Economic Hardship and Educational Differentials in Disability in 26 European Countries

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Article

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Abstract

Objective: The objective of this article is to study to what extent European variations in differentials in disability by education level are associated to variation in poverty. **Method:** Using the European Statistics on Income and Living Conditions (EU-SILC) for 26 countries, we measure the prevalence of activity limitation (AL) and the rate of economic hardship (EH) by level of education. We measure the increased AL prevalence (*disadvantage*) of the low-educated relative to the middle-educated and the reduced AL prevalence (*advantage*) of the high-educated groups, controlling or not for EH. **Results:** The rate of EH and the extent of the AL-advantage/disadvantage vary substantially across Europe. EH contributes to the AL-advantage/disadvantage but to different extent depending on its level across educational groups. **Discussion:** Associations between poverty, education, and disability are complex. In general, large EH goes along with increased disability differentials. Actions to reduce poverty are needed in Europe to reduce the levels and differentials in disability.

Keywords

disability, SES differentials, Europe, inequality, economic hardship

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Introduction

In a context of increased longevity and population aging, social administrations are under pressure. Active promotion of healthy aging aims, among other goals, to reinforce the sustainability of existing social benefits by preventing and reducing the risks of disability and dependence. Indeed, it is of crucial importance to reduce these risks in mid- and old-adult ages when the prevalence of disability starts reaching significant levels. At mid-adult ages, the objective of increasing labor force participation into late working life and to postpone the retirement age only holds if people are healthy enough to remain at work. At late-adult ages, the objective of keeping people independent to maintain their quality of life, as well as to postpone and reduce the needs for long-term care (LTC), only holds if people are healthy enough to live independently and perform their everyday tasks (Rechel et al., 2013). However, there are large and persistent social inequalities in the chance of reaching the retirement age in good health and in the chance of remaining independent in later ages (Cambois, Laborde, Romieu, & Robine, 2011; Majer, Nusselder, Mackenbach, & Kunst, 2010; Maki et al., 2013). Reducing social differentials in disability within and across countries has become a priority for public policies (Mackenbach, Karanikolos, & McKee, 2013). Moreover, it could be an efficient way for increasing healthy aging throughout Europe (Jagger et al., 2013; Lagiewka, 2012).

The literature has shown substantial variation in the size of social inequalities in health and disability across countries (Mackenbach et al., 2008). Poorly educated or deprived social groups have excess risks (*disadvantage*) regarding health outcomes compared with the rest of the population, and well educated or better-off social groups have reduced risks (*advantage*). However, the magnitude of these health and disability advantages and disadvantages significantly varies across countries (Cambois et al., 2016). What explains these variations is still unclear, as are the relevant actions to be taken to equalize the chances of healthy life expectancies (Eikemo, Bambra, Judge, & Ringdal, 2008; Huijts & Eikemo, 2009; Marmot, Friel, Bell, Houweling, & Taylor, 2008). Social inequalities in health issues result from complex interactions between individual characteristics and local contexts (i.e., national, regional, etc.) regarding health, health behaviors, and public policies. Education and income, two of the main features of social stratification, substantially differ across and within the European countries. Insufficient income, deprivation, and poverty remain a central concern in Europe due to their impact on health and quality of life and because of the co-existence of many policies and schemes to reduce poverty and social deprivation. Due to large variation in their implementation, we expect a significant variation in

the level of poverty across and within European countries. Consequently, we expect varying association between poverty and disability differentials in European countries.

In this study, we explore whether and how poverty, assessed through individuals' self-perceived economic hardship (EH), is associated with the disability advantage and disadvantage across educational groups in European countries.

Income, Poverty, and Health

Income impacts the individual's health status through two main causal pathways (Marmot, 2002). First, there is a material effect of income on health due to living conditions and the amount and type of goods and services that people can afford, from which their health might benefit. Second, there is a psychological effect of income on health associated with the level of control people have on their life and their environment.

In general, the increase in income should increase the access to goods and services and have positive return on health. However, there might be a ceiling above which most of the material conditions required for good health are satisfied. As a result, an increase in income might have a positive effect on health over the full range of the social gradient but with a decreasing return when the "material" ceiling is reached; that is, a non-linear relationship (Rodgers, 1979). Furthermore, due to this non-linear relationship, health should be more, negatively or positively, affected by the socioeconomic context in the lower than in the upper part of the social gradient, as shown when comparing different Norwegian regions (Dahl, Elstad, Hofossc, & Martin-Mollardd, 2006) or different labor market situations at early stages of people's occupational life in Europe (Cutler, Huang, & Lleras-Muney, 2015). Poverty and social deprivation identify situations that can be far below this ceiling, and should be strongly linked with health, due to limited access to basic goods and services challenging the chance of keeping healthy (food and energetic insecurity, limited access to care and secure environment, etc.). The psychosocial part of the *income-health* association described by Marmot (2002) explains that the impact of income might go much above the "material" ceiling and play in favor of the highest income groups, although with smaller return.

In this framework, protective welfare regimes, with income redistribution and poverty reduction schemes, should mechanically improve population's health, by improving the health of the poorest more than altering the health of the richest. Therefore, we expect variation in poverty across Europe and across educational groups to contribute to the variation in disability levels

and differentials. More specifically, we expect countries with low levels of poverty and redistribution policies to have low levels of disability and reduced social differentials.

Poverty and Educational Differentials in Health

The *income-health* association partially explains the educational differentials in health or disability (Marmot, 2002; Montez, Hummer, & Hayward, 2012; Ross & Mirowski, 1999), as well as education partially reflects material conditions in early stages of life (Davey Smith et al., 1998; Hayward & Gorman, 2004; Van den Mheen, Stronks, Van den Bos, & Mackenbach, 1997). Indeed, education attainment contributes to determine the socioeconomic situation in adulthood, including financial resources, which can add to or buffer the health impact of early life (Conti, Heckman, & Urzua, 2010; Hayward & Gorman, 2004; Holland et al., 2000). Therefore, a part of the variations in the differentials in health and disability, by level of education, observed in Europe should be mediated by the country-specific pattern of poverty. We hypothesize that the impact of poverty and deprivation is different across the educational groups and varies according to the countries' specific socioeconomic context.

However, we also assume that the patterns depend on how poverty is distributed across educational groups. And, for instance, it depends on the characteristics of the groups in situations of poverty in countries where the share of the population affected is small and selected compared with countries where poverty, even for relatively highly educated, people is largely spread out.

In this study, we examine the level of poverty observed in the low-, middle-, and high-educated groups in Europe, the disability differentials across educational groups, comparing separately the excess prevalence (*disadvantage*) of disability in the low-educated groups and the reduced prevalence (*advantage*) of disability in the high-educated groups (relative to the middle-educated groups), and the interaction with poverty. Country-specific situations are compared with the all-countries-average pattern to identify countries that depart from this average.

Data and Indicators

Database

The "European Union Statistics on Income and Living Conditions" (EU-SILC) is a database assembled by Eurostat with data provided by the national statistical offices of the European participating countries, designed to provide comparable data across the European Union (EU). We used the 2009 EU-SILC cross-sectional dataset. In most countries, data are collected by an ad hoc interview survey,

providing self-reported information for health and socioeconomic status (SES) variables. Elsewhere, SES variables are collected through population registers and health data through a complementary survey, often made by telephone. We examined sample selection, survey designs, collection mode, and question wording to assess the comparability of the data (Appendix Box A1, Appendix Table A1). The representativeness of country samples was assessed according to age, occupation, and education distributions. Following this assessment, Iceland, Luxembourg, and Malta have been excluded, and caution is recommended for some additional countries (see the "Discussion" section). Individuals aged 80+ have been excluded due to their high level of missing information. After these exclusions, the study sample comprises 289,816 individuals aged 30 to 79 from 26 European countries (Table 1).

Disability

Disability results from life events, such as injuries and chronic diseases, which might impair body functions and hamper performance of usual activities, challenging social participation and quality of life (World Health Organization, 2001). Education and poverty are associated with disability both through unequal exposure to disabling health events and unequal resources to adjust to deteriorated functions (assistive devices, caregiving, adapted environment; Verbrugge, Rennert, & Madans, 1997). In EU-SILC, disability is measured by the *Global Activity Limitation Indicator* (GALI), which targets health-related activity limitation (AL) with a single question: "For at least the past 6 months, to what extent have you been limited because of a health problem in activities people usually do?" (severely limited; limited but not severely vs. not limited)." AL is self-reported and, therefore, varies across European countries in part because of different regional propensities to report health disorders (Berger, Van Oyen, et al., 2015; Jurges, 2007). However, this AL measure is consistently correlated with more detailed measurement instruments for disability (Berger, Van Oyen, et al., 2015; Cabrero-Garcia & Julia-Sanchis, 2014; Jagger et al., 2010). It is predictive of mortality (Berger, Van der Heyden, & Van Oyen, 2015; Van der Heyden, Berger, & Van Oyen, 2015), and consumption of medical care services (Van der Heyden, Berger, Yokota, & Van Oyen, 2015).

Poverty and Education

Measuring poverty in international studies raises a number of difficulties: Based on individuals' income, variation in income levels and standard of living impose to adjust the definition. Data on income need also to be of equivalent quality, which might often not be the case depending on the data collection mode used

Table 1. Country Description: EU-SILC Participation Rate, Sample Sizes Between Ages 30 and 80, Distribution by Educational Groups, Prevalence of AL and EH, 2009.

	Countries	Participation rate % (all ages)[a]	Sample size	Weighted distribution by educational groups (%)			Age-standardized prevalence of activity limitation (%)				Economic hardship (%)
				Low-educated	Middle-educated	High-educated	All	Low-educated	Middle-educated	High-educated	All
AT	Austria	71.1	8,496	21.8	60.2	18.0	29.9	44.9	27.4	20.5	19.6
BE	Belgium	62.7	8,796	37.2	30.6	32.1	24.9	37.0	21.4	14.1	18.3
BG	Bulgaria	77.2	9,910	29.6	51.4	19.1	17.3	25.9	14.1	12.5	58.0
CY	Cyprus	89.5	5,266	38.8	36.0	25.2	20.9	32.8	14.1	9.9	39.1
CZ	Czech Republic	82.3	13,416	13.0	74.5	12.6	24.6	44.3	23.3	12.5	32.6
DE	Germany	76.5	19,044	17.3	57.8	25.0	35.7	50.3	35.8	25.5	17.0
DK	Denmark	53.5	4,693	29.6	41.6	28.7	26.2	37.2	22.4	20.3	11.6
EE	Estonia	74.0	7,735	15.1	53.3	31.5	31.9	56.4	31.7	20.5	26.4
ES	Spain	81.0	21,582	52.7	20.1	27.2	23.8	31.5	18.3	12.9	30.1
FI	Finland	79.2	7,627	26.2	39.7	34.1	31.3	42.9	31.1	22.7	14.6
FR	France	82.7	14,890	36.8	40.4	22.8	24.8	36.5	21.0	12.8	27.2
GR	Greece	84.0	11,065	45.0	33.0	22.0	18.0	29.6	10.2	5.8	24.5
HU	Hungary	84.5	15,189	25.1	56.7	18.2	33.2	52.3	29.2	19.1	70.1
IE	Ireland	78.9	7,187	43.2	28.2	28.6	22.1	32.6	17.6	10.8	37.4

(continued)

Table 1. (continued)

	Countries	Participation rate % (all ages)[a]	Sample size	Weighted distribution by educational groups (%)			Age-standardized prevalence of activity limitation (%)				Economic hardship (%)
				Low-educated	Middle-educated	High-educated	All	Low-educated	Middle-educated	High-educated	All
IT	Italy	83.7	32,278	54.1	33.6	12.3	25.9	35.1	16.4	11.7	29.6
LT	Lithuania	86.9	8,169	21.0	54.8	24.3	25.5	46.2	23.2	12.9	51.6
LV	Latvia	78.3	8,788	20.2	56.0	23.8	36.1	54.5	34.4	24.7	65.5
NL	Netherlands	83.4	8,030	30.2	39.7	30.1	28.9	41.2	26.5	19.7	11.5
NO	Norway	60.4	4,013	22.3	46.4	31.3	17.7	28.6	18.1	9.5	9.6
PL	Poland	76.3	21,562	20.0	63.8	16.2	25.9	44.8	23.1	13.4	46.6
PT	Portugal	86.4	7,253	76.2	12.0	11.9	30.2	34.7	17.3	14.4	23.7
RO	Romania	96.2	12,421	36.0	53.4	10.6	23.3	34.8	18.2	10.1	38.8
SE	Sweden	73.0	5,609	17.6	50.4	31.9	16.2	24.1	17.0	10.5	9.7
SI	Slovenia	77.7	7,069	23.7	56.5	19.8	27.7	41.0	26.0	16.8	38.1
SK	Slovakia	88.5	9,266	10.2	72.8	17.1	40.3	69.5	39.3	26.9	31.6
UK	The United Kingdom	71.3	10,462	25.2	46.1	32.8	22.3	36.7	19.7	14.5	20.7
	All		289,816	33.0	44.5	22.5	26.9	37.2	24.5	16.2	27.3

Source. EU-SILC data (2009).
Note. AL = activity limitation; EH = economic hardship; EU-SILC = European Union Statistics on Income and Living Conditions.
[a]Coverage of the individual file compared with the total household file.

in the different countries. In the 2009 EU-SILC, poverty can be measured through material deprivation as an alternative to income-based measures (Whelan & Maître, 2013). Among the three modules included to assess material deprivation, we used the module on "economic stress."[1] Its first item relates to "the household ability to cope with unanticipated expenses" (yes/no). The second item relates to "the household ability to make ends meet, namely, to pay for its usual necessary expenses?" The associated question is introduced by a short text: "A household may have different sources of income and more than one household member may contribute to it. Thinking of your household's total income" and proposes six answer categories: "with great difficulty, with difficulty, with some difficulty, fairly easily, easily, and very easily." The third item informing about difficulties in reimbursing mortgage has not been used in our poverty indicator due to substantial missing values.

We combined the first two items to build the indicator of EH used in this study as poverty indicator. We consider as EH people cumulating both difficulties to make ends meet and difficulty to cope with unexpected expenses (in total, we had 239 missing information in our study population for the EH items).

Using the International Standard Classification of Education, respondents have been distributed in three groups of education: low (0-2 primary and lower secondary education), middle (3-4 upper secondary education), and high (5-6 tertiary education).[2]

Analysis

We examined first the rate of EH in each country for the three educational groups to discuss the differentials of poverty across Europe. Then, we analyzed the disability advantage and disadvantage across educational groups.

In a first step, Model 1 is a logistic regression model, pooling the 26 countries to assess the variation in the AL-advantage and disadvantage of the high- and low-educated groups in the 26 countries. The risk of AL is estimated as a function of the country (to control the country level of AL), plus three independent variables, age (including age squared), sex, and education, interacted with country to account for their country-specific associations (Box 1). The AL relative advantage of the high-educated groups and disadvantage of the low-educated groups are shown by the odds ratios (ORs) associated with the *Education* × *Country* interaction term (middle-educated as a reference). Countries' ORs are compared with the average European pattern for high- and low-educated groups to identify the countries that stand apart from it. To compute the average ORs, we calculated from Model 1 the 26 country-specific predictive margins to estimate the (unweighted) all-countries-average predictive margins and ORs.

Box 1. Logistic Regression Models, Pooling the 26 Countries to Assess the Variation in the AL-Advantage and Disadvantage of the High- and Low-Educated Groups in the 26 Countries.

Model 1: $logit(p_{AL}) = \beta_{1i}X_{1i} + \beta_{2ia}X_{2ia} + \beta_{2ia}X_{2ia}^2 + \beta_{3ij}X_{3ij} + \beta_{4iz}X_{4iz}$
Model 2: $logit(p_{AL}) = \beta_{1i}X_{1i} + \beta_{2ia}X_{2ia} + \beta_{2ia}X_{2ia}^2 + \beta_{3ij}X_{3ij} + \beta_{4iz}X_{4iz} + \beta_{5iq}X_{5iq}$
X_{1i} for Country with *i = (1-26)* for countries
X_{2ia} for Country#Age with i = (1-26) for countries and a = [30-79] for age
X_{3ij} for Country#Sex with *i = (1-26)* for countries and *j = (1-2)* for sex
X_{4iz} for Country#Education with *i = (1-26)* for countries and *z = (1-3)* for education
X_{5iq} for Country#EconomicHardship with *i = (1-26)* for countries *q = (0-1)* for economic hardship

Note. Logistic regression equation (models included EU-SILC baseline weights). AL = activity limitation; EU-SILC = European Union Statistics on Income and Living Conditions.

In a second step, Model 2 replicated Model 1 adding our indicator of EH, interacted with country (Box 1). Model 2 provides new estimates corresponding to the country-specific AL-advantage and disadvantage across educational groups, when controlling the country-specific EH. In the same way as for Model 1, we computed from Model 2 all-countries-average predictive margins and ORs. We examine countries showing different patterns compared with the average in Model 1 and in Model 2 for both the relative AL-advantage of the high-educated groups and relative AL-disadvantage of the low-educated groups. We comment the varying impact of accounting for EH in the model.

Finally, Model 1 and Model 2 also brought additional information regarding EH. Model 1 allowed assessing the degree of association between the EH and disability for the 26 countries. Finally, Model 2 also estimated whether poverty levels contribute to the country-specific increased or reduced AL-advantage/disadvantage found in Model 1. We use this information when describing the context of EH in the European countries.

Pooling the data allows comparisons between the country coefficients of the model, although it also implies multiplying the estimated coefficients, especially with the country interaction (to account for varying sex, age, and education effect across countries). Most of the coefficients are statistically significant as shown with the coefficients associated with EH (Figure 2) or education (Figures 4 and 5).

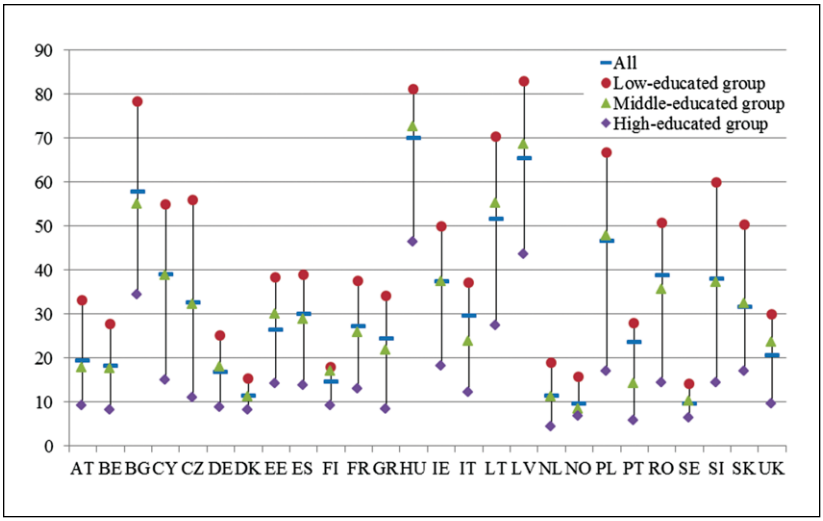

Figure 1. Percentage of people reporting EH in the age range 30 to 79 years, for three educational groups across the 26 European countries.
Note. EH = economic hardship. Country labels: AT = Austria; BE = Belgium; BG = Bulgaria; CY = Cyprus; CZ = Czech Republic; DE = Germany; DK = Denmark; EE = Estonia; FI = Finland; FR = France; GR = Greece; HU = Hungary; IE = Ireland; IT = Italy; LV = Latvia; LT = Lithuania; NL = Netherlands; NO = Norway; PL = Poland; PT = Portugal; RO = Romania; SK = Slovakia; SI = Slovenia; ES = Spain; SE = Sweden; UK = The United Kingdom.

Results

Distribution of AL and EH Across the 26 Countries

The AL age-standardized prevalence varies across the 26 countries (Table 1). The low-educated groups consistently show the highest AL prevalence and the high-educated groups the lowest prevalence, although to a different extent across countries. The distribution of low-educated people is usually large in most Southern European countries and small in a number of Eastern European and Baltic countries. This is partly explained by different histories of the educational systems across Europe. There is no evidence of a systematic relationship between the population distribution across educational groups and the extent of the differentials. The smallest group's size does not always translate into a larger health gap compared with the average in the population.

The level of EH is 27.3% on average but it varies across countries (Table 1). It is below 10% for the 30- to 79-year-old age group in Norway and Sweden but above 66% in Latvia and Hungary. Figure 1 shows, from the lowest to the

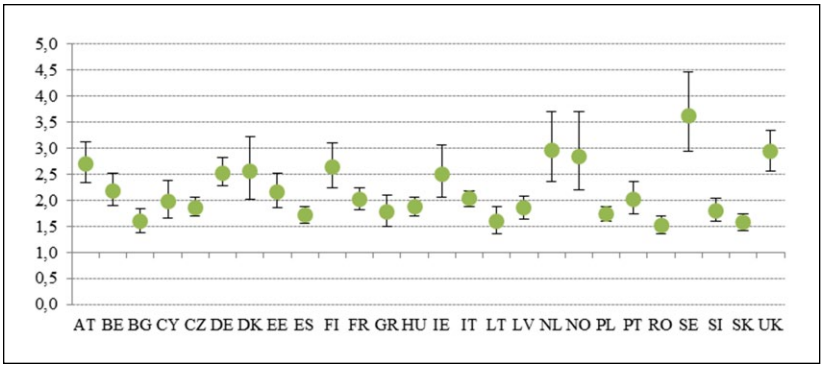

Figure 2. ORs to report ALs for people reporting EH in the 26 European countries (reference: people not reporting EH), Model 2.
Note. OR = odds ratio; AL = activity limitation; EH = economic hardship. Country labels: AT = Austria, BE = Belgium, BG = Bulgaria; CY = Cyprus; CZ = Czech Republic, DE = Germany; DK = Denmark, EE = Estonia; FI = Finland; FR = France; GR = Greece; HU = Hungary; IE = Ireland; IT = Italy; LV = Latvia; LT = Lithuania; NL = Netherlands; NO = Norway; PL = Poland; PT = Portugal; RO = Romania; SK = Slovakia; SI = Slovenia; ES = Spain; SE = Sweden; UK = The United Kingdom.

highest values, the range of the rate of EH across educational groups in the 26 European countries. Although the low-educated groups are systematically more affected by EH, there are large variations. The lowest levels of EH for the low-educated groups, between 15% and 20%, are observed in Sweden, Denmark, Norway, and Finland. The Netherlands comes just after, and also displays the lowest level of EH for the high-educated groups. Germany, Belgium, Portugal, and the United Kingdom come next with a level of EH for the low-educated groups between 20% and 30%. The remaining Western and Southern European countries (except Ireland and Cyprus) and Estonia have a rate of EH between 30% and 40%. In Ireland and Cyprus, at least half of low-educated groups report EH. The rates of EH are even higher, with large variations in Eastern European and Baltic countries. For instance, more than 40% of the high-educated groups report EH in Hungary and Latvia.

Association of EH and Disability in the 26 European Countries

EH is positively associated with AL in all countries (Figure 2). The highest ORs for EH are found in Sweden, the Netherlands, and the United Kingdom and lowest in Bulgaria, Slovakia, Lithuania, and Romania (controlling for country, age, sex, and level of education). In general, the degree of

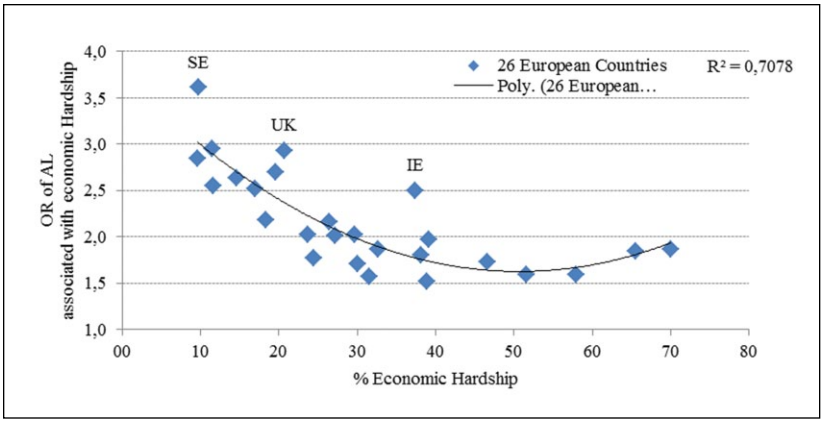

Figure 3. Correlation between the ORs to report ALs for people reporting EH and the level of EH observed in 26 European countries.
Note. OR = odds ratio; AL = activity limitation; EH = economic hardship. Country labels: AT = Austria, BE = Belgium, BG = Bulgaria; CY = Cyprus; CZ = Czech Republic, DE = Germany; DK = Denmark, EE = Estonia; FI = Finland; FR = France; GR = Greece; HU = Hungary; IE = Ireland; IT = Italy; LV = Latvia; LT = Lithuania; NL = Netherlands; NO = Norway; PL = Poland; PT = Portugal; RO = Romania; SK = Slovakia; SI = Slovenia; ES = Spain; SE = Sweden; UK = The United Kingdom.

association between EH and AL diminishes when the level of EH increases, as illustrated in Figure 3.

The Disability Advantage and Disadvantage Across Educational Groups

See Figure 4 for the relative AL-disadvantage of the low-educated groups (compared with middle-educated groups) and Figure 5 for the relative AL-advantage of the high-educated groups (derived for Model 1 and Model 2). The χ^2 of the two models shows that EH significantly contributes to AL. The ORs of AL by education level have changed, although to different extents according to each country.

In Figure 4, the closest the OR to 1, the smallest the AL-disadvantage of the low- compared with the middle-educated group. The all-countries-average ORs for the low-educated groups are 1.55 in Model 1 and 1.41 in Model 2.

We found larger relative AL-disadvantages compared with the average pattern in the Czech Republic, Hungary, Italy, and almost significant in Denmark in Model 1. The AL-disadvantage is still significantly larger than the average in Model 2 accounting for EH, except in Italy, where the AL-disadvantage decreased down to the level of the average pattern.

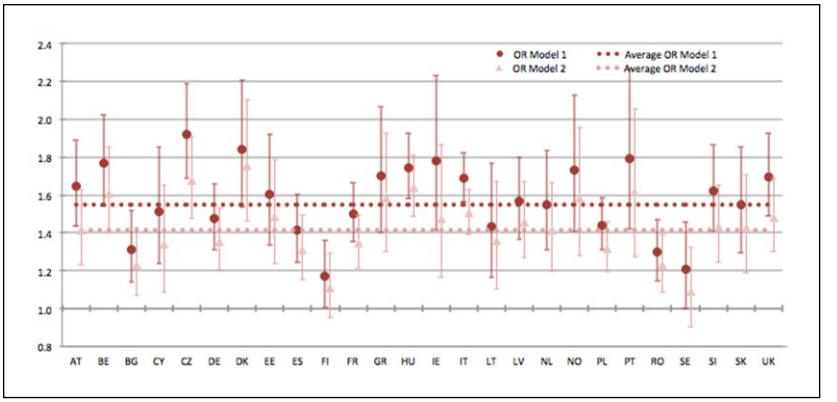

Figure 4. Country-Specific and European Average ORs to report ALs for low-educated people in the 26 European countries (reference: middle-educated people), controlling for country, sex, age (Model 1), and economic hardship (Model 2).
Note. OR of AL for the Country × Education term, adjusted on age, age^2, sex, and country (Model 1) + economic hardship (Model 2):
Model 1: $logit\left(p_{AL}\right) = \beta_{1i}X_{1i} + \beta_{2ia}X_{2ia} + \beta_{2ia}X_{2ia}^2 + \beta_{3ij}X_{3ij} + \beta_{4iz}X_{4iz}$
Model 2: $logit\left(p_{AL}\right) = \beta_{1i}X_{1i} + \beta_{2ia}X_{2ia} + \beta_{2ia}X_{2ia}^2 + \beta_{3ij}X_{3ij} + \beta_{4iz}X_{4iz} + \beta_{5iq}X_{5iq}$
X_{1i} for Country with i = *(1-26)*; for Country#Age X_{2ia} with i = *(1-26)* and a=(30-79); X_{3ij} for Country#Sex with i = *(1-26)* and j = *(1-2)*; X_{4iz} for Country#Education with i = *(1-26)* and z = *(1-3)*; X_{5iq} for Country#EconomicHardship with i = *(1-26)* and q = *(0-1)*.
OR = odds ratio; AL = activity limitation. Country labels: AT = Austria, BE = Belgium, BG = Bulgaria; CY = Cyprus; CZ = Czech Republic, DE = Germany; DK = Denmark, EE = Estonia; FI = Finland; FR = France; GR = Greece; HU = Hungary; IE = Ireland; IT = Italy; LV = Latvia; LT = Lithuania; NL = Netherlands; NO = Norway; PL = Poland; PT = Portugal; RO = Romania; SK = Slovakia; SI = Slovenia; ES = Spain; SE = Sweden; UK = The United Kingdom.

In contrast, smaller relative AL-disadvantage compared with the all-countries-average has been observed in Sweden, Finland, Bulgaria, and Romania in Model 1. But this AL-disadvantage is no longer significantly different from the average pattern after controlling EH (Model 2) in Bulgaria and Romania. In Sweden and Finland, the ORs low- versus middle-educated were low in Model 1, and when adjusting for EH, their confidence intervals include 1 (no significant increased AL for the low- compared with the middle-educated group when adjusting for EH).

Figure 5 displays the AL-advantage of the high- compared with the middle-educated groups: The average OR goes from 0.63 in Model 1 to 0.70 in Model 2.

In the Czech Republic, Estonia, Hungary, Lithuania, and Norway, the AL-advantage of high-educated groups relative to the middle-educated groups is significantly larger than the average pattern (Model 1). It remains

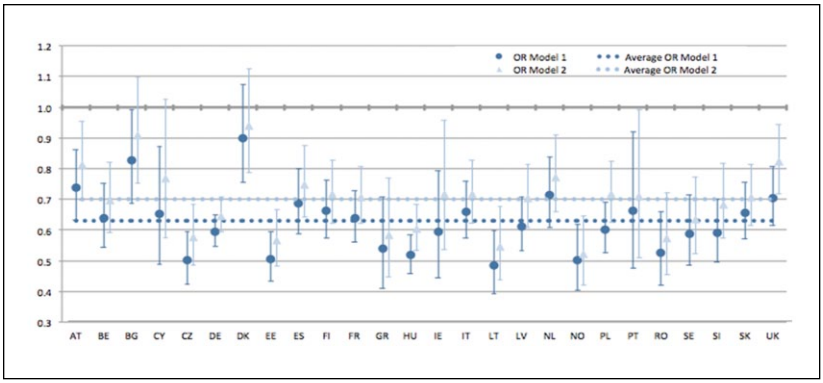

Figure 5. Country-specific and European average ORs to report ALs for high-educated people in the 26 European countries (reference: middle-educated people), controlling for country, sex, age (Model 1), and economic hardship (Model 2).
Note. OR of AL for the Country × Education term, adjusted on age, age², sex, and country (Model 1) + economic hardship (Model 2):
Model 1: $logit(p_{AL}) = \beta_{1i}X_{1i} + \beta_{2ia}X_{2ia} + \beta_{2ia}X^2_{2ia} + \beta_{3ij}X_{3ij} + \beta_{4iz}X_{4iz}$
Model 2: $logit(p_{AL}) = \beta_{1i}X_{1i} + \beta_{2ia}X_{2ia} + \beta_{2ia}X^2_{2ia} + \beta_{3ij}X_{3ij} + \beta_{4iz}X_{4iz} + \beta_{5iq}X_{5iq}$
X_{1i} for Country with *i = (1-26)*; X_{2ia} for Country#Age with *i = (1-26)* and a = (30-79); X_{3ij} for Country#Sex with *i = (1-26)* and *j = (1-2)*; X_{4iz} for Country#Education with *i = (1-26)* and *z = (1-3)*; X_{5iq} for Country#EconomicHardship with *i = (1-26)* and *q = (0-1)*.
OR = odds ratio; AL = activity limitation. Country labels: AT = Austria, BE = Belgium, BG = Bulgaria; CY = Cyprus; CZ = Czech Republic, DE = Germany; DK = Denmark, EE = Estonia; FI = Finland; FR = France; GR = Greece; HU = Hungary; IE = Ireland; IT = Italy; LV = Latvia; LT = Lithuania; NL = Netherlands; NO = Norway; PL = Poland; PT = Portugal; RO = Romania; SK = Slovakia; SI = Slovenia; ES = Spain; SE = Sweden; UK = The United Kingdom.

significantly larger than the mean pattern in Model 2, although it decreases, except in Norway, where controlling for EH changes the OR only very slightly.

In Bulgaria, the United Kingdom, and almost in Austria, the AL-advantage of the high-educated group is smaller than the mean European pattern in Model 1 and/or in Model 2. In these countries, EH plays a not negligible role even if the differentials between high- and middle-educated groups tend to be lower than elsewhere in Europe, except Denmark. In Denmark, high-educated people do not have an AL-advantage compared with the middle-educated group and controlling EH hardly changes the OR.

Discussion

The EH level varies to a large extent across and within the 26 European countries studied. Regarding EH, we found country patterns that could be read in terms of regional context. The Nordic countries display the lowest levels and the smallest

absolute differentials in EH, which might be due to the protective welfare regime (Bergqvist, Yngwe, & Lundberg, 2013; Eikemo & Bambra, 2008). In contrast, the Eastern European and Baltic countries generally present the highest levels of EH in the three educational groups, attesting for the social and economic context with the recent transition toward market economies (Rechel & McKee, 2009).

EH is associated with AL in all 26 countries, but with country-specific patterns. We observed that when the level of EH is high, the association with AL is weakened and vice versa. This result might be explained by a selection effect. When EH concerns a small part of the population, especially in countries with a high level of protection against material deprivation such as Nordic countries, EH may be concentrated in people with poor health and disability. In these countries, it could involve more than elsewhere a reverse causation between disability and poverty: Poor health might result in low income (due to the difficult access or difficulty in remaining in the labor market), in addition to the effect of low income on health. The reverse causation might be even more important in a study focusing on disability. AL focused in this study on health-related limitation in usual activities, which might correspond to limitation in school and work activities (Tubeuf, Jusot, Devaux, & Sermet, 2008). So AL might be more often the cause rather than the consequence of poverty compared with other health dimensions.

Based on the literature, we expected the low-educated groups to be more disadvantaged regarding disability in countries with less favorable economic context (large rate of EH) and low levels of income redistribution, such as Eastern European and Baltic countries (Cutler et al., 2015; Dahl et al., 2006). This is only the case in Hungary and in the Czech Republic, where compared with the average pattern, the low-educated groups have a larger AL-disadvantage. But in the other countries, we found that the high-educated groups benefit from an increased AL-advantage compared with the mean EU pattern (Czech Republic, Estonia, Hungary, and Lithuania). These findings highlight that the large educational differentials in AL observed in these countries are due to the high-educated groups being more advantaged than expected regarding the average pattern, compared with the middle-educated. Accounting for EH tends to decrease the AL-advantage and disadvantage but the overall patterns remain the same as compared with the average patterns. In these countries, where EH is large in both the middle- and low-educated groups, the high-educated might have a better access to basic and other goods and services compared with the two other groups, combined with the higher control on their life and environment, better job, and better place of residence, relative to the rest of the population. This suggests that the large social differentials observed in the Baltic and Eastern European countries might be due to some of the high-educated people being substancially more protected from poverty compared to the rest of the population, while rates of poverty are high in all educational groups, even in the highest.

Egalitarian welfare regimes are expected to protect from material deprivation and to reduce health and disability inequalities. Indeed, we found low levels of EH and small differentials in AL have been observed in the Nordic countries. However, how these differentials are constructed differ. The AL-advantages of the high-educated groups in Sweden and Finland do not differ from the average pattern and seem to be weakly associated with EH. And they experience a significantly smaller relative AL-disadvantage of the low-educated compared with the average pattern, which even disappears once EH is controlled. While these countries have high levels of social protection for the most deprived, the social net limits the situation of EH, and this situation is strongly linked to AL, so it could be more concentrated on people with disability, and still be more frequent in low- and middle-educated groups. Sweden and Finland might illustrate the reverse causation in the *income-health* association described above. According to Lundberg and colleagues (2008), the reverse causation could be viewed as a specific case in the *income-health* association. In that case, redistributing income would not improve the population's health as much as it does when poverty is the determining factor. Following this assumption, eliminating residual EH in Sweden and Finland might be less a question of improving health (if AL is the cause of EH) but of improving the quality of life (access to basic and other goods and services) of people experiencing AL. More research is needed on the share of the population reporting EH in these countries.

In contrast, the relative AL-disadvantage of the low-educated Danes is among the largest observed in this study, with little association with EH. Other factors than poverty can explain the relatively poorer functional health status of the low-educated as compared with the middle-educated groups, including lifestyle, work conditions, access to health care, and so on. Moreover, in Denmark, the high-educated do not have a disability advantage compared with the middle-educated group, as observed in the other countries. Whether high- and middle-educated groups are more similar in Denmark than elsewhere (in terms of risks or protection for AL) and whether it explains that differentials are more pronounced between the middle- and low-educated than elsewhere deserves further attention. It could also be that the high-educated group benefits less from its social status than in other countries.

Norway presents an opposite situation to Denmark regarding the high-educated group with a significant larger AL-advantage for the high-educated compared with the middle-educated groups. The disadvantage of the low-educated group compared with the middle-educated group is large, although not significantly different from the average pattern. But EH seems to play a larger role than in the other Nordic countries (although the models do not allow for quantification). The levels of disability and of EH are quite low in Norway but EH is strongly associated with AL. More than in Sweden and Finland, controlling for EH reduces the educational differentials between low- and middle-educated

groups (although these models do not allow for quantification). The rather strong contribution of income inequalities on health differentials in Norway has been found in other studies (Dahl et al., 2006; Yngwe, Fritzell, Burstrom, & Lundberg, 2005). How to explain the larger advantage of the high-educated group? The health system is less publicly grounded in Norway than in the other Nordic countries, and access to health care could be part of the explanation (Organisation for Economic Co-Operation and Development [OECD], 2010). In Norway, more than in Sweden and Finland, the income gradient might provide more AL-advantage to high-educated people, through a better access to goods and services and better control of life.

We found few results in Western and Southern countries. Only Italy displayed larger AL-disadvantage for the low-educated group (relative to middle-educated group) compared with the average, and, in this case, when adjusting for EH, the AL-disadvantage becomes not significantly different from the average, so the specific pattern of Italy seems to be linked to the association between poverty and disability.

We assumed in section "Introduction" that poverty levels might have a stronger impact on low-educated groups. However, we found out that it is not systematically the case, and it could contribute more in the differentiation between the middle- and high-educated. It depends on how EH is distributed across educational groups. It also depends on whether the disability gap results from the high-educated being more advantaged or from the low-educated being more disadvantaged compared with the middle-educated. These country-specific patterns, and how they relate to the rate of EH, highlight the diversity of the socioeconomic patterns behind the well-documented variation in health gaps.

There are a number of limitations in this study. The measure of EH is convenient to assess and compare basic material deprivations across countries that might have different income and consumption levels (Whelan & Maître, 2013). It allows distinguishing between countries where existing schemes fighting poverty result in very low levels of deprivation and countries where there is still room to conduct such policies. However, the interest of this measure may be limited above the "material" ceiling to assess the impact that income might have on social differentials in disability. Income characteristics might be useful to further document the variation in the disability advantage of the high-educated groups (Yngwe, Diderichsen, Whitehead, Holland, & Burstrom, 2001), although cross-national comparison of income is challenging.

There are also some limitations in the EU-SILC database and its comparability across countries. We carefully examined the survey design and explored the representativeness of the national samples. Following this quality assessment, we did not include Iceland, Malta, and Luxembourg. We also recommend caution with countries such as Sweden, the United Kingdom, and Slovakia, where low-educated groups are slightly under-represented in the samples. Because poor

health is associated with non-participation, under-representation of low-educated groups might induce an underestimation of their AL-disadvantage (Lorant, Demarest, Miermans, & Van Oyen, 2007). Regarding comparability of the wording in EU-SILC, the AL question is standardized in most countries; however, some differences persist (see Appendix Box A1). For instance, the Bulgarian wording refers to "activity limitations at work," which might orient the respondent's answer and induce different patterns compared with other countries. This might explain the specific situation of Bulgaria, which contrasts with the other Eastern European countries. Even standardized, the wording of the question on AL might have slightly different meanings across countries and birth cohorts. Furthermore, the measure of the level of education, as well as the measures of EH, might also be sensitive to differences across national contexts, although the EU-SILC variables used to build these indicators have been harmonized following the standards rules of Eurostat. These comparability issues cannot be fully solved.

Comparing 26 countries and 26 welfare regimes, with indicators of AL, EH, and level of education, gives an opportunity to better understand social differentials in disability. However, it induces a very large number of estimates with the risk of some Type I statistical errors among our tests, calling for confirmation studies with different datasets.

Despite these limitations, this study has shed light on two contrasted patterns behind the social differentials opposing the two ends of the educational gradient, as highlighted in a previous study (Cambois et al., 2016). First, in a number of countries, generally Eastern European and Baltic countries but also in Norway, country-specific differentials in AL result from a larger advantage of the high-educated groups compared with the rest of the population. Second, in some Eastern European and Baltic countries and in Italy, country-specific differentials in AL may also result from the larger disadvantage of the lower-educated groups compared with the middle-educated groups. This present study adds to previous ones by highlighting that EH differs across educational groups and may contribute to these two patterns. EH possibly impacts more the low-educated groups but not systematically. However, in countries where the rates of EH are large, the middle-educated group is also concerned, helping explain the larger advantage of the high- compared with the middle- and low-educated groups. In countries where EH is low, the association with larger disability disadvantage might be explained by another pathway (reverse causation): in these settings, EH could concentrate on a selected population partly characterized by poor health and disability, which highlight the need for further attention to the risk of material deprivation in disability situations.

It has been underlined that the whole social protection system and how it is implemented drives individuals' resources to manage health (Mackenbach et al., 2013; Marmot et al., 2008; Navarro & Shi, 2001). Our study adds new

insights, showing a contribution of EH to the social differentials in disability, but suggests very different features across Europe while the poverty level varies dramatically across European countries and educational groups.

Appendix

Box A1. International Comparability of the 2009 EU-SILC Database: Collection Mode, Samples, and Questionnaires.

Individual participation rates for the 2009 EU-SILC database are varying across countries, being sometimes very low (Table A1). This is a critical issue because poor health might be a reason for not participating and might differ across SES (Lorant et al., 2007).

First, it seems that low participation is associated with the varying administration mode (i.e., telephone interview leading to the lowest participation rates).

Second, in most countries, the sample distribution (weighted) remains accurate with regard to age, education, and occupation structure, compared with the "gold standard" provided by the Labour Force Survey, except in Iceland, Luxembourg, and Malta, which were excluded from this study. However, we recommend caution for countries where low-educated groups are overrepresented (Ireland, Belgium, Slovenia, Lithuania, Portugal) or underrepresented (The United Kingdom, Sweden, Slovakia), compared with the Labour Force Survey distribution.

Third, regarding the wording of the question on activity limitation, a 2009 Eurostat report showed that 14 out of 26 countries under study used a comparable wording. Among the rest of the 12 countries, seven referred to limitations in the respondent's activities (which omit activities the respondent never does due to his or her health problem) with possible underestimation of the overall limitations (Belgium, Cyprus, Greece, Lithuania, Latvia, Romania, Slovakia); five used different questions either referring to specific rather than general activities (i.e., work) or by using filters before exploring the severity and/or length of limitations (Bulgaria, Germany, Hungary, the Netherlands, The United Kingdom). Among these 12 countries, when possible, we compared EU-SILC prevalence to other datasets using similar questions (i.e., the Survey on Health, Ageing and Retirement in Europe 2010 or the European Health Interview survey circa 2008). EU-SILC usually provides lower levels of activity limitation (except for Belgium) due to wording and/or survey issues (coverage, response rate . . .).

We also need to consider possible variation in the self-reported information on educational level. Although we used the international classification, the national educational system and how it changed across generations might be an issue for the comparison.

Note. EU-SILC = European Union Statistics on Income and Living Conditions; SES = socioeconomic status.

Table A1. Summary of the 2009 EU-SILC Information: Collection Mode, Sample Size for the Individual Information and Coverage Rates, Sub-Sample With Health Information, and Reason for Attrition From Individual Sample to the Sub-Sample With Health Information (Individuals Aged 30-79).

			EU-SILC individual sample		Sub-sample (health questions)	Attrition from the total EU-SILC individual sample to sub-sample with health information					
							Reasons for attrition[b] (%)				
		EU-SILC collection mode[a]	Size (all ages)	Coverage compared with the Total Household file (%)	Size (all ages)	Attrition (%)	Unknown	Proxy	Register data	Non-response to the heath questions	Age under 16
AT	Austria	F-F/CATI	13,610	71.1	11,054	19	0.0	0.0	0.0	0.0	18.7
BE	Belgium	F-F	14,721	62.7	11,651	21	0.0	0.0	0.0	0.6	20.2
BG	Bulgaria	F-F	15,047	77.2	13,148	13	0.4	0.0	0.0	0.0	12.2
CY	Cyprus	F-F	9,283	89.5	7,553	19	0.0	0.0	0.0	0.0	18.6
CZ	Czech Republic	F-F	23,302	82.3	16,827	28	0.0	12.2	0.0	0.0	15.5
DE	Germany	Self-Administered	28,368	76.5	23,686	17	0.5	0.0	0.0	0.4	15.6
DK	Denmark	Register/CATI	15,025	53.5	5,866	61	0.0	38.6	0.0	0.0	22.4
EE	Estonia	F-F	13,542	74.0	11,220	17	0.0	0.0	0.0	0.6	16.5
ES	Spain	F-F/CATI	36,865	81.0	30,418	17	0.0	0.0	0.0	1.1	16.4
FI	Finland	Register/CATI	25,157	79.2	9,962	60	0.6	38.5	0.0	0.1	21.3
FR	France	F-F	25,611	82.7	20,113	21	0.0	0.0	0.0	0.4	21.0
GR	Greece	F-F/CATI	18,035	84.0	15,045	17	0.7	0.0	0.0	0.0	15.8
HU	Hungary	F-F	25,053	84.5	20,354	19	0.3	0.0	0.0	2.1	16.3
IE	Ireland	Register/F-F	12,641	78.9	9,900	22	0.0	0.0	0.0	0.0	21.7
IT	Italy	F-F	51,196	83.7	42,159	18	0.4	0.0	0.0	1.5	15.8
LT	Lithuania	F-F/CATI	12,852	86.9	10,700	17	3.0	0.0	0.0	0.9	12.8
LV	Latvia	Register/F-F/CATI	14,403	78.3	12,066	16	0.0	0.0	0.0	1.0	15.3

(continued)

Table A1. (continued)

			EU-SILC individual sample		Sub-sample (health questions)	Attrition from the total EU-SILC individual sample to sub-sample with health information					
							Reasons for attrition[b] (%)				
		EU-SILC collection mode[a]	Size (all ages)	Coverage compared with the Total Household file (%)	Size (all ages)	Attrition (%)	Unknown	Proxy	Register data	Non-response to the heath questions	Age under 16
NL	Netherlands	Register/CATI	23,687	83.4	9,717	59	0.0	35.6	0.0	0.0	23.3
NO	Norway	Register/CATI	13,855	60.4	5,349	61	0.0	35.2	1.2	0.6	24.4
PL	Poland	F-F	38,541	76.3	29,228	24	0.0	0.0	0.0	6.3	17.9
PT	Portugal	F-F	13,013	86.4	11,091	15	0.5	0.0	0.0	0.0	14.2
RO	Romania	F-F	18,703	96.2	16,282	13	0.3	0.0	0.0	0.0	12.7
SE	Sweden	Register/CATI	18,441	73.0	7,540	59	0.0	39.3	0.0	0.0	19.8
SI	Slovenia	Register/F-F/CATI	29,576	77.7	9,276	69	0.0	0.0	53.6	0.0	15.0
SK	Slovakia	F-F	16,137	88.5	13,636	15	0.1	0.0	0.0	1.1	14.3
UK	The United Kingdom	F-F	19,380	71.3	15,359	21	0.0	0.0	0.0	1.3	19.4

Source. Eurostat, 2009 comparative EU intermediate quality report, version 3, July 2011.

Note. EU-SILC = European Union Statistics on Income and Living Conditions; CATI = Computer-Assisted Telephone Interview. Country labels: AT = Austria, BE = Belgium, BG = Bulgaria; CY = Cyprus; CZ = Czech Republic, DE = Germany; DK = Denmark, EE = Estonia; FI = Finland; FR = France; GR = Greece; HU = Hungary; IE = Ireland; IT = Italy; LV = Latvia; LT = Lithuania; NL = Netherlands; NO = Norway; PL = Poland; PT = Portugal; RO = Romania; SK = Slovakia; SI = Slovenia; ES = Spain; SE = Sweden; UK = The United Kingdom.

[a]Collection modes: Registers; F-F (paper-and-pencil or computer-assisted interview); CATI = Computer-Assisted Telephone Interview; Self-administered.

[b]EU-SILC data collection for household is based on registers in a number of countries. In these countries, specific information on individuals is collected by a separate data collection, mainly processed by telephone and going with low participation. Furthermore, individual information on health is only available for a sub-sample of individuals: first, this is due to the age threshold (information collected for the 16 year old and above only), then to country-specific rules for proxies (proxies not allowed in a number of countries for health information), non-response to the health question; use of register data for part of sample in a number of countries, not specified.

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Notes

1. *Basic deprivation* comprises three items related to a meal with meat or a vegetarian alternative, adequate home heating, and leisure activity. *Consumption deprivation* comprises three items related to a personal computer (PC), a car, or Internet connection. These two dimensions could be more sensitive to variation across countries in the perception or definition of the items.
2. http://www.uis.unesco.org/education/pages/international-standard-classification-of-education.aspx

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