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Summary

Background: The purpose of this study is to establish whether the reporting of health differs by education level and, if so, to determine the extent to which this biases the measurement of health inequalities among older Europeans.

Methods: Data are from the Survey of Health, Ageing and Retirement in Europe (SHARE) covering eight countries. Differential reporting of health by education is identified from ratings of anchoring vignettes that describe fixed health states. Ratings of own health in six domains (mobility, pain, sleep, breathing, emotional health, cognition) are corrected for differences in reporting using an extended ordered probit model. For each country and health domain, we compare the corrected with the uncorrected age-sex standardised high to low education rate ratio for the absence of a health problem.

Results: Before correction for reporting differences, there is no significant disparity in health by education in 32 of 48 cases. There is a significant difference in reporting of health by education in 29 cases. Correcting for these differences generally increases health disparities (except for Spain and Sweden) and results in the emergence of significant inequalities in 18 cases. The greatest impact is in Belgium, Germany and The Netherlands, where disparities become significant only after adjustment in four of the six health domains.

Conclusions: Higher educated older Europeans are more likely to rate a given health state negatively. As a result, measured health inequalities by education are often underestimated, and even go undetected, if no account is taken of these reporting differences.

Keywords: health measurement, self-rated health, reporting differences, vignettes.

Introduction

The measurement of socioeconomic inequalities in health has made extensive use of self-rated measures of health.[1-9] The popularity of self-rated health (SRH) is driven by its low cost and feasibility in large-scale surveys, but is also justified by extensive evidence showing it to be a powerful predictor of mortality[10,11] and of medical care use.[12,13] There are, however, concerns that, besides containing valuable information on health status, SRH may vary with conceptions of what constitutes good health and expectations for own health.[14] If such beliefs and expectations vary with socioeconomic status, then differences in SRH will not provide an unbiased measure of socioeconomic inequality in health.

The problem is illustrated in Figure 1, which shows the hypothetical mapping between true health and the categorical responses of a SRH instrument for a representative high and low educated individual. All response thresholds are assumed higher for the more highly educated person and so, for any given true level of health, she will report worse health on the categorical scale. For example, if H^*_L and H^*_H represent the true health levels, then both report their health as "moderate" despite the fact that the more highly educated person has better true health. Relying on SRH would lead to the false conclusion of no socioeconomic inequality in health. If there are only data on SRH, it is not possible to disentangle the differences in reporting behaviour from those in true health and SRH measures potentially give a distorted picture of socioeconomic inequalities in health.

Figure 1 here

Differences in reporting of health by socioeconomic status may arise because individuals report their health relative to that of peers. In this case, differences in SRH would understate those in true health between socioeconomic groups. The same bias would arise if more highly educated individuals are better informed of treatment options and so are less tolerant of a given health condition. But the bias could also be in the opposite direction if, for example, health problems are reported as a justification for not working.[15]

Several studies have investigated reporting differences in SRH by demographic and socioeconomic status (SES). One approach has been to test whether the ability of SRH to predict mortality varies across socio-demographic groups. With respect to SES, the results from different countries are strikingly mixed.[16] Some studies have found no differences in the predictive ability of SRH by SES,[17,18] others have found SRH to be more strongly related to mortality at higher SES,[19,20] and still others have found the opposite.[21,22] Another approach has been to examine whether after controlling for a health indicator assumed to measure health objectively and comprehensively there is any systematic variation in SRH, which is argued to be attributable to reporting differences. Lindeboom and Van Doorslaer[23] using Canadian data found no evidence of reporting heterogeneity by education and income, while Etilé and Milcent[24] found some evidence in French data of reporting differences by income. The problem with these approaches is that objective indicators, such as mortality, may not be available and, in any case, do not capture health conditions that are not life threatening, while other indicators, like diseases or health limitations, are usually also self-reported and are potentially contaminated by the same measurement errors as SRH.[25,26]

As noted in a recent editorial in this journal,[16] a potentially attractive alternative is to identify reporting behaviour directly through the rating of case vignettes that describe a fixed levels of functioning within a given health domain.[27,28] Survey respondents are asked to rate these hypothetical cases on the same response scale as is used to evaluate their own health within that domain. If respondents evaluate the same hypothetical case differently, there is evidence of reporting differences. This makes it possible to identify systematic differences in response thresholds in relation to socio-demographic characteristics. Assuming that individuals rate the vignettes in the same way as they rate their own health (*response consistency*), the thresholds obtained from the vignette responses can be imposed on the model for reported own health, making it possible to identify differences in true health by SES and not merely a mixture of health and reporting differences. Having identified how reporting of health varies by SES, one can compute the health that each group would report if they all used the response thresholds of a reference group. That is, one can measure health on a comparable scale. For example, in terms of Figure 1, the health of the high education individual, H^*_H, could be re-labeled "good", while that of the low education individual would remain "moderate".

Bago d'Uva et al[29] have used the vignette approach to measure health inequalities in China, Indonesia and India. They found significant differences in the reporting of health by education and income, in addition to age, gender and rural/urban residence, that caused inequalities by education to be overestimated (except for China) and those by income to be underestimated.

The current study uses vignettes to test for reporting differences by education and to determine the impact on health disparities by education of correcting for such differences. This is done using data on older individuals in eight European countries. In ageing developed countries, most morbidity and mortality is concentrated among the older population and health inequalities within it have become the focus of an increasing number of studies.[6,7,30-32]

Methods

Study population

Our data are from the Survey of Health, Ageing and Retirement in Europe (SHARE), which randomly samples from the population aged 50 years and over (plus spouses) in 12 countries.[33,34] The first wave of SHARE contains data collected in 2004-05 and here we used the version that was released in June 2007 (Release 2.0). Supplementary samples containing the vignettes data are available for all but four countries. The data analysis is conducted separately for each of the following eight countries (sample size): Belgium (567), France (885), Germany (508), Greece (720), Italy (445), The Netherlands (538), Spain (464), Sweden (417).

Measures

Respondents were asked to classify their own health in six domains, in response to the questions: "Overall in the last 30 days, how much...": "of a problem did you have with moving around? (*mobility*); "difficulty did you have with concentrating or remembering things?" (*cognition*); "bodily aches or pains did you have?" (*pain*); "difficulty did you have with sleeping such as falling asleep, waking up frequently during the night or waking up too early in the morning?" (*sleep*), "of a problem did you have because of shortness of breath?" (*breathing*); "of a problem did you have with feeling sad, low, or depressed?" (*emotional health*). The response categories were: "None", "Mild", "Moderate", "Severe" and "Extreme". In addition, for each domain, respondents were asked to evaluate three vignettes, each describing a fixed level of difficulty in that domain, on the same response scale. The descriptions of the vignettes for all domains are given in the Supplementary Data published online with this article.

As an indicator of SES we use educational attainment based on the International Standard Classification of Education (ISCED 97): (i) finished at most primary education or first stage of basic education (ISCED 0-1); (ii) lower secondary or second stage of basic education (ISCED 2), (iii) upper secondary education (ISCED 3-4) and (iv) recognized third level education, which includes higher vocational education and university degree (ISCED 5-6).[35]

For Germany, the SHARE data do not distinguish between levels (i) and (ii). The lowest education group is used as the reference in the analysis. We control for age by means of a continuous variable. Because of relatively limited sample sizes, we control for sex by a dummy variable in the regression models, rather than estimating separate models for males and females.

Data analyses

For each country and domain, we first use an ordered probit model to estimate the association between self-reported health and educational level controlling for sex and age but not for reporting differences. From these estimates, we compute the highest to lowest education group rate ratio for the reporting no problem or difficulty in a given domain. We present these ratios for males at the sample mean age (64). We do not present results for females because we estimate a common model (controlling for sex), and so the rate ratios for males and females derive from the same education coefficients. We have nevertheless computed the rate ratios for women and, as expected, the results are consistent with those for men.

Rate ratios corrected for reporting differences between socio-demographic groups are computed from a hierarchical ordered probit (HOPIT) model,[28] in which the thresholds at which a given health state is reported as an extreme/severe/moderate/mild/no health problem are allowed to vary by age, sex and education level. The information to identify these socio-demographic varying reporting thresholds comes from the rating of the case vignettes. Having allowed for differences in reporting scales, the effect of education on reported own health gives the association with true health. We compute the corrected rate ratio from this association while setting the response thresholds of the highest education group equal to those of men aged 64 with the lowest level of education. We test for differences in response scales by educational level using a log-likelihood ratio test of joint significance of the three education dummy variables in the four response thresholds.[29]

All statistical analyses were performed with Stata 9.2. The ordered probit model was estimated using the Stata command *oprobit*, and for the estimation of the HOPIT model we used the code provided in Jones, Rice et al.[36] Rate ratios and their confidence intervals were obtained using the command *nlcom*.

Results

To give an impression of reporting differences by education group we present in Table 1, for The Netherlands, the proportion that classifies the vignette corresponding to the middle health state within each domain as representing no or mild difficulty. Except for *cognition*, the higher educated are much *less* likely, on average, to consider the health problem described in the vignettes as one of no or mild difficulty.

Table 1 here

At the 5% level, there are significant differences in the response scales by education in 29 of the 48 domain/country combinations (Table 2). Differential reporting by education is most marked in the domain of *mobility*, for which differences are significant in seven of the eight countries, and in France and The Netherlands, where differences are significant for all domains. Italy and Germany display the least evidence of differential reporting scales, with the education dummies being significant in only one and two domains respectively.

Table 2 here

Before adjustment for reporting differences, high to low education rate ratios for the reporting of no problem or difficulty with own health are generally greater than one but not significantly (5%) so in 32 of the 48 cases, including all domains in Sweden, The Netherlands and Belgium, and all but *pain* in Germany (Table 3). Adjusting the ratios for reporting differences raises their magnitude in 39 of the 48 cases, and results in them becoming significantly different from one in 18 cases (Tables 3 & 4). The impact of the adjustment is strongest for Belgium, France, Germany and The Netherlands, where it increases the rate ratio in all domains and turns an insignificant into a significant difference in three (France) or four (Belgium, Germany and The Netherlands) domains. Spain and Sweden differ from the other countries in that the higher education group rates a given health state more positively in three and four domains respectively, and consequently adjustment reduces the magnitude of the rate ratio, although it does not change the significance and the adjustment is small in the case of Spain. The rate ratio for *cognition* falls slightly and loses significance for Italy, but this is an artefact of the very small size of the highest education group. Rate ratios for the larger second and third education groups relative to the bottom do not display this pattern. In terms of uncovering significant inequalities, the adjustment for differential reporting scales has the greatest impact in the domains of *sleep* and *breathing*.

Tables 3 & 4 here

Discussion

This study uses ratings of case vignettes to examine the extent to which the reporting of health in six domains differs by educational level and the degree to which any such differences bias the measurement of health inequalities among the older population in eight European countries. We find clear evidence of reporting differences in most of the health domains and countries analysed. In general, more highly educated individuals are more critical of a given health state, although the opposite is true in Spain and Sweden for at least half of the health domains. In the remaining countries, failure to correct for differential reporting leads to underestimation of health inequalities by education. In particular, for Belgium and The Netherlands the uncorrected rate ratios show no significant inequalities by education in the probability of being free of a health problem or difficulty. But correction for differential reporting leads to an increase in the ratios for all domains and reveals significant inequalities to the advantage of the more highly educated in four of the domains. As a result, socioeconomic inequalities in health in Belgium and The Netherlands, and in France and Germany, appear greater relative to those in other European countries once account is taken of differential reporting. Correspondingly, health inequalities in Spain and, particularly, Sweden appear comparatively smaller after the correction.

