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SOCIAL DETERMINANTS

Does self-rated health predict death in adults aged 50 years and above in India? Evidence from a rural population under health and demographic surveillance

Siddhivinayak Hirve,[1]* Sanjay Juvekar,[1] Somnath Sambhudas,[1] Pallavi Lele,[1] Yulia Blomstedt,[2] Stig Wall,[2] Lisa Berkman,[3] Steve Tollman[4] and Nawi Ng[5]

[1]Vadu Rural Health Program, KEM Hospital Research Centre, Pune, Maharashtra, India, [2]Department of Public Health and Clinical Medicine, Umeå University, Umeå, Sweden, [3]Harvard Center for Population and Development Studies, Harvard University, Boston, MA, USA, [4]Health and Population Division, School of Public Health, University of Witwatersrand, Johannesburg, South Africa and [5]Department of Public Health and Clinical Medicine, Umeå Centre for Global Health Research, Umeå, Sweden

*Corresponding author. Vadu Rural Health Program, KEM Hospital Research Centre, Vadu Budruk, Shirur, Pune 412216, Maharashtra, India. E-mail: sidbela@vsnl.com

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Background The Study on Global Ageing and Adult Health (SAGE) aims to improve empirical understanding of health and well-being of adults in developing countries. We examine the role of self-rated health (SRH) in predicting mortality and assess how socio-demographic and other disability measures influence this association.

Methods In 2007, a shortened SAGE questionnaire was administered to 5087 adults aged $\geqslant$50 years under the Health Demographic Surveillance System in rural Pune district, India.

Respondents rated their own health with a single global question on SRH. Disability and well-being were assessed using the WHO Disability Assessment Schedule Index, Health State Score and quality-of-life score. Respondents were followed up every 6 months till June 2011. Any change in spousal support, migration or death during follow-up was updated in the SAGE dataset.

Results In all, 410 respondents (8%) died in the 3-year follow-up period. Mortality risk was higher with bad/very bad SRH [hazard ratio (HR) in men: 3.06, 95% confidence interval (CI): 1.93–4.87; HR in women: 1.64, 95% CI: 0.94–2.86], independent of age, disability and other covariates. Disability measure (WHO Disability Assessment Schedule Index) and absence of spousal support were also associated with increased mortality risk.

Conclusion Our findings confirm an association between bad/very bad SRH and mortality for men, independent of age, socio-demographic factors and other disability measures, in a rural Indian population. This association loses significance in women when adjusted for disability. Our study highlights the strength of nesting cross-sectional surveys within the context of the Health Demographic Surveillance System in studying the role of SRH and mortality.

Keywords Ageing, self-rated health, mortality

Introduction

Self-rated health (SRH) is a widely used measure by which a person reflects and intuitively summarizes his/her own health state.[1–6] It is based on a respondent's evaluation of his/her health status on a Likert scale using a global health question ('In general, how would you rate your health today?'). The pathways behind SRH are unclear. One theory suggests that the person first recognizes in his/her own way the 'meaning of health'; identifies the different components of 'my health' based on ability to function physically, body feelings, pain and sensations, signs of disease, diagnosed health problems, preventive health behaviours and risks and strengths for future health; and then processes this information in the context of age, earlier health experience, health states of his/her peers and finally his/her own health expectations. He/she then summarizes this mass of information into a single rating on a 5-point category scale based on his/her understanding of the scale, his/her emotions at the time of self-rating and cultural conventions and norms of reporting health states.[7] SRH, although non-specific in its measurement, is an all-inclusive and reliable measure of health that is sensitive to the person's perception of health and complements other more specific measures of health. However, relying on it solely in assessing or evaluating health care may be misleading.[8,9] SRH is known to decline as age advances, and women are more likely than men to report poor SRH.[10] This association is likely to be mediated through limitations in functional ability and disease.[11–13] The socio-economic environment shapes perception of health, as does the body.[14] Individuals with no education and low financial security report poor SRH.[15–18] The role of social support and social network is less clear. Family kinship, marital stability, social class, social capital and social participation are associated with good SRH.[19–23] On the other hand, social support is less predictive of SRH when controlling for economic status.[24]

A strong association between poor SRH and increased risk of all-cause and disease-specific mortality independent of age, sex, income, education, social networking, health practices, objective health status and chronic illness has been consistently reported from North America and Europe.[25–33] Similar associations have been seen in Japan, China and Indonesia.[34–37] The predictive ability of SRH for mortality may be sensitive to the cultural environment, and hence, cross-cultural comparisons must be made with caution.[38] A meta-analysis of 22 cohort studies shows a 2-fold risk for all-cause mortality for those reporting 'poor' health status.[39] Poor SRH is a strong indicator of mortality across all socio-economic strata.[40] However, how SRH predicts mortality is not clear, although there is evidence from rich countries that high levels of disability, illness and poor physical and cognitive performance influence this association.[41] Disease and disability affect body function, activities of daily living and social networking, which in turn affect SRH and mortality.[11,14,22,23,42] It is not known whether socio-economic status and/or disability play a role as health determinants that reduce the predictive influence of SRH on mortality in low- and middle-income countries. A major gap in our knowledge about SRH is whether its meaning, evaluation and ability to predict subsequent mortality or other objective indicators of health status are similar in developing countries such as India to those seen in highly industrialized Western countries. Owing to limited resources, unreliable mortality statistics and lack of infrastructure for conducting longitudinal research and long-term follow-up of population cohorts, only a few studies have linked SRH to mortality in less-developed countries.[35,43,44]

The Study on Global Ageing and Adult Health (SAGE) is designed by the WHO to provide longitudinal evidence to improve understanding of health and well-being of adults aged $\geqslant$50 years in developing countries. This article examines the role of SRH in predicting mortality within the context of a rural Indian population under the Health and Demographic Surveillance System (HDSS). We assess how socio-demographic characteristics and other self-reported health/disability measures influence this prediction.

Methods

Study area and study sample

The first wave of the SAGE survey was conducted in six developing countries (China, Ghana, Mexico, South Africa, Russian Federation and India) based on methodologies adapted from the World Health Survey.[45] In 2007, a shortened version of SAGE was designed for use among adults aged $\geqslant$50 years in eight HDSS sites (including Vadu HDSS) within the INDEPTH network.[46] In Vadu HDSS, deaths, births, migrations and change in marital status are enumerated on a census basis every 6 months, covering a population of ~100 000 over 22 villages. A simple random sample of 6000 individuals from 14 749 aged $\geqslant$50 years was drawn from the HDSS database for potential enrolment in SAGE in 2007. Trained graduate researchers administered SAGE short version in Vadu participants' homes.

Measures

Mortality among SAGE respondents subsequent to the survey was the outcome of interest. Person-years of follow-up were estimated for all respondents from the date of the SAGE interview until death or censoring (out-migration or last HDSS visit before the end of follow-up period on 30 June 2011).

Our primary predictor was the global SRH question using a 5-point Likert scale, ranging from 1 to 5, where 1 indicates very good health and 5 indicates very bad health. Because of small numbers in the

extreme categories, we recoded SRH into three categories, which were 'very good/good', 'moderate' and 'bad/very bad'. Three additional self-report health measures, based on limitations of functional activity and subjective well-being in the absence of medical diagnosis, were included. The WHO Health State Score (WHO-HSS) was based on questions from eight health domains; each domain had two questions. Item response theory in Winsteps was used to derive a Rasch summary score. This score was transformed to a scale of 0–100 (where 0 indicates best health status and 100 indicates worst health status). The shortened 12-item version of the WHO Disability Assessment Schedule (WHO-DAS) assessed six domains of functioning in daily life (understanding and communicating, getting around, self-care, getting along with others, life activities and participation in society).[47] The weighted mean of 12 responses was transformed into a final score ranging from 0 to 100 (where 0 indicates no disability and 100 indicates extreme disability). The WHO quality-of-life (WHO-QoL) score was a mean of eight responses to questions on overall happiness and satisfaction with health, living conditions and other aspects of life, with a range of 1–5 (where 1 indicates best and 5 indicates worst quality of life). We used *z*-score transformations of WHO-HSS, WHO-DAS and WHO-QoL measures to allow for easier comparison of the results for these health scores.

The SAGE data were linked to the 2007 HDSS database to add socio-demographic covariates, including age, education, socio-economic status, marital status and family size. Age was categorized in 10-year intervals. Education was categorized into three groups: primary or less, secondary and higher secondary or more. As part of HDSS, socio-economic status of all households in the study area had been separately assessed based on the Indian National Family Health Survey 'Standard of Living Index' (SLI), where the facilities (e.g. toilet, electricity, drinking water source) and physical items (e.g. land and livestock ownership, material assets like refrigerator) of each household were given weighted scores and summed. Finally, all households in HDSS were assigned to quintile groups based on the summary score. Family size was a count of the members of the household. Spousal support was based on the marital status of the respondent and death or out-migration status of the spouse from subsequent rounds of HDSS database.

Statistical methods

The socio-demographic profile, SRH and other health and disability measures based on self-report (WHO-HSS, WHO-DAS and WHO-QoL) were compared between men and women using Student's *t*-test and chi-square tests of significance. Mortality rates stratified by socio-demographic characteristics were estimated separately for men and women. Hazard ratios (HRs) for SRH stratified by gender and individual socio-demographic characteristics were estimated using Cox's proportional hazards regression in STATA. We confirmed the proportional hazards assumption with the 'stphtest' command in STATA and Schoenfeld's plot of residuals against time for each covariate (results not shown). First, we estimated HR for age and for SRH adjusted for age and stratified by sex (Model 1). We then modelled SRH with the socio-demographic variables, adjusted for age and stratified by sex (Model 2). We confirmed there was no multi-collinearity (variance inflation factor for each measure <10) between the different WHO health and disability measures (WHO-DAS, WHO-HSS and WHO-QoL) and included them in the final model (Model 3). As socio-demographic characteristics and disability may modify the effect of SRH on mortality, we tested for interaction between SRH and spousal support, education, socio-economic status and WHO-DAS measure in predicting mortality.

Results

Of a random sample of 6000 individuals from the HDSS database, 568 could not be traced (out-migrations or incorrect/incomplete address) for interview, hence 5432 (91%) individuals aged $\geqslant 50$ years were included in the survey. In the process of linking the SAGE database with HDSS data, 294 individuals were excluded because their identity information could not be matched with the HDSS records. A further 51 individuals were excluded from analysis owing to missing or inconsistent responses on critical variables like age or date of death. The results are based on the analysis of 5087 (85%) respondents aged $\geqslant 50$ years who completed the SAGE survey in 2007, with follow-up through routine HDSS surveillance till June 2011. The socio-demographic profile of those in the original sample excluded from the analysis was similar to that of individuals included in the final analysis (results not shown). Spousal support changed in 14 respondents (0.3%) during the follow-up period, and the most recent spousal status was used in the analysis.

Table 1 compares the socio-demographic characteristics of SAGE participants by sex. Men were ~0.6 years older than women and were more likely to report better health and lesser disability. Men were also better educated than women. A higher proportion of women (44.9%) had no spousal support compared with men (13.3%). The proportion of men and women in the richest quintile was ~30% compared with ~10–12% in the poorest quintile. There was no difference in the socio-economic status of households between men and women. WHO-HSS, WHO-DAS and WHO-QoL measures were worse for older men and women compared with their younger counterparts.

A total of 410 (232 men, 178 women) respondents died in the 3-year follow-up period. There was no significant difference between mortality rates for men

Table 1 Socio-demographic profile of SAGE participants, Vadu, India

Respondent characteristics	Men ($n=2651$)	Women ($n=2436$)	*P*-value
Mean age in years (SD)	63.4 (0.17)	62.8 (0.18)	0.034
Age group (%)			0.047
50–59 years	37.8	37.6	
60–69 years	37.1	40.1	
70–79 years	19.8	17.1	
80+ years	5.3	5.2	
SRH (%)			0.000
Very good	4.3	2.8	
Good	56.5	48.3	
Moderate	35.8	44.1	
Bad	3.3	4.7	
Very bad	0.2	0.2	
Education (%)			0.000
Primary or less	84.7	97.7	
Secondary	10.5	1.5	
Higher secondary or more	4.9	0.8	
Spousal support (%)			0.000
With spousal support	86.7	55.1	
Without spousal support	13.3	44.9	
Socio-economic status (%)			0.066
First (poorest) quintile	10.6	12.5	
Second quintile	15.2	14.9	
Third quintile	20.9	22.7	
Fourth quintile	22.4	19.7	
Fifth (richest) quintile	30.9	30.3	
Mean family size (SD)	8.0 (0.08)	7.7 (0.08)	0.008
Mean WHO-HS score[a] (SD)			
50–59 years	30.3 (11.13)	32.7 (9.70)	0.000
60–69 years	32.2 (9.72)	34.1 (8.74)	0.000
70–79 years	34.2 (8.92)	35.2 (8.59)	0.074
80+ years	34.1 (9.81)	37.4 (8.95)	0.005
All ages	32.0 (10.24)	33.9 (9.17)	0.000
Mean WHO-DAS score[b] (SD)			
50–59 years	20.1 (13.15)	22.6 (13.59)	0.000
60–69 years	21.7 (13.83)	24.7 (13.61)	0.000
70–79 years	24.7 (14.02)	27.2 (14.24)	0.008
80+ years	25.2 (15.20)	30.2 (17.70)	0.014
All ages	21.9 (13.81)	24.6 (14.09)	0.000
Mean WHO-QoL score[c] (SD)			
50–59 years	1.98 (0.358)	2.02 (0.361)	0.006
60–69 years	2.01 (0.375)	2.04 (0.359)	0.064
70–79 years	2.07 (0.403)	2.07 (0.422)	0.955
80+ years	2.02 (0.431)	2.13 (0.486)	0.046
All ages	2.01 (0.379)	2.04 (0.379)	0.002

[a]Range: 0–100; 100 = worst health state.
[b]Range: 0–100; 100 = most disability.
[c]Range: 1–5; 1 = very good, 5 = very bad.
SD, standard deviation.

and women (31.1 and 26.2 per 1000 person-years, respectively; $P=0.082$). Mortality rate increased with age and was higher for men than for women across all age groups except among those aged $\geqslant 80$ years (Table 2). Mortality rate decreased as education level increased in men and women; however, in the most educated women, the mortality rate was high but unreliable with very wide confidence intervals (CIs). Overall, mortality was higher for those without spousal support compared with those with spousal support, more so for men than women (63.4 and 40.8 per 1000 person-years, respectively). Mortality was higher in poorer socio-economic status groups compared with richer groups in both men and women.

Table 3 shows the mortality hazard for SRH stratified by each socio-demographic characteristic separately. The mortality hazard was significantly higher for men who reported poor/very poor SRH compared with those who reported very good/good SRH across all age groups (HR ranged from 2.92 to 5.51). An increased but non-significant mortality hazard was also seen in women. Mortality hazard was significantly higher for men (HR: 4.97) and women (HR: 2.64) with primary or less education and who reported poor/very poor SRH compared with those who reported very good/good SRH. Mortality hazard could not be reliably ascertained for women with more than primary education because of very small numbers. Increased mortality hazard was seen for both men and women across all socio-economic status groups, although this increased mortality hazard was significant only for men who reported poor/very poