Published by Oxford University Press on behalf of the International Epidemiological Association
International Journal of Epidemiology 2007;36:1207–1213
doi:10.1093/ije/dym095

SPECIAL THEME: SELF-RATED HEALTH

The predictive ability of self-assessed health for mortality in different educational groups

Martijn Huisman,[1,2]* Frank van Lenthe[1] and Johan Mackenbach[1]

Accepted 4 April 2007

Background The purpose of this study was to assess potential differences in the predictive ability of self-assessed health for mortality between educational groups, and to find explanations for any of these educational differences.

Methods We used data from the longitudinal GLOBE study, with a 13-year mortality follow-up. Analyses were performed for people aged between 25–74 years at baseline ($n = 16\,722$). The associations of self-assessed health with mortality were estimated with Cox regression analyses, and the resulting hazard ratios were used as indicators of the 'predictive ability' of self-assessed health for mortality. Differences between educational levels were estimated by including an interaction term of education with self-assessed health in regression models with mortality as the outcome. The analyses were subsequently adjusted for: life threatening chronic conditions, non-life threatening conditions, stressors and health behaviour, to test the contribution of these factors to the predictive ability of self-assessed health.

Results Results indicated that the predictive ability of self-assessed health for mortality was greater in men with tertiary education as compared with the lowest educated men. No differences were observed in women. None of the four health aspects accounted for the educational difference in men.

Conclusions Because differences in the predictive ability for mortality were limited to the extreme educational groups in men, educational differences in self-assessed health that are reported in numerous studies should not be expected to seriously overestimate educational differences in 'objective' health status.

Keywords Self-assessed health, mortality, socioeconomic position, education, predictive ability

Introduction

The existence of socioeconomic inequalities in health has been reported by numerous studies, many of them using self-reported outcomes of health.[1–6] The assumption of those studies is that inequalities in self-reported health reflect inequalities in the unmeasured 'true' state of health between socioeconomic groups. However, it appears that there are important differences in people's perception of health between socioeconomic groups.

Simon[7] found higher educated people to report aspects of well-being (a.o. happiness, feeling in control, feeling good) more often as important aspects when assessing their health, as compared with lower educated. Two older qualitative studies found that men and women from higher social groups more often used multi-dimensional information when assessing their health, including elements of being fit, being active and the absence of illness, whereas those from lower classes tended to limit themselves more to physical and functional aspects.[8,9] A recent study (2006) used anchoring vignettes to describe health states in terms of several health-related aspects, such as mobility, pain, self-care and others, to assess variations in the evaluation of different health states by socioeconomic position.[10] The results suggested that reporting heterogeneity tended to increase estimated inequalities in health by education level. This means that lower educated evaluate a given objective

[1] Department of Public Health, Erasmus MC, University Medical Center Rotterdam, PO Box 2040, 3000 CA Rotterdam, The Netherlands.

[2] Department of Psychiatry, University Medical Center Groningen, PO Box 30001, 9700 RB, Groningen, The Netherlands.

* Corresponding author. E-mail: martijn.huisman@med.umcg.nl
Martijn Huisman is guarantor of the study.

health status (as it is described by vignettes) on average as worse than higher educated do.

Thus, to fully understand the meaning of estimates of socioeconomic inequalities in self-reported health, we need to further study the differences in perceptions and in reporting of health between socioeconomic groups. One aspect of self-reported health that has been emphasised often in epidemiological studies is its capacity to predict mortality. Idler and Beyamini's seminal review of studies that assessed the association of self-assessed health with mortality showed that subjects who rate their health as poor have a two to five times higher risk of dying between two to 13 years of follow-up.[11]. A recent meta-analysis again confirmed the association, showing that persons reporting 'poor' health had a 2-fold higher mortality risk compared with persons reporting 'excellent' health.[12] But studies that have assessed the capacity of self-assessed health to predict mortality have not taken possible differences between socioeconomic groups into account. It might be that this capacity differs between socioeconomic groups.

Qualitative research not only hinted at possible differences between socioeconomic groups in the perception of health, it has demonstrated the 'multidimensionality' of people's view of health.[13–17] It is of importance to consider this multidimensionality when studying the capacity of self-assessed health to predict mortality, because not all dimensions of perceptions of health are also important for mortality. Stressors such as life events for instance, appear to be highly correlated with self-assessed health,[18] but they are less strongly related to mortality. Similarly, chronic conditions that can cause significant morbidity, but do not have high mortality (e.g. arthritis and arthrosis) can be expected to influence people's perception of their own health. Consequently, a study incorporating information on people's perception of health, on mortality during follow-up and additionally on measures of different dimensions of health will allow for the extra opportunity to assess the contribution of those different dimensions of health to potential socioeconomic differences in the capacity of self-assessed health to predict mortality. Theoretically, people with different educational backgrounds may emphasise different dimensions of health when assessing their overall level of health. For instance, if lower educated were to rely more on stressors that they experience in daily life when assessing and reporting their overall health, it might reduce the association of their self-assessed health with subsequent mortality as compared with that of higher educated.

This issue has been addressed in relation to sex differences, because the association of self-assessed health with mortality often appears less strong in women than in men.[17,19,20] Women appeared to rely more on a wider range of factors when forming a judgement about their overall health, including non-health related factors such as negative affect and non-life threatening diseases such as joint diseases, as compared with men.[21]

As far as we know, only two quantitative studies have investigated the association of self-assessed health with mortality in different socioeconomic groups.[22,23] Both studies used Swedish data. Burström and Fredlund[22] found that differences in the relative association of self-assessed health with mortality between five occupational groups were due to differences in the base level of mortality. Van Doorslaer and Gerdtham[23] did not find differences between educational and between income groups in the association. But it is important to investigate this issue in other cultural settings as well, as people's view on health is profoundly shaped by their cultural background.[24–26] The current study investigates whether there are differences in the capacity of self-assessed health to predict mortality by educational group in a population-based study in The Netherlands.

We used data from a longitudinal cohort study that was initiated in the beginning of the 1990s to study the explanations of socioeconomic inequalities in health in The Netherlands; the GLOBE study. This study has yielded detailed information on a broad spectrum of health aspects that may influence people's perception and reporting of their own health. For instance, the study provides information on specific chronic conditions, both life threatening and non-life threatening, health-related behaviours and stressors. This information allowed us not only to compare the capacity of self-assessed health to predict mortality between educational groups, but also to investigate possible explanations for any differences.

In brief, the aim of this study is to: (i) assess educational differences in the capacity of self-assessed health to predict mortality, and (ii) to estimate the contribution of several dimensions of health to any of these educational differences.

Methods

Study population

Our data are from the longitudinal GLOBE study, a longitudinal population-based study that has been conducted in the south of The Netherlands since 1991. More information on the design and objectives of the study can be found in another publication.[27] At baseline, a cohort of non-institutionalized men and women aged 15–74 years with the Dutch nationality was approached in the city of Eindhoven, and surrounding municipalities, for participation in the study. The response to the baseline postal questionnaire was 70.1% ($n = 18\,973$). From this sample, we selected people aged 25 and older ($n = 16\,722$), from which we excluded subjects with missing information on self-assessed health ($n = 558$), education ($n = 502$), and on any one or more of the health aspects ($n = 2443$). This left us with a total of 13 219 cases to be included in the analyses.

Vital statistics information from municipal population registries was obtained during follow-up, until 2004. The coverage of these municipal registries is virtually complete.[28] Within 13 years of follow-up a total of 1594 (12.1%) of the 13 219 subjects had died. No information on specific cause of death was available through these registries.

Measures

At baseline, people were asked to rate their health with the following non-comparative question: 'How is your health in general?', with answering categories: 'very good', 'good', 'fair', 'sometimes good and sometimes poor', 'poor'. This question was the first to be asked in the postal survey, and was thus not preceded by other questions about more specific and objective health issues.

Furthermore, people were asked to indicate whether they suffered from a range of chronic physical and mental

conditions during the past 5 years, and from somatic complaints. Life threatening chronic conditions and somatic complaints signalling life threatening underlying conditions were grouped together. These included the following: chronic bronchitis/asthma/emphysema/CARA, serious heart condition or myocardial infarction, hypertension, stroke, serious kidney disease (not kidney stones), diabetes, disease of the nervous system (like Parkinson, multiple sclerosis or epilepsy), malignancy or cancer, using medication for high blood pressure, experiencing pain in chest or heart area, experiencing shortness of breath.

Chronic conditions that are usually not life threatening, and somatic complaints that do not necessarily indicate any underlying life threatening conditions were also grouped together: gastric or duodenal ulcer, chronic illness of intestine, kidney stones, prostate problems, chronic back complaints/hernia/sciatica, arthrosis of knee or hip or hand, arthritis, other form of rheumatism, migraine, burn-out or depression or severe nervousness, chronic skin disease or eczema, varicose veins, injury because of an accident, experiencing pain in bones and muscle, having an upset stomach, having an aching back, often feeling tired, often having headaches, sometimes having a numb feeling in limbs, sometimes feeling faint, sometimes feeling listless, feeling tired sooner than normal, experiencing a puffy feeling in the stomach, usually not feeling rested in the morning, using sleeping medication or sedatives, usually not feeling fit and energetic.

People were also asked whether they experienced one or more of a small range of life events or stressors during the last 12 months preceding filling in the questionnaire: moving house, significant drop in financial situation, being a victim of theft/robbery/abuse/rape, becoming unemployed, partner or family member becoming unemployed, a serious illness of partner or close family member, death of partner, death of close family member or friend, divorce/separation.

Two measures of health behaviour were included: smoking and alcohol consumption. The smoking variable was based on the smoking status of subjects (whether or not they currently smoked or had ever smoked) and the amount smoked. The following values were assigned: 0 'never smoked', 1 'smoked in the past', 2 'only smokes pipe or cigars', 3 'smokes between 0 and 20 cigarettes a day' and 4 'smokes more than 20 cigarettes a day. Based on information on the frequency and the amounts that people indicated to drink alcohol, subjects were divided into three groups: abstainers, light to moderate drinkers and excessive drinkers.

We included information on education as an indicator of subjects' socioeconomic position. Level of education was defined as follows: (i) finished primary education or less, (ii) finished lower secondary education, (iii) finished higher secondary education, (iv) finished tertiary education (i.e. higher vocational education or university degree). Education was chosen because it consistently shows important inequalities in health across all countries, age groups and sexes. As such, it is a relevant indicator of a broad segment of the population, including those who are outside of the workforce.

Subjects were asked about their marital status. The following categories of marital status were distinguished: (a) married, (b) unmarried, (c) divorced/separated, (d) widowed.

Data analyses

We assessed the association of self-assessed health with mortality using Cox proportional hazards method of regression. These associations (Hazard Ratios) were used as indicators of the capacity of self-assessed health to predict mortality. This means that higher hazard ratios indicate stronger predictive capacity of self-assessed health for subsequent mortality. The age-adjusted association of self-assessed health with mortality was determined firstly for men and women separately, stratified by four educational groups. The presence of trends of mortality across self-assessed health in our data was assessed by entering self-assessed health as a continuous variable in the regression model, separately for each educational group.

Secondly, in a subsequent regression analysis, we included an interaction term of education with self-assessed health in the model instead of stratifying by educational group to assess differences in the association of self-assessed health and mortality between educational levels. For the purposes of testing interaction, the self-assessed health variable was included in the regression model as a continuous variable. The contribution of specific dimensions of health to any educational differences in the predictive capacity of self-assessed health was estimated with regression analyses adjusting for (i) life threatening conditions, (ii) non-life threatening conditions, (iii) life events and (iv) health behaviours, respectively. After adjusting for these factors we examined the adjustment in the interaction term of education and self-assessed health as compared with the unadjusted interaction estimate. In these analyses, we included the variable for marital status, which was considered to be a confounder.

Subjects whose smoking status, or whose drinking status was missing were left out of the analyses that included health behaviour variables in the regression model (i.e. when the contribution of health behaviour to educational differences in the predictive ability of self-assessed health was assessed). There was an educational gradient in the percentage of subjects with missing information on these variables. In those with primary education, 6.6% ($n = 181$) had missing values for alcohol use, and 1.3% ($n = 35$) for smoking. In those with tertiary education these percentages were 1.5% ($n = 38$) and 0.2% ($n = 6$), respectively.

Results

The number of subjects indicating that their health was bad was clearly greater in the lower educational groups, as was mortality (Table 1). Subjects with primary education had a higher crude risk of dying if they indicated that their health was 'Very good' (12.3% in primary educated, 3.8% in tertiary educated), but they had a lower crude risk of dying if they had indicated that their health was 'bad' (33.8% in primary educated, 35.3% in tertiary educated). These descriptive results already point toward a differing relation of self-assessed health with mortality between educational groups.

In all educational groups self-assessed health was a significant predictor of mortality (Table 2), with the exception of women with a higher secondary education. In that group, only women indicating that their health was 'bad' had a significantly higher level of mortality during follow-up as compared

Table 1 Number of subjects having 'Very good' and 'Bad' self-assessed health and number of deaths during follow-up, by education level; men and women combined, ages 25+

Education	*n* at baseline	*n* with 'Very good' health	*n* with 'Bad' health	Died during follow-up	*n* with 'Very good' health who died during follow-up	*n* with 'Bad health' who died during follow-up
Primary	2727	268 (9.8%)	71 (2.6%)	567 (20.8%)	33 (12.3%)	24 (33.8%)
Lower secondary	5272	836 (15.9%)	65 (1.2%)	553 (10.5%)	53 (6.3%)	22 (33.8%)
Higher secondary	2682	531 (19.8%)	25 (0.9%)	277 (10.3%)	35 (6.6%)	6 (24.0%)
Tertiary	2538	627 (24.7%)	17 (0.7%)	197 (7.8%)	24 (3.8%)	6 (35.3%)

Table 2 Associations of self-assessed health with mortality by education in men and women aged 25+, adjusted for age

	Men	Women
Stratified analyses		
Primary education		
Very good	1.00	1.00
Good	1.55 (0.91–2.66)	1.21 (0.73–2.01)
Fair	2.12 (1.23–3.67)	1.94 (1.16–3.25)
Sometimes good/ sometimes bad	2.94 (1.68–5.15)	2.47 (1.46–4.18)
Bad	3.65 (1.76–7.58)	4.20 (1.93–9.11)
Lower secondary education		
Very good	1.00	1.00
Good	1.09 (0.74–1.62)	1.41 (0.89–2.22)
Fair	2.07 (1.37–3.12)	1.63 (0.99–2.69)
Sometimes good/ sometimes bad	3.19 (2.07–4.93)	2.67 (1.57–4.57)
Bad	4.45 (2.22–8.91)	5.15 (2.49–10.66)
Higher secondary education		
Very good	1.00	1.00
Good	1.21 (0.75–1.95)	0.96 (0.52–1.76)
Fair	1.95 (1.15–3.30)	2.01 (0.99–4.08)
Sometimes good/ sometimes bad	2.90 (1.63–5.16)	2.14 (0.87–5.28)
Bad	2.35 (0.69–8.04)	8.55 (2.36–30.97)
Tertiary education		
Very good	1.00	1.00
Good	1.36 (0.83–2.14)	1.91 (0.63–5.83)
Fair	3.13 (1.85–5.30)	3.08 (0.80–11.85)
Sometimes good/ sometimes bad	4.30 (2.05–9.02)	2.36 (0.50–10.74)
Bad	9.87 (3.35–29.13)	3.43 (0.60–19.56)
Trend in mortality across self-assessed health[a]		
Primary	1.38 (1.24–1.55)	1.43 (1.26–1.62)
Lower secondary	1.60 (1.43–1.79)	1.40 (1.22–1.59)
Higher secondary	1.45 (1.24–1.69)	1.47 (1.15–1.88)
Tertiary	1.84 (1.54–2.21)	1.40 (1.01–1.93)

Note: [a]*P*-value linear trend test men of all educational groups 0.000; *P*-value linear trend test women of primary, lower secondary and higher secondary educational groups 0.000; *P*-value women of tertiary education 0.045.

with those who indicated that their health was 'very good'. Nonetheless, tests for trend in mortality across self-assessed health pointed out that a trend was present in all educational groups, in both men and women.

The interaction of education with self-assessed health was significant only in tertiary educated men (Table 3), meaning that the increase in mortality risk with a decrease in self-assessed health is somewhat larger in this education group as compared with the lowest education group. The hazard ratio of the interaction term amounted to about 1.3, indicating that the predictive ability of self-assessed health for mortality is some 30% stronger in the tertiary educated [See also Table 2: 1.84 (mortality across SAH in the tertiary educated)/1.38 (mortality across SAH in the primary educated)=1.33].

Theoretically it could still be the case that despite little differences in the strength of the association of self-assessed health with mortality between educational groups, we would find different mediators of this association across educational groups. This would mean that people from different educational backgrounds emphasize different aspects of health when they are evaluating their health and provide an answer to the self-assessed health question. For instance, lower educated have higher chances of dying from certain specific causes of death than higher educated,[29] which will reflect differences in their (ill-) health experience during their lives. However, none of the four types of health correlates (life-threatening, non-life threatening conditions, stressors and health behaviour) showed any remarkable effect on the interaction term of education with self-assessed health (Table 3). This does not mean that they are not mediators of the association of self-assessed health with mortality, because they are (adjusting for these factors attenuates the association of self-assessed health with mortality; data not shown)—it means just that they do not mediate the association differentially by education.

Thus, we observed that the self-assessed health of the highest educated men showed somewhat greater predictive ability for mortality during follow-up as compared with that of the lowest educated. However, none of the health aspects that were included in this study could account for this greater predictive ability. Otherwise, no differences were observed between educational groups.

Discussion

This study set out to investigate differences in the predictive ability of self-assessed health between educational groups, and to study the effect on this association of adjusting for respectively: (i) life threatening conditions, (ii) non-life threatening conditions, (iii) life events/stressors and (iv) health

Table 3 Interaction of education with self-assessed health in relation to mortality in men and women aged 25+, before and after adjustment for health-related aspects

	Base model; Age, education	Model 1; Base model + marital status	Model 2; Age + marital status + life threatening illness[a]	Model 3; Age + marital status + non-life threatening illness[b]	Model 4; Age + marital status + stressors[c]	Model 5; Age + marital status + smoking & alcohol use
Men						
Primary education	1.00	1.00	1.00	1.00	1.00	1.00
Lower secondary	1.15 (0.98–1.35)	1.15 (0.98–1.35)	1.18 (1.00–1.38)	1.10 (0.93–1.29)	1.15 (0.98–1.35)	1.15 (0.97–1.35)
Higher secondary	1.05 (0.87–1.27)	1.05 (0.87–1.27)	1.08 (0.89–1.31)	1.01 (0.83–1.23)	1.05 (0.87–1.27)	1.07 (0.88–1.31)
Tertiary education	1.33 (1.08–1.65)	1.31 (1.05–1.62)	1.31 (1.05–1.63)	1.35 (1.08–1.69)	1.31 (1.05–1.61)	1.33 (1.07–1.66)
Women						
Primary education	1.00	1.00	1.00	1.00	1.00	1.00
Lower secondary	0.98 (0.81–1.17)	1.00 (0.83–1.20)	1.02 (0.85–1.23)	0.99 (0.82–1.19)	1.01 (0.84–1.21)	1.03 (0.85–1.24)
Higher secondary	1.03 (0.78–1.35)	1.04 (0.79–1.36)	1.01 (0.77–1.32)	1.01 (0.77–1.33)	1.05 (0.80–1.37)	1.08 (0.82–1.43)
Tertiary education	0.98 (0.69–1.38)	0.99 (0.70–1.41)	0.93 (0.65–1.31)	0.98 (0.69–1.39)	1.01 (0.71–1.43)	1.00 (0.68–1.47)

[a]Prevalence of pain in chest and heart area, shortness of breath, medication use for high blood pressure, serious kidney disease, chronic lung disease, heart disease, hypertension, stroke, diabetes, disease of the nervous system (Parkinson, multiple sclerosis), malignancy/cancer.

[b]Prevalence of pain in muscles/bones, upset stomach, backache, fatigue, headache, numbness in limbs, dizziness, listlessness, sooner tired than normal, puffy feeling in stomach, not feeling refreshed when rising in the morning, sleeping medication/sedatives use, feeling energetic, ulcer, gallstones/gallbladder infection, chronic bowel problems, kidney stones, prostate problems, serious back problems, arthrosis, arthritis, other forms of rheumatism, migraine, burn-out/depression/nervousness, skin disease/eczema, varicose veins, injury because of accident.

[c]Prevalence of moving house, drop in financial situation, victim of crime, becoming unemployed, partner/family member becoming unemployed, illness of partner/family member, death of partner, death of a significant person (not partner), divorce.

behaviour. Only in men did we observe a difference in the predictive ability of self-assessed health between those with a tertiary level education and primary education. The predictive ability of self-assessed health was slightly larger in tertiary educated men as compared with men with primary education only. However, none of the four aspects of health that were included in the study could account for this difference.

Our study had several strengths and limitations. A strong point of our study was the sample size, which was large, in combination with the length of follow-up, which allowed us to investigate the association of self-assessed health with mortality in a population that was stratified by a fairly detailed educational variable. As our results indicate it is important to study differences between educational groups using a measure that is sensitive to the many gradations of the educational system, as an increased association of self-assessed health with mortality was observed in tertiary educated men, but not in higher secondary educated men, who often are also considered as being 'higher educated'. Yet, even in a study of this magnitude there are only limited numbers of deaths related to the extremes of 'very good' and 'bad' health in each education group. Preferably, the results of this study should be confirmed by other studies with even bigger numbers.

Another strong point of our study was that it included a broad range of both life threatening and non-life threatening chronic conditions, and we are confident that all relevant physical chronic conditions that may mediate the association of self-assessed health and mortality are represented in our data.

A limitation of the study was the lack of information on mental conditions and (negative) affect measures. Those measures are important correlates of self-assessed health, and they may 'obscure' the association of self-assessed health with mortality (in cases where they are not strongly related to mortality). The point of interest here would be whether such measures could account for the difference between tertiary educated men and lower educated men. In our study, people were asked whether or not they had suffered from 'burn-out, depression or nervousness'. Adjusting the analyses separately for this measure did not result in any attenuation of the interaction term of self-assessed health with education (data not shown), and thus did not account for the educational difference in men. However, this measure admittedly is a very broad and imprecise measure for our purposes in this regard, and future studies should assess the relative contribution of mental health to the association of self-assessed health and mortality in different educational groups.

Another limitation of our study was that we could not include detailed measures of social support, which is a factor that is important for health.[30,31] The analyses were adjusted for marital status, which is a partial proxy for social support, but leaves aside the quality of the relationship with the spouse, and possible other sources of social support inside and outside the family.

Finally, the non-response in our study should be considered. For some types of information used in the study, non-response was higher in the lower educated, such as for health-related behaviour. In general, the higher non-response in the lower educated probably means that the amount of health-problems and ill-health related behaviours has been slightly underestimated. Assuming that we would miss the lower educated with worst health disproportionately, i.e. those who would have indicated 'bad' self-assessed health and had higher risks of dying during follow-up, we consequently may have somewhat underestimated the association between the two in the lower educated. This is likely to be the case, for of $n = 558$ we missed information on self-assessed health (of which $n = 200$ primary educated, $n = 49$ tertiary educated and $n = 39$ with missing information on education). Of these, 25.5% of the primary educated had died, compared with 14.3% of the tertiary educated.

Our findings slightly depart from those of previous quantitative studies assessing the predictive ability of self-assessed health for mortality in different socioeconomic groups. Differences between socioeconomic groups were not observed in the study of Van Doorslaer *et al*.,[23] and it was concluded that self-assessed health was a valid health outcome measure for research on social comparisons of health. The study of Burstrom and Fredlund did show differences between socioeconomic groups in the relative association of self-assessed health with mortality, but because rate differences were not much different between these groups they concluded that the relative difference was due to the higher base rate of mortality in the lower groups.[22] The results of our study also demonstrate that there is a difference in the predictive ability of self-assessed health for mortality between the highest and the lowest educated men. However, when we checked the absolute differences in mortality rates between those with less than good self-assessed health and those with good or very good self-assessed health across educational groups we found larger absolute differences in the higher educated (even though mortality was lower). Thus, the educational difference in the relative association of self-assessed health with mortality in our data did not seem to be explained by the higher base rate in the lower educated.

Thus, in the event that our findings are replicated by future research, we should ask what the reasons could be for the observed difference. Firstly, as Sen[32] wrote when discussing 'problems' with self reports of health: 'One problem with relying on the patient's own view of matters that are not entirely sensory lies in the fact that the patient's internal assessment may be seriously limited by his or her social experience'.[32] Of course, this is an especially salient point for social comparisons of health as the experience of health greatly differs between social groups, as many studies have indicated. Studies using data from the longitudinal GLOBE study, the same data as we have used for our analyses, have been among this research.[33] It could be that there are no important differences in the aspects that mediate the association of self-assessed health with mortality, but that the lower educated adjust the threshold for incorporating information on health problems in their assessment of health, because they experience on average more health problems in their surroundings. Thereby, lower educated would incorporate the same information in their perception of health overall, only less accurately than the higher educated. On the other hand, it is not immediately clear why this would be the case in men, but not in women.

Our interest in educational differences in the self-assessed health-mortality association coincides with a recent trend in research on socioeconomic inequalities in health; i.e. incorporating concepts from the field of differential psychology in that research, such as the concept of intelligence.[34–36] For instance, Gottfredson[37] described how important aspects of life can be understood as complex tasks, of which the outcomes heavily rely on cognitive ability, and how this is relevant to the study of socioeconomic inequalities in health. Perhaps we should expect the same about forming a perception of such a broad and elusive concept as overall health. When forming a perception of health a number of cognitive processes may be involved, such as recall of relevant experience, evaluation of relevant information,[38] and employing judgmental heuristics which may be dependent on cognitive ability. Sadly, we did not have measures of cognitive ability to adjust for in our analyses, and can only speculate about its role in educational differences in assessing health. At this point, it seems hard to reason out why—if there was an important role for cognitive ability—the impact would remain limited to tertiary educated men (as we only found a difference in the predictive ability of self-assessed health for mortality between the highest and the lowest educated men).

At this stage, we can do no more than speculating. Assessing the relative importance of cognitive ability and cultural factors (and other possible explanatory factors) in perceptions of health in relation to socioeconomic position is left to future studies. However, we should await whether future research will replicate our findings. Future studies should investigate the effect of education on the predictive ability of self-assessed health for mortality in other cultural settings as well, and with other indicators of socioeconomic position, before taking effort in finding explanations.

In conclusion, this study found that the assessment of health of tertiary educated men carried a higher predictive value for mortality during follow-up. But because differences in the predictive ability for mortality were limited to the extreme educational groups in men, educational differences in self-assessed health that are reported in numerous studies should not be expected to seriously overestimate educational differences in 'objective' physical health problems.

Acknowledgements

The GLOBE study was financially supported by The Netherlands Health and Development Council (ZON), the Ministry of Public Health, Welfare and Sports, the Prevention Fund ('Praeventiefonds'), the former Ministry of Welfare, Public Health and Cultural Affairs, the Sick Fund Council ('Ziekenfondsraad'), The Netherlands Organisation for the Advancement of Research ('NWO'), Erasmus University Rotterdam and the National Commission for the Chronically Ill ('NCCZ').

Conflict of interest: None declared.

KEY MESSAGES

- The predictive ability of self-assessed health was slightly stronger in tertiary educated men compared to lowest educated men.
- Educational differences in the following health dimensions did not appear to account for this educational difference in men: (i) life threatening conditions, (ii) non-life threatening conditions, (iii) life events, and (iv) health behaviours.
- Because educational differences in the predictive ability of self-assessed health for mortality were only small, studies reporting educational differences in self-assessed health should not be expected to seriously overestimate differences in underlying 'true' health.

References

[1] Power C, Matthews S, Manor O. Inequalities in self-rated health: explanations from different stages of life. *Lancet* 1998;**351:**1009–14.

[2] Silventoinen K, Lahelma E. Health inequalities by education and age in four Nordic countries, 1986 and 1994. *J Epidemiol Community Health* 2002;**56:**253–58.

[3] Huisman M, Kunst AE, Mackenbach JP. Socioeconomic inequalities in morbidity among the elderly; a European overview. *Soc Sci Med* 2003;**57:**861–73.

[4] Koolman X, Van Doorslaer EKA. Explaining the differences in income-related health inequalities across European countries. *Health Econ* 2004;**13:**609–28.

[5] Kunst AE, Bos V, Lahelma E *et al*. Trends in socioeconomic inequalities in self-assessed health in 10 European countries. *Int J Epidemiol* 2005;**34:**295–305.

[6] Singh-Manoux A, Marmot MG, Adler NE. Does subjective social status predict health and change better than objective social status? *Psychosom Med* 2005;**67:**855–861.

[7] Simon J. How is your health in general? Qualitative and quantitative studies on self-assessed health and socioeconomic differences herein. Thesis, Erasmus University Rotterdam, 2002.

[8] d'Houtaud A, Field MG. The image of health: variations in perception by social class in a French population. *Soc Health Illness* 1984;**6:**30–60.

[9] Calnan M, Johnson B. Health, health risks and inequalities: an exploratory study of women's perceptions. *Soc Health Illness* 1985;**7:**55–75.

[10] Bago d'Uva T, Van Doorslaer E, Lindeboom M, O'Donnell O, Chatterji S. *Does reporting heterogeneity bias the measurement of health disparities? Tinbergen Institute Discussion Paper TI 2006-033/3*, 2006.

[11] Idler E, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav* 1997;**38:**21–37.

[12] DeSalvo KB, Bloser N, Reynolds K, He J, Muntner P. Mortality prediction with a single general self-rated health question; a meta-analysis. *J Gen Intern Med* 2005;**20:**267–75.

[13] Krause N, Jay G. What do global self-rated health items measure? *Med Care* 1994;**32:**930–42.

[14] Borawski-Clark EA, Kinney JM, Kahana E. The meaning of older adults' health appraisals: congruence with health status and as determinants of mortality. *J Gerontol* 1996;**51b:**S157–70.

[15] Manderbacka K. Examining what self-rated health is understood to mean by respondents. *Scand J Soc Med* 1998;**38:**299–308.

[16] Idler E, Hudson SV, Leventhal H. The meanings of self-ratings of health. A qualitative and quantitative approach. *Res Aging* 1999;**21:**458–76.

[17] Benyamini Y, Blumstein T, Lusky A, Modan B. Gender differences in self-rated health-mortality association: is it poor self-rated health that predicts mortality or excellent self-rated health that predicts survival? *Gerontologist* 2003;**43:**396–405.

[18] Singh-Manoux A, Martikainen P, Ferrie J, Zins M, Marmot M, Goldberg M. What does self-rated health measure? Results from the British Whitehall II and French Gazel cohort studies. *J Epidemiol Community Health* 2006;**60:**364–72.

[19] Idler EL. Discussion: gender differences in self-rated health, in mortality, and in the relationship between the two. *Gerontologist* 2003;**43:**372–25.

[20] Spiers N, Jagger C, Clarke M, Arthur A. Are gender differences in the relationship between self-rated health and mortality enduring? Results from three birth cohorts in Melton Mowbray, United Kingdom. *Gerontologist* 2003;**43:**406–11.

[21] Benyamini Y, Leventhal EA, Leventhal H. Gender differences in processing information for making self-assessments of health. *Psychosom Med* 2000;**62:**354–64.

[22] Burstrom B, Fredlund P. Self rated health: is it as good a predictor of subsequent mortality among adults in lower as well as in higher social classes? *J Epidemiol Community Health* 2001;**55:**836–40.

[23] Van Doorslaer E, Gerdtham U-G. Does inequality in self-assessed health predict inequality in survival by income? Evidence from Swedish data. *Soc Sci Med* 2003;**57:**1621–29.

[24] Appels A, Bosma H, Grabauskas V, Gostautas A, Sturmans F. Self-rated health and mortality in a Lithuanian and a Dutch population. *Soc Sci Med* 1996;**42:**681–89.

[25] Jylha M, Guralnik J, Ferrucci L, Jokela J, Heikkinen E. Is self-rated health comparable across cultures and genders? *J Gerontol B Psychol Sci Soc Sci* 1998;**53:**S144–52.

[26] Salomon JA, Tandon A, Murray CJL. World Health Survey Pilot Study Collaborating Group. Comparability of self rated health: cross sectional multi-country survey using anchoring vignettes. *Brit Med J* 2004;**328:**258–63.

[27] Mackenbach JP, Van de Mheen H, Stronks K. A prospective cohort study investigating the explanation of socio-economic inequalities in health in The Netherlands. *Soc Sci Med* 1994;**38:**299–308.

[28] Schrijvers C, Stronks K, Van de Mheen HD, Mackenbach JP. Explaining educational differences in mortality: the role of behavioural and material factors. *Am J Public Health* 1999;**89:**535–40.

[29] Huisman M, Kunst A, Bopp M *et al*. Educational inequalities in cause-specific mortality in middle-aged and older men and women in eight western European populations. *Lancet* 2005;**365:**493–500.

[30] Berkman LF, Syme L. Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda county residents. *Am J Epidemiol* 1979;**109:**186–204.

[31] Lett HS, Blumenthal JA, Babyak MA, Strauman TJ, Robins C, Sherwood A. Social support and coronary heart disease: epidemiologic evidence and implications for treatment. *Psychosom Med* 2005;**67:**869–78.

[32] Sen A. Health: perception versus observation. *Brit Med J* 2002;**324:**860–61.

[33] Van Lenthe FJ, Schrijvers CTM, Droomers M, Joung IMA, Louwman MJ, Mackenbach JP. Investigating explanations of socio-economic inequalities in health: The Dutch GLOBE study. *Eur J Public Health* 2004;**14:**63–70.

[34] Deary I. Intelligence, health and death. *Psychologist* 2005;**18:**610–3.

[35] Singh-Manoux A, Ferrie JE, Lynch JW, Marmot M. The role of cognitive ability (intelligence) in explaining the association between socioeconomic position and health: Evidence from the Whitehall II prospective cohort study. *Am J Epidemiol* 2005;**161:**831–39.

[36] Batty GD, Der G, Macintyre S, Deary IJ. Does IQ explain socio-economic inequalities in health? Evidence from a population based cohort study in the west of Scotland. *Brit Med J* 2006;**332:**580–84.

[37] Gottfredson L. Why g matters: the complexity of everyday life. *Intelligence* 1997;**24:**79–132.

[38] Redelmeier DA, Tu JV, Schull MJ, Ferris LE, Hux JE. Problems for clinical judgment 2: obtaining a reliable past medical history. *Can Med Ass J* 2001;**164:**809–13.