The study adds to the literature on SRH in several respects. First, ratings of vignettes provide a more direct test of differential reporting than is possible, for example, by comparing the degree to which SRH predicts mortality by SES.[17-22] Second, the method not only provides a test for differential reporting, but also a means of correcting measured health inequalities for the phenomenon. Third, we are able to do this for a range of health domains, covering not only physical but also cognitive functioning and emotional behaviour the differential reporting of which may not be reflected in the relationship between SRH and mortality. Fourth, comparable data from a cross-national survey allows examination of the extent to which the direction and the magnitude of differential reporting by SES varies across cultural settings. While we find that reporting differences generally lead to an underestimation of socioeconomic inequalities in health, this is not always the case for Sweden and Spain, and there is variation over the remaining countries in the degree of underestimation. Therefore, correcting for systematic reporting biases may lead to different rankings of countries in international comparisons of health inequalities.

One limitation of the study is that we do not allow for the possibility that differential reporting by education varies between males and females. With the relatively limited sample sizes available, separate estimation of the model by gender would have reduced the precision of the estimates. However, we control for sex throughout the analysis, allowing both the level of health and reporting to differ by gender. A second limitation is that the analysis is restricted to the population aged 50 years and over. Although health inequality between older individuals is of fundamental interest given the concentration of morbidity in this population, future studies should investigate whether correcting for reporting differences has the same impact on measured socioeconomic inequalities in health within the population of younger adults. Because the data are limited to older adults, we chose education, rather than income, as the most appropriate indicator of SES.[7,32] With a younger sample, it would be interesting to test and correct for differential reporting by alternative indicators of SES such as occupation and income. A final, important limitation of the study is that it does not investigate reporting differences in the general SRH variable commonly used in the literature on socioeconomic inequalities in health, but in six more specific health domains. Reporting differences in general SRH may derive not only from the use of different scales to evaluate health within specific domains but also from differential weighting of the domains in the valuation of health overall.[37] For example, one might expect individuals employed in manual occupations to place greater weight on mobility functioning, while those engaged in professional occupations may place relatively greater weight in cognitive functioning. An important topic for future research is the development of a methodology to aggregate vignette corrected reports of specific health domains into a measure of general health that takes account of differential weighting of the domains.

One plausible interpretation of our main finding is that less well-educated individuals have lower health standards and expectations because they observe more health problems in their surrounding reference groups and adjust their norms accordingly.[20] But exposure to a higher prevalence of health problems need not reduce the tendency to report a given limitation. In a recent study on self-reported work disability, Van Soest et al[38] find that higher prevalence of work disability in one's reference group is associated with a greater likelihood of considering a given condition as work limiting. This is suggestive of peer effects reducing the threshold at which it is considered socially acceptable not to work because of a health problem. Contact with health services may also influence expectations for health.[39] Sutton et al[40] find that individuals are more likely to report illness if they have recently visited their GP. They argue that this may because patients receive more information regarding their health state, process this information more accurately or are advised that their illness should limit their activities.

Besides having implications for the measurement of health inequality, differential reporting of health by SES may point to a potentially important cause of this inequality. If lower expectations for health result in the less well-educated being less likely to report a given health condition in a survey, then it seems plausible that they will also be less inclined to take the preventive measures and the curative treatments that can protect and improve their health. Improved understanding of health reporting behaviour is therefore not only of interest from the rather technical perspective of measurement but also with respect to the substantive issue of identifying and rectifying the causes of socioeconomic inequality in health.

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Key Findings

- There is evidence of reporting differences by educational level for most health domains and countries analysed in this study.
- These reporting different lead mostly to the underestimation of educational disparities in health, except for Spain and Sweden.

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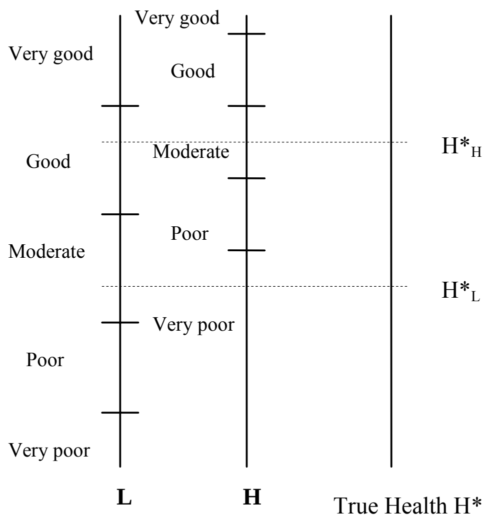

Figure 1: Self-reported health for high (H) and low (L) educated individuals. Level H^*_L is perceived by person L as "moderate" and by person H as "very poor". Level H^*_H is perceived by person L as "good" and by person H as "moderate". If persons L and H have health levels H^*_L and H^*_H, respectively, self-reports will be the same: "moderate".

Table 1: Proportions of respondents in The Netherlands who classify middle vignette as "no difficulties" or "mild difficulties" by educational level

Education level	Pain	Sleep	Mobility	Emotional	Cognition	Breathing
Primary	0.26	0.09	0.18	0.17	0.20	0.17
Lower secondary	0.15	0.08	0.14	0.10	0.17	0.06
Upper secondary	0.17	0.05	0.14	0.09	0.16	0.07
Tertiary	0.08	0.04	0.03	0.04	0.23	0.03

Table 2: Tests of different response scales by educational level

	p-value					
Country	Pain	Sleep	Mobility	Emotional	Cognition	Breathing
Belgium	0.006	0.002	0.012	0.011	0.943	0.042
France	0.000	0.000	0.000	0.000	0.000	0.001
Germany	0.189	0.743	0.010	0.879	0.941	0.013
Greece	0.000	0.000	0.008	0.185	0.002	0.000
Italy	0.786	0.040	0.276	0.487	0.352	0.102
Netherlands	0.032	0.000	0.000	0.000	0.003	0.000
Spain	0.118	0.108	0.049	0.031	0.452	0.600
Sweden	0.213	0.198	0.028	0.005	0.185	0.062

Notes: Likelihood ratio test of joint significance of all education dummy variables in the four response thresholds of the HOPIT model.

Table 3: High to low education rate ratios for no health problem or difficulty, with and without adjustment for reporting differences

Country		Rate ratio (95% confidence interval)					
		Pain	Sleep	Mobility	Emotional health	Cognition	Breathing
Belgium	unadjusted	1.13 (0.78 - 1.48)	1.11 (0.83 - 1.39)	1.06 (0.86 - 1.25)	1.10 (0.90 - 1.31)	1.05 (0.75 - 1.35)	1.09 (0.90 - 1.27)
	Adjusted	1.27 (0.89 - 1.66)	1.33 (1.04 - 1.63)	1.22 (1.02 - 1.42)	1.24 (1.03 - 1.45)	1.12 (0.76 - 1.48)	1.22 (1.00 - 1.45)
France	unadjusted	1.39 (1.08 - 1.70)	1.05 (0.84 - 1.25)	1.21 (1.06 - 1.35)	1.05 (0.91 - 1.19)	1.40 (1.13 - 1.66)	1.10 (0.95 - 1.24)
	Adjusted	1.54 (1.22 - 1.86)	1.32 (1.08 - 1.56)	1.33 (1.19 - 1.48)	1.23 (1.09 - 1.37)	1.61 (1.32 - 1.90)	1.27 (1.10 - 1.44)
Italy	unadjusted	1.77 (0.98 - 2.57)	1.09 (0.66 - 1.52)	1.53 (1.24 - 1.82)	1.43 (1.06 - 1.81)	1.57 (1.03 - 2.11)	1.24 (1.02 - 1.47)
	Adjusted	1.91 (1.06 - 2.75)	1.34 (0.88 - 1.80)	1.59 (1.32 - 1.85)	1.53 (1.19 - 1.88)	1.55 (0.99 - 2.11)	1.34 (1.18 - 1.51)
Germany	unadjusted	1.99 (1.14 - 2.84)	1.31 (0.94 - 1.68)	1.33 (0.95 - 1.71)	1.06 (0.81 - 1.32)	1.37 (0.92 - 1.81)	1.26 (0.97 - 1.56)
	Adjusted	2.08 (1.25 - 2.91)	1.42 (1.03 - 1.80)	1.44 (1.04 - 1.84)	1.14 (0.85 - 1.42)	1.52 (1.01 - 2.04)	1.40 (1.11 - 1.70)
Greece	unadjusted	1.23 (0.94 - 1.51)	1.29 (1.09 - 1.49)	1.03 (0.92 - 1.14)	1.34 (1.08 - 1.60)	1.37 (1.11 - 1.63)	1.15 (0.98 - 1.32)
	Adjusted	1.45 (1.14 - 1.76)	1.34 (1.12 - 1.57)	1.04 (0.92 - 1.16)	1.33 (1.05 - 1.61)	1.54 (1.26 - 1.83)	1.04 (0.81 - 1.27)
Netherlands	unadjusted	1.11 (0.77 - 1.44)	0.99 (0.74 - 1.24)	0.99 (0.79 - 1.19)	1.10 (0.88 - 1.33)	1.32 (0.88 - 1.76)	1.17 (0.93 - 1.40)
	Adjusted	1.35 (0.97 - 1.73)	1.31 (1.06 - 1.56)	1.18 (1.00 - 1.36)	1.38 (1.16 - 1.60)	1.39 (0.94 - 1.83)	1.40 (1.17 - 1.62)
Sweden	unadjusted	0.95 (0.77 - 1.14)	1.09 (0.89 - 1.29)	1.32 (0.91 - 1.73)	1.38 (0.98 - 1.79)	1.19 (0.94 - 1.44)	1.10 (0.81 - 1.39)
	Adjusted	1.02 (0.82 - 1.21)	1.07 (0.82 - 1.32)	1.08 (0.64 - 1.52)	1.27 (0.86 - 1.68)	1.03 (0.75 - 1.32)	1.38 (1.05 - 1.71)
Spain	unadjusted	1.44 (1.07 - 1.80)	1.40 (1.11 - 1.69)	1.37 (1.12 - 1.62)	1.26 (1.07 - 1.45)	1.60 (1.29 - 1.90)	1.12 (0.94 - 1.29)
	Adjusted	1.43 (1.02 - 1.84)	1.40 (1.06 - 1.75)	1.52 (1.25 - 1.79)	1.25 (1.02 - 1.47)	1.55 (1.21 - 1.89)	1.17 (0.95 - 1.38)

Notes: Probability of reporting no health problem or difficulty in each domain for the highest education group relative to the lowest. Unadjusted ratios estimated from the ordered probit model that imposes homogeneous reporting thresholds. Adjusted ratios estimated from the HOPIT model allowing reporting thresholds to vary by education, age and gender. All ratios computed for males at sample mean age (64).

Table 4: Direction of adjustment and change in significance of rate ratios for no health problem or difficulty after correcting for different response scales by educational level.

Country	Pain	Sleep	Mobility	Emotional	Cognition	Breathing
Belgium	▴	▲	▲	▲	▴	▲
France	▴	▲	▴	▲	▴	▲
Germany	▴	▲	▲	▴	▲	▲
Greece	▲	▴	▴	▴	▴	▾
Italy	▲	▴	▴	▴	▼	▴
Netherlands	▴	▲	▲	▲	▴	▲
Spain	▾	▴	▴	▾	▾	▴
Sweden	▴	▾	▾	▾	▾	▲

Notes: This table provides a graphical summary of the results given in Table 3.

▲ – High to low education rate ratio is insignificant (5%) before correction and becomes significantly greater than 1 after adjustment.

▴ – Rate ratio increases with the correction, but significance does not change (ie, either adjusted and unadjusted are significant, or both are insignificant).

▾ – Rate ratio decreases with adjustment but significance does not change.

▼ – Rate ratio is significant before adjustment and becomes insignificant with the adjustment.