman et al. 2008, Mackenbach et al 1997, 2005, 2008). Less is known about how socioeconomic status predicts changes in health over time, conditioning on health at baseline. The predictive value of socioeconomic status on changes in health provides insight into the causality of the SES-health association, because by taking into account baseline health, selection effects of health to SES can be blocked. Longitudinal data from the SHARE now allow us to examine this pattern, building up on previous studies based on cross-sectional data only (Espelt et al. 2008, Eikemo et al. 2008a, 2008b, Huisman et al. 2008, Mackenbach et al 1997, 2005, 2008). Secondly, interpreting results from longitudinal studies on socioeconomic inequalities in mortality in Europe is cumbersome, because mortality is the result of both incident health events and survival after these events. Thus, observed associations may reflect the impact of socioeconomic status on both incidence and survival, or a combination of both. Disentangling effects of socioeconomic status on incidence and survival is important from a policy perspective. If SES-mortality associations reflect the impact of socioeconomic status on survival, policies that improve access and quality of secondary care in all socioeconomic groups are more likely to contribute to reduce health inequalities. In contrast, if SES-mortality associations mostly reflect the impact of socioeconomic status on incident poor health, policies that focus on preventing disease outcomes are more likely to contribute to reduce health inequalities.

This study examines the impact of educational level on changes on self-rated health in the population aged 50 years and over in 11 European welfare states. Our study comprises countries in three different regions of Europe (Northern, Western and southern Europe), which makes it possible to examine regional variations. We hypothesise that socioeconomic status is a stronger predictor of health changes in Southern European countries, due the their

relatively limited level of welfare prevision as compared to other European countries. We expect socioeconomic status to have a less strong impact on health changes in Scandinavian populations, due to their long traditions of social-democratic welfare policies that may contribute to prevent disparities.

The paper is organised as follows. The next section describes the data used in this study and the measurement of key variables. Section 3 explains our statistical approach in the analysis of associations between education and health events. Statistical results are presented in Section 4. Section 5 puts these results into perspective and concludes.

Methods

Data and measurements

The data used in the present study are drawn from the first and second waves of the Survey of Health, Ageing and Retirement in Europe (SHARE), which was purposefully designed to provide comparable multi-disciplinary data across European countries. Specific details are provided elsewhere (Börsch-Supan et al. 2005). Shortly, representative samples of the non-institutionalised population aged 50+ in each country were interviewed using structured computerised questionnaires. Interviews were face-to-face and took place in the household. Comparable questionnaires were applied in each country. Common translation guidelines were applied and pilots were performed to enhance comparability. Individuals were first interviewed in 2004/2005, and subsequently re-contacted for interview two years later (2006/2007).

SHARE is based on representative samples drawn from population registries, or from multi-stage sampling, in Sweden, Denmark, Germany, the Netherlands, France, Switzerland, Austria, Italy, Spain and Greece (Börsch-Supan et al. 2005). The average household response rate at baseline was 61.6%, ranging from 39% (Switzerland) to 81% (France). From 27,351 participants who responded to the first wave, 17,582 (64.3%) who responded also to the second wave were included in the analysis. We excluded individuals with missing values for education (n=120), health outcomes at either wave (n=337), behavioural risk factors (n=223), and sampling weights (n=8). The final sample included 16,995 respondents. In the following, we describe the measurement of the main variables used in our study.

Educational level. We measure education by the highest level of formal educational achievement. Since international comparability of education levels is fraught with problems of comparability [ZIT], we operationalise education in two ways: Firstly, we reclassify national-specific levels of education into three categories according to the international standard classification of education (ISCED). These corresponded to levels 0-2 (lower secondary school or lower), 3 (Upper secondary school) and 4-6 (post-secondary). This classification was used to make absolute levels of educational level comparable across countries. Because substantial differences remain in the distribution of education in each country, however, we use a second alternative measure of education based on the number of years of schooling. This variable is constructed based on the original highest educational level degree achieved, using external information on the number of years needed to complete degrees in each country. The number of years of schooling is used as a continuous variable, whereas ISCED levels is used as a categorical variable.

Health. Our study is based on four major and complementary health outcomes available in SHARE: (1) Self-rated health was measured by asking individuals to rate their health in a five-point scale (excellent, very good, good, fair, poor). For the present analysis, this variable is dichotomised based on having less than good self-rated health. For sake of simplicity, we will describe those with fair or poor health as being in poor health, and those with good or better health as being in good health. (2) Long-term illness was measured by asking respondents to report whether they have any long-term health problems, illness, disability or infirmity that has troubled them over a period of time. (3) Chronic diseases were measured by asking respondents whether they had ever had a doctor's diagnosis of a list of major chronic diseases presented on a show-card. From this information, we constructed a simple summary measure based on whether individuals reported at least one of the following major conditions: heart disease, stroke, diabetes, lung disease, asthma, arthritis, osteoporosis, cancer, ulcer or Parkinson disease. (4) As a measure of disability, respondents were asked whether they had limitations with basic activities, including: (a) limitations with ADLs (activities of daily living), measured by a validated scale of limitations individuals have with basic activities, namely dressing, walking, bathing, eating, getting in and out of bed, and using the toilet (Nicholas et al. 2003); (b) Limitations with IADLs (Instrumental activities of daily living), measured by a validated scale of limitations with the following activities: using a map, cooking, shopping, telephoning, taking medications, working in the house, and managing

money (Nicholas et al. 2003). Individuals were classified as suffering from limitations when they reported limitations with at least one ADL or IADL.

The present study focuses on health changes or health transitions between wave 1 and wave 2 of SHARE. We examine both transitions from good to poor health (health deterioration), as well as transitions from poor to good health (health improvement). In order to analyse health deterioration, for each health outcome, we examine the development of new negative health events at wave 2 among respondents who were free of that health event in wave 1. For example, we examine transitions to poor self-rated health at wave 2, by estimating the risk of reporting this outcome only for respondents who were in good health at wave 1 (and excluding those who already were in poor health at wave 1). Conversely, we analyse health improvement by examining the transition to a good health state, conditioning on having poor health at wave 1, for each health outcome separately. That is, transitions to good self-rated health at wave 2 were assessed by examining the risk of this outcome only among those who were in poor health at wave 1 (excluding those who were in good self-rated health at wave 1).

Wealth, income and consumption. Wealth was operationalised as household total net worth and distinguished two separate measures: Financial wealth, which included the sum of net stock value, mutual funds, savings, bonds and all other savings; and housing wealth, which included the value of primary residence net of mortgage, other real estate value, share of own business and owned cars minus liabilities. Income was defined as the sum of all sources of income by all members in the household. In order to measure consumption, respondents were asked about their household's expenditure on two different sub-groups of consumption: Food consumption at home and food consumption outside the home. In addition, in order to examine the material living standards, respondents were asked to assess the ease with which their household can make ends meet. Individuals were provided with a 4-point scale including with 'great difficulty', 'some difficulty', 'fairly easily', and 'easily' (Börsch-Supan et al. 2005a).

Missing items for wealth, income and consumption were recovered using multiple imputation techniques (Börsch-Supan et al. 2005a, Börsch-Supan et al. 2005b). However, we only use one of five different imputations. To account for differences in the number of household members, wealth, income and consumption values were divided by the square root of the number of members living in the household (Huisman et al. 2003, Buhmann et al. 1988).

Data on wealth, income and consumption were adjusted for purchasing power parity and transformed into euros.

Other chronic diseases, symptoms, depression, healthcare utilisation and employment status. The following variables were assessed as presumed mediators or confounders of the association between educational level and health: (1) In addition to the major chronic diseases defined as outcome, respondents were also asked whether they had ever been diagnosed with high blood pressure or hypertension, high cholesterol, cataracts or hip fracture. (2) Self-reported symptoms were assessed by asking individuals whether during the last six months they had experienced any of 11 symptoms presented on a show-card (e.g., pain, breathlessness, sleeping problems, swollen legs). For our analysis, we construct a simple score based on the number of symptoms. (3) Depression was measured by the Euro-Depression (Euro-D), a scale of depression symptoms validated for the European population. A EURO-D score higher than 3 indicates of a depressive symptomatology and this value is used to dichotomise the EURO-D score (Prince et al. 1999a, 1999b). (4) Healthcare utilisation was measured by asking individuals the number of contacts they had with a medical doctor during the last 12 months. In addition, respondents were asked about the number of hospital visits they have had in the last 12 months. We construct separate scores for both variables by summing up the number of visits in this period. (5) Finally, employment status was measured by asking individuals whether they were employed or self-employed, unemployed, retired, permanently sick or disabled, or homemaker.

Behavioural risks. We look at four different dimensions of health behaviours: smoking, alcohol consumption, physical activity, and overweight/obesity. (1) Smokers are categorised as current, former or never. (2) Alcohol drinking frequency was classified as drinking any alcoholic beverage daily or almost daily, 5-6 days/week, 3-4 days/week, 1-2 days/week, or <=1-2 days/month. Alcohol drinking intensity was dichotomised based on drinking >2 drinks 5-6 days/week. (3) Physical inactivity was dichotomised based on never or almost never engaging in moderate or vigorous physical activity. (4) Body mass index (BMI) was defined as weight divided by the square of height (kilograms/meters^2). It was then categorised into underweight (<18.5), normal (18.5 - <25), overweight (25- <30) and obesity (30+).

Methods of analysis

Our data analysis proceeds in several steps. (1) We begin by estimating Poisson regression models to compute the incidence of new health events according to level of education in each country. Since the time span between subsequent interviews of the same respondents varies across individuals and countries, the time at risk or exposure also varies across respondents. To account for the fact that longer exposure implies a higher risk of becoming ill, we control for the time between interviews in wave 1 and 2 (measured by the log of the number of person-years) as offset variable. The Poisson regression takes as outcome variable whether a new health event occurred between wave 1 and wave 2. Results from the Poisson regression are presented by plotting the predicted rates of each health outcome according to educational level.

(2) In order to examine the shape of the association between years of schooling and health transitions, we fit smooth nonparametric LOESS function curves of each health outcome across the distribution of years of schooling in each European region. LOESS is a locally weighted regression smoother, fitting multiple linear regression lines to small parts of the years of schooling axis, and combining central parts of these regression lines (Cleveland 1979). In this and subsequently analyses, we group countries in three different categories based on their geographical location: Northern Europe (Sweden and Denmark), Western (Germany, Belgium, the Netherlands, France, Switzerland and Austria) and Southern Europe (Italy, Spain and Greece).

(3) Based on the Poisson regression models, we compute rate ratios that compare incident health outcomes between those with the highest level of education and those with the lowest level of education in each European region. (Relative risks or incidence rate ratios are estimated as the exponential of the regression parameters.) Equivalent rate ratios are calculated to compare the influence of a 10-year increase in years of schooling on health outcomes, entering years of schooling as a continuous variable in the model. Poisson regression models additionally control for age, sex and country.

(4) We examine the association between educational level and potential confounders or mediators of the association between educational level and health, including wealth, income, consumption, healthcare utilisation, symptoms, chronic diseases, behavioural risk factors and

employment status. We use logistic regression to model chronic diseases, risk behaviours and working status on educational level, and to obtain odds ratios that compare participants with post-graduate educational level (reference) vs. participants with only primary education. We use Poisson regression to model continuous variables (financial and real assets; consumption at home and outside the home; number of doctor and hospital visits; and number of symptoms) on education, and to obtain rate ratios that compare counts between participants with post-graduate educational level (reference) vs. participants with only primary education.

(5) Finally, to assess whether the impact of educational level on health transitions is independent of confounders or mediators, we include all potential confounders and mediators in the same model and calculate adjusted incidence rate ratios that compare rates of health outcomes between the highest and lowest educational level groups, separately for each European region. Models are adjusted for symptoms and chronic diseases at baseline, because we aim to examining the impact of education on changes in health over the follow-up period, independently of baseline health. We used appropriate sampling weights in all calculations.

Results

Incidence of health events by education

Figure 1 shows the incidence of health deterioration according to educational level in each European country, based on Poisson models adjusted for age and sex. There are some differences among countries in the overall levels of health. For instance, we observe a tendency for higher health deterioration rates in France than in other European countries, and lower rates of health deterioration in Greece and Switzerland. However, in general, the incidence of new health events is comparable across most other countries. Overall, the incidence of poor self-rated health, chronic disease and activity limitations is lower among those with a post-secondary or university education (highest level), and is highest among those with only primary education or less (lowest educational level). This association is consistent in all European countries for most health outcomes. In most countries, there is a graded association with increasing rates of health deterioration by decreasing level of education. The association between educational level and transitions to long standing illness is less consistent and smaller, and is not observed clearly in Denmark, Germany, the Netherlands and France.

--- about here Figure 1 ---

Figure 2 shows the predicted rates of health deterioration according to years of schooling using age and sex adjusted LOESS regression curves. There is a nearly linear decrease in the rate of reporting a new event of poor self-rated health as years of schooling increase in all European regions. The regression lines are fairly parallel for Northern and Western Europe but are steeper for the southern European region, suggesting that years of schooling is more strongly related to improvements in self-rated health in the latter. The incidence rates of chronic disease and activity limitations also decrease as years of schooling increase. The association between educational level and incidence of chronic disease is similar in Western and Southern Europe, but is less steep in the Northern European region. A similar pattern is observed for activity limitations, with less steep curves in Scandinavia than in Western and Southern Europe. In contrast, there is no consistent association between educational level and new events of longstanding illness. In Northern and Southern Europe the incidence of new events of long-standing illness decreases as years of schooling increases and is steeper between about 13 and 18 years of schooling, but beyond 18 years the association becomes positive. Years of schooling are not clearly related to new events of longstanding illness in Western Europe.

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Table 1 presents incidence rate ratios that compare the rate of health deterioration (left panel) and health improvement (right panel) according to educational level and years of schooling in each European region based on models controlling for age, sex and country. Results from the left panel confirm the findings from Figures 1 and 2 above: lower educational level or fewer years of schooling are associated with a higher rate of health deterioration. In Northern Europe, those with at most primary education had 46% (95%CI [confidence interval] 1.18, 1.80) higher rates of transiting from good to poor self-rated health; the corresponding figures are 55% (1.33, 1.81) in Western Europe and 94% (1.45, 2.61) in Southern Europe. A decrease of 10-years of schooling is associated with a 67% (1.28, 2.19) increased risk of transiting from good to poor health in Northern Europe; the corresponding figures are 70% (1.47, 1.97) in Western Europe and 91% (1.60, 2.28) in Southern Europe.

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Educational level is inversely associated with the incidence of chronic disease and activity limitations. These associations are significant in Western and Southern Europe, but do not reach statistical significance in Northern Europe. For instance, the rate of an incident activity limitation is 2.22 (1.41, 3.49) higher in those with low as compared to those with high education in Southern Europe; the corresponding figures are 1.63 (1,34, 2.00) in Western Europe and 1.18 (0.87, 1.61) in Northern Europe. The lack of significant results for chronic disease and activity limitations in Northern Europe may be due to the smaller sample size of this specific region. However, effect estimates tend also to be small in this region, suggesting that the effect of educational level on these outcomes is less clear in this region. Transition to longstanding illness are not associated with educational level in Northern and Western Europe, but are significantly associated with educational level (RR=1.32, 1.00, 1.74) and years of schooling (RR=1.32, 1.10, 1.57) in Southern Europe.

The right panel of Table 1 presents the rate of health improvement at wave 2 among those who reported poor health at wave 1. Although confidence intervals are wide due to the small sample size, there is a general tendency for lower incidence of transitions from poor to good health in those with low education as compared to those with high education. When using years of schooling, these associations are often significant or of borderline significance in Southern Europe, and – only for self-rated health – in Western Europe. Associations are never significant for Northern Europe. For instance, in Western Europe, a low educational level is associated with a reduced rate (RR=0.62, 0.49, 0.79) of having good health at wave 2 after experiencing an episode of poor health at wave 1. In Southern Europe, a low educational level is associated with a reduced rate (RR=0.75, 0.55, 0.92) of transition from longstanding illness at wave 1 to no illness at wave 2 compared to those with high educational level.

Educational level, confounders and mediators

Table 2 presents ratios that compare financial variables, consumption, healthcare utilisation, baseline health, behavioural risk factors and working status between those with low educational level and those with high educational level. For variables marked with an asterisk, estimates are Poisson regression based ratios of counts of continuous variables of low as compared to high-educated respondents. For other variables, estimates are logistic

regression based odds ratios that compare the odds of an event (e.g., smoking) between high and low educated in each region.

--- about here Table 2 ---

Wealth, income and consumption. Having a low educational level is associated with less financial wealth in all European regions. However, this association is stronger in the South, where those with low education had only 0.36 times the wealth of those with high education, whereas the corresponding figure in Northern and Western Europe is 0.45. Those with low education also have less housing (real) wealth. In contrast to financial wealth, however, this disadvantage is more marked for those in Northern and Western Europe, where the low educated have 0.47 and 0.66 times the housing wealth of the high educated, as opposed to 0.77 in Southern Europe. Low educational level is also associated with less consumption of food both at home and outside the home as compared to those with high education in all European regions, but this disadvantaged is more marked in Southern Europe than in Western Europe or Scandinavia. Northern Europeans with low education have 36% (1.07, 1.72) higher odds of reporting that their income met their needs with some or great difficulty than those with high education. In Western Europe those with low education have 276% higher odds (2.35, 3.32), and in Southern Europe 402% (3.17, 5.08) higher odds of reporting difficulty of income to meet needs compared to those with high education. Thus, except for housing wealth, there is a general tendency for educational level to be more strongly associated with income, financial wealth and consumption disadvantage in Southern than in Western or Northern Europe.

Baseline health and healthcare utilisation. As expected, lower educational level is associated with higher incidence of chronic disease and symptoms at baseline. For instance, those with at most primary schooling have 33% (1.02, 1.75) higher odds of reporting heart disease as compared to those with post-graduate or university education. Educational level is not associated with high cholesterol, stroke and cataracts. The association between educational level and many diseases such as heart disease, hypertension and diabetes is similar across all European regions. However, associations between education and some other diseases vary across regions. For example, lower education is strongly associated with more lung disease in Northern and Western Europe, but not in Southern Europe. The odds of arthritis and

depression are higher in the low educated in Western and Southern Europe, but not in Northern Europe.

The association between Educational level and healthcare utilisation is different across regions. In Northern Europe, low educational level is associated with fewer doctor visits, but it is not associated with hospitalisations. In contrast, there is no association between education and doctor or hospital visits in Western Europe, whereas in Southern Europe low education is associated with more visits to the doctor, but less hospitalisations. Differences in doctor and hospital visits between educational groups are partly dependent on underlying differences in health. Therefore, in supplementary analyses, we examined whether these associations changed after adjustment for baseline health (results not shown). The pattern of results does not change for hospitalisations. In contrast, after adjusting for baseline health, differences in the number of doctor visits become larger in Northern Europe (RR=0.73, 0.70, 0.77); the low educated show less visits than the high educated in Central Europe (RR=0.90, 0.87, 0.91); whereas differences in Southern Europe are attenuated by about two thirds but remain significant, indicating more doctor visits in those with low education (RR=1.24, 1.19, 1.30).

Behavioural risk factors. Low educational level is associated with higher current (OR=1.87, 1.48, 2.37) and ever smoking (1.42, 1.18, 1.71) in Northern Europe, but this association is not present in Western Europe as a whole. In contrast, in Southern Europe the odds of reporting ever smoking is lower in those with low education as compared to those with high education (OR=0.57, 0.46, 0.71). Lower educational level is associated with higher overweight and obesity in all European regions, and with less physical activity in Northern and Western Europe, but not in Southern Europe. In all regions, lower education is associated with lower odds of drinking $\geq$ 2 alcoholic drinks per day.

Employment status. Low educational level is associated with reduced odds of being employed in all regions, but this association is stronger in Southern Europe than in Western or Northern Europe. Further analyses suggest that different pathways to retirement explain these associations in each region. For instance, a low educational level in Northern Europe is associated with 2.36 (1.87, 2.97) times higher odds of being retired, whereas in Southern

Europe low education is associated with 0.57 (0.44, 0.74) times lower odds of being retired compared to those with high education. In addition, low education is associated with higher odds of being unemployed or permanently disabled in Western and Southern Europe, but not in Northern Europe. These findings suggest that a low educational level is associated with an 'unfavourable' employment status in Southern and Western Europe, but not in Northern Europe.

Results after controlling for confounders and mediators

Table 3 shows the impact of educational level on health transitions in each European region in models that control for age, sex, wealth, income, consumption, baseline chronic conditions and symptoms, healthcare utilisation, employment status and behavioural risk factors. Although the magnitude of associations is attenuated, educational level remains significantly associated with transitions from good to poor self-rated health in all European regions. For instance, those with low education in Northern Europe have a 25% (1.01, 1.56) higher rate of transiting from good to poor self-rated health than those with high education; the corresponding figures are 36% (1.10, 1.59) in Western Europe and 44% (1.06, 1.95) in Southern Europe. In general, educational level and/or years of schooling remain associated with chronic disease and limitations in Western and Southern Europe, whereas there is no such association in Northern Europe. Educational level is unrelated with transitions to long-term illness in all regions.

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The right panel of Table 3 shows the adjusted estimates of the effect of education on health improvement. The associations observed in age and sex adjusted models (Table 1) for Southern Europe are attenuated after controlling for covariates. However, years of schooling remain associated with lower likelihood of transition to no activity limitations in Southern Europe (0.69, 0.51, 0.93). Educational level and years of schooling are not associated with health improvements in these models in Northern and Western Europe.

Summary and conclusions

In the social epidemiological literature, the prevailing opinion appears to be that overall population health and social inequalities in health are largely affected by the social and economic organisation of societies (Kaplan 2007). In this paper, we expand the current international comparative literature on health inequalities by exploring the impact of educational level on health changes in a large cross-national sample of Europeans aged 50+. We find that lower educational level is associated with higher incident events of poor health, chronic diseases and disability, but it is less consistently associated with new events of longstanding illness. Conversely, higher education is associated with more transitions from poor to good health over a two-year period, although these associations are only significant in Western and Southern Europe. At baseline, lower educational level is associated with less wealth, income and consumption, more chronic diseases and symptoms, less healthy behaviour and higher likelihood of being unemployed or disabled. However, these associations vary substantially across European regions. In Southern Europe low education is more strongly associated with reduced financial resources, unemployment and work disability than in the North, whereas in Northern Europe educational level is more strongly associated with smoking and related conditions such as lung disease. After adjusting for all these factors, the impact of educational level on health deterioration remains significant for most outcomes in Western and Southern Europe, but only for self-rated health in Northern Europe.

To conclude, although great progress has been made in improving population health and in reducing the prevalence of many diseases in welfare states, social inequalities in health are far from being eliminated. Nevertheless, our finding that the education-related differences in the incidence of poor health outcomes vary across welfare states – after controlling for a host of potential confounders and mediators – suggests that social and economic policies are (still) important in shaping the relationship between socio-economic status and health. The fact that we are able to find differential effects of educational level on incident health events highlights the importance of policies that focus on preventing disease outcomes rather than policies that improve access and quality of secondary care in order to reduce health inequalities.

An interesting finding of our paper is that the association between educational level and potential mediators of the health gradient differ between European regions. Our results suggest that inequalities by education in financial resources, income, consumption and labour market participation are smaller in Northern than in Central or Southern Europe. However, relatively small inequalities in these material resources and participation in the labour market in Northern Europe are offset by their relatively large inequalities in smoking as compared to the Central and Southern European regions. This may partly explain the puzzling finding from previous studies reporting that socioeconomic inequalities in health are not smaller in Northern Scandinavian countries than in the rest of Europe, despite their relatively high levels of welfare generosity (Espelt et al. 2008, Eikemo et al. 2008a, 2008b, Huisman et al. 2008, Mackenbach et al 1997, 2005, 2008). A possible interpretation is that the relatively favourable access to financial resources among the low educated in Northern Europe might protect this group from certain diseases, but may also mean that they are more able to afford certain unhealthy behaviours such as smoking than their low educated counterparts in Central or Southern Europe (Espelt et al. 2008). As a consequence, socioeconomic inequalities in smoking-related diseases in Northern Europe may be larger than in Southern or Central Europe. Conversely, smaller or inverse inequalities in smoking but larger inequalities in material resources in Southern and Central Europe may lead to larger inequalities in non-smoking related diseases than in Northern Europe. The net effect is that socioeconomic inequalities in health are pervasive in all European regions, despite the fact that the mechanisms underling these inequalities may differ across the different welfare regimes in Europe.

In conclusion, we find that after controlling for educational differences in wealth, income, consumption, health behaviours, labour force status and baseline health, the impact of educational level on health transitions remains significant for most outcomes in Western and Southern Europe, but it is substantially attenuated and non-significant after adjustment in Northern Europe. The structural mechanisms that account for these differences across Welfare European states are yet to be disentangled.

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Table 1. Age and sex adjusted rate ratios of health deterioration and health improvement over a two-year period according to educational level in three European regions

	Health deterioration								Health improvement							
	Good to poor health		Longstanding illness		1+ chronic disease		1+ limitations		Poor to good health		1+ to 0 limitations		Illness to no-illness	
Educational level*																
Northern	1.46	(1.18, 1.80)	1.20	(0.94, 1.53)	1.22	(0.92, 1.61)	1.18	(0.87, 1.61)	0.78	(0.48, 1.27)	0.73	(0.51, 1.04)	0.86	(0.68, 1.09)
Western	1.55	(1.33, 1.81)	1.11	(0.95, 1.29)	1.40	(1.18, 1.66)	1.63	(1.34, 2.00)	0.62	(0.49, 0.79)	1.00	(0.79, 1.27)	0.96	(0.82, 1.14)
Southern	1.94	(1.45, 2.61)	1.32	(1.00, 1.74)	1.98	(1.43, 2.75)	2.22	(1.41, 3.49)	0.83	(0.52, 1.31)	1.17	(0.58, 2.39)	0.71	(0.55, 0.92)
Years of education**																
Northern	1.67	(1.28, 2.19)	1.33	(0.96, 1.83)	1.23	(0.86, 1.76)	1.37	(0.93, 2.02)	0.84	(0.46, 1.53)	0.70	(0.44, 1.11)	0.74	(0.54, 1.02)
Western	1.70	(1.47, 1.97)	1.08	(0.93, 1.25)	1.54	(1.30, 1.82)	1.81	(1.50, 2.18)	0.64	(0.51, 0.81)	0.94	(0.76, 1.17)	0.97	(0.82, 1.14)
Southern	1.91	(1.60, 2.28)	1.32	(1.10, 1.57)	1.39	(1.16, 1.66)	1.94	(1.54, 2.45)	0.79	(0.61, 1.01)	0.65	(0.49, 0.85)	0.75	(0.64, 0.89)

Health deterioration is estimated by conditioning on being healthy in wave 1 and transiting to poor health in wave 2; health improvement is estimated by conditioning on being in poor health in wave 1 and transiting to good health in wave 2

*Rate ratios compare incident health outcomes between respondents with post-graduate educational level (reference) vs. respondents with only primary education

**Rate ratios of incident health outcomes for every 10 years of additional years of schooling

Table 2. Ratio of low vs. high education for wealth, income, consumption, healthcare utilization and risk behaviour in Northern, Western and Southern Europe at ages 50+

	European region					
	Northern		Western		Southern	
Wealth						
Financial assets*	0.45	(0.45, 0.45)	0.45	(0.45, 0.45)	0.36	(0.36, 0.36)
Real assets*	0.47	(0.47, 0.47)	0.66	(0.66, 0.66)	0.77	(0.77, 0.77)
Income*	0.75	(0.75, 0.75)	0.66	(0.66, 0.66)	0.59	(0.59, 0.59)
Consumption						
food consumption at home*	0.87	(0.87, 0.88)	0.85	(0.85, 0.85)	0.82	(0.82, 0.83)
food consumption outside home*	0.58	(0.57, 0.58)	0.55	(0.54, 0.55)	0.33	(0.33, 0.34)
Income meet needs with difficulty*	1.36	(1.07, 1.72)	2.76	(2.35, 3.23)	4.02	(3.17, 5.08)
Health care utilization						
Number of Doctor visits*	0.86	(0.82, 0.90)	1.10	(1.07, 1.12)	1.68	(1.61, 1.76)
Number of hospital visits*	0.99	(0.95, 1.030	1.00	(0.97, 1.02)	0.95	(0.91, 1.00)
Health						
Number of symptoms*	1.22	(1.14, 1.31)	1.23	(1.18, 1.29)	1.50	(1.36, 1.65)
Heart disease	1.33	(1.02, 1.75)	1.05	(0.87, 1.26)	1.96	(1.25, 3.06)
Hypertension	1.41	(1.16, 1.72)	1.29	(1.14, 1.47)	1.49	(1.18, 1.87)
High cholesterol	1.00	(0.79, 1.26)	1.17	(1.01, 1.35)	1.14	(0.90, 1.46)
Stroke	1.22	(0.78, 1.92)	0.76	(0.56, 1.04)	0.77	(0.40, 1.48)
Diabetes	1.33	(0.96, 1.84)	2.07	(1.67, 2.53)	3.30	(2.00, 5.44)
Cancer	1.00	(0.71, 1.40	0.60	(0.47, 0.77)	0.66	(0.40, 1.08)
Asthma	1.39	(1.00, 1.94)	1.17	(0.85, 1.61)	0.58	(0.39, 0.87)
Arthritis	1.03	(0.79, 1.34)	1.25	(1.06, 1.46)	2.49	(1.86, 3.34)
Osteoporosis	1.66	(0.95, 2.89)	0.93	(0.75, 1.16)	1.94	(1.19, 3.16)
Lung	2.37	(1.43, 3.91)	2.10	(1.57, 2.80)	1.02	(0.66, 1.58)
Cataracts	1.10	(0.79, 1.51)	0.74	(0.59, 0.94)	1.07	(0.66, 1.71)
Hip fracture	0.99	(0.56, 1.76)	2.86	(1.67, 4.91)	0.60	(0.31, 1.16)
Depression	0.99	(0.78, 1.25)	1.72	(1.49, 1.98)	2.73	(2.10, 3.57)
Smoking						
Current	1.87	(1.48, 2.37)	1.07	(0.91, 1.26)	1.03	(0.81, 1.31)
Ever	1.42	(1.18, 1.71)	0.75	(0.66, 0.85)	0.57	(0.46, 0.71)
Body mass index						
Overweight	1.92	(1.61, 2.29)	2.07	(1.84, 2.33)	2.61	(2.13, 3.19)
Obesity	2.10	(1.61, 2.75)	2.14	(1.82, 2.51)	2.94	(2.15, 4.01)
Physical inactivity	2.74	(1.46, 5.14)	2.59	(2.00, 3.34)	1.11	(0.80, 1.54)
$\geq$ 2 more drinks/day	0.80	(0.50, 1.26)	0.72	(0.61, 0.85)	0.63	(0.50, 0.80)
Working status						
Employed	0.44	(0.34, 0.56)	0.39	(0.33, 0.46)	0.23	(0.17, 0.30)
Retired	2.36	(1.87, 2.97)	0.90	(0.78, 1.05)	0.57	(0.44, 0.74)
Unemployed or disabled	1.20	(0.81, 1.79)	1.84	(1.44, 2.36)	2.71	(1.63, 2.52)

All models are adjusted for age, sex, educational level and country

Unless otherwise indicated, ratios compare the odds of an event between respondents with post-graduate educational level (reference) vs. respondents with only primary education

*Continuous variables analysed using Poisson regression; ratio compares counts between respondents with post-graduate educational level (reference) vs. respondents with only primary education

Table 3. Age and sex adjusted rate ratios of health deterioration and health improvement over a two-year period according to educational level in three European regions, adjusting for wealth, income, consumption, healthcare utilization and risk behaviour

	Health deterioration								Health improvement							
	Good to poor health		Longstanding illness		1+ chronic disease		1+ limitations		Poor to good health		1+ to 0 limitations		Illness to no-illness	
Educational level*														
Northern	1.25	(1.01, 1.56)	1.04	(0.81, 1.32)	1.12	(0.84, 1.49)	1.03	(0.76, 1.41)	0.88	(0.53, 1.43)	0.72	(0.50, 1.04)	0.95	(0.75, 1.21)
Western	1.36	(1.16, 1.59)	0.99	(0.84, 1.16)	1.19	(1.00, 1.42)	1.33	(1.08, 1.64)	0.74	(0.58, 0.95)	1.14	(0.88, 1.47)	1.14	(0.96, 1.36)
Southern	1.44	(1.06, 1.95)	1.01	(0.75, 1.34)	1.59	(1.14, 2.22)	1.49	(0.94, 2.36)	1.05	(0.66, 1.68)	1.25	(0.61, 2.57)]	0.97	(0.74, 1.27)
Years of education**														
Northern	1.34	(1.01, 1.76)	1.07	(0.77, 1.48)	1.10	(0.77, 1.59)	1.14	(0.77, 1.70)	0.95	(0.51, 1.74)	0.73	(0.45, 1.17)	0.88	(0.64, 1.22)
Western	1.43	(1.23, 1.66)	0.94	(0.80, 1.10)	1.30	(1.09, 1.54)	1.42	(1.17, 1.73)	0.80	(0.62, 1.03)	1.07	(0.85, 1.34)	1.19	(1.00, 1.41)
Southern	1.40	(1.16, 1.68)	1.01	(0.83, 1.22)	1.16	(0.96, 1.41)	1.42	(1.11, 1.80)	1.07	(0.82, 1.40)	0.69	(0.51, 0.93)	1.04	(0.87, 1.26)

Health deterioration is estimated by conditioning on being healthy in wave 1 and transiting to poor health in wave 2; health improvement is estimated by conditioning on being in poor health in wave 1 and transiting to good health in wave 2

All models are adjusted for age, sex, country, financial assets, real assets, food consumption at home, food consumption outside home, level to which income meets needs, smoking status, body mass index, physical activity, excessive drinking, number of doctor's visits, number of hospital visits, number of symptoms, heart disease, stroke, hypertension, high cholesterol, diabetes, cancer, asthma, arthritis, osteoporosis, lung, cataracts, hip fracture, depression, current smoking, former smoking, overweight, obesity, employment status

*Rate ratios compare incident of health outcomes between respondents with post-graduate educational level (reference) vs. respondents with only primary education

**Rate ratios of incident health outcomes for every 10 years of additional years of schooling

Figure 1. Age and sex adjusted incident poor health, longstanding illness, chronic diseases and activity limitations according to educational level in 11 European countries adjusting for age and sex

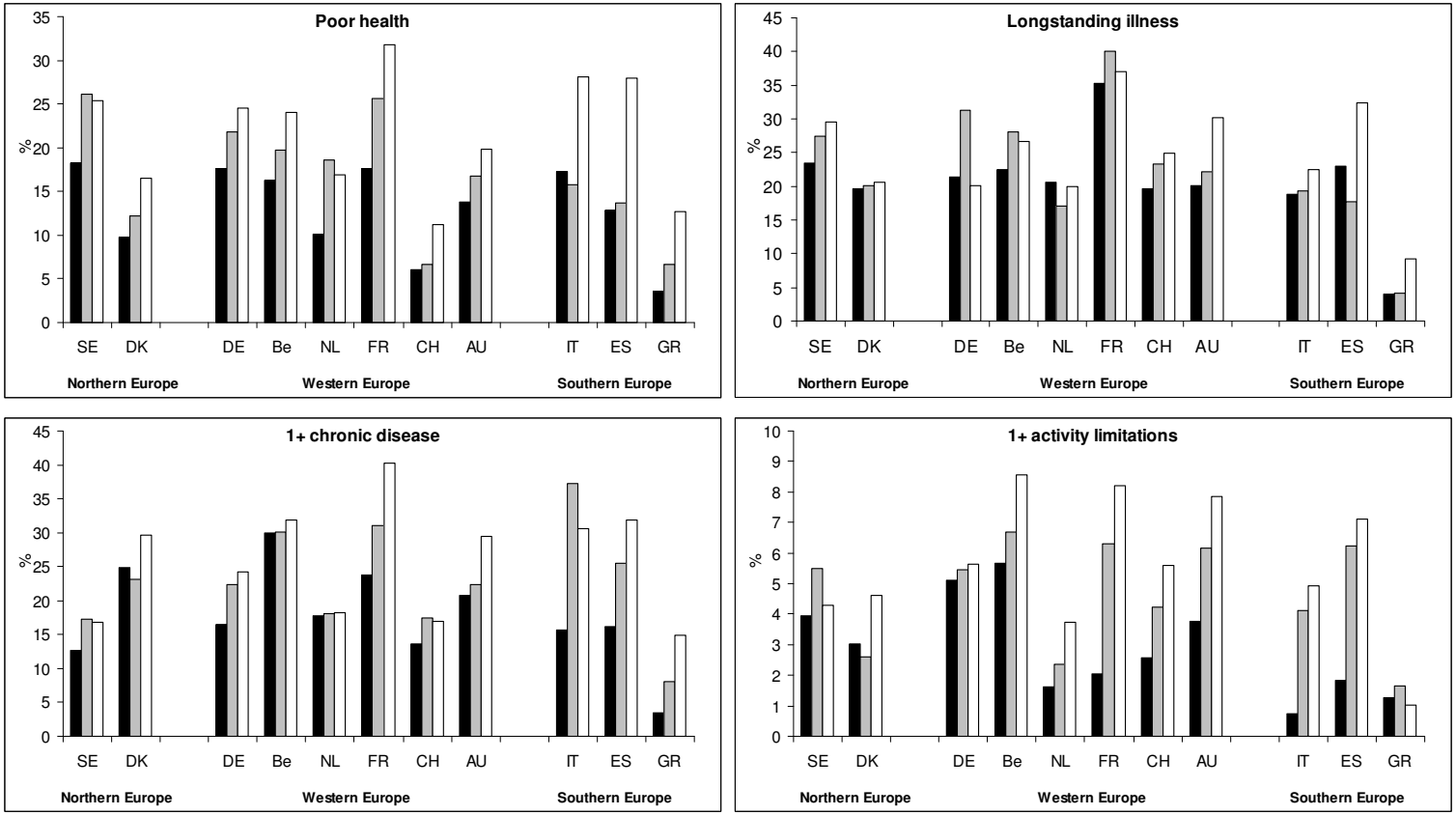

Figure 2. Age and sex adjusted LOESS curves of incident poor health, longstanding illness, chronic diseases and activity limitations according to years of schooling in Northern Europe (Denmark, Sweden), Western Europe (Germany, Belgium, the Netherlands, France, Switzerland, Austria) and Southern Europe (Spain, Italy, Greece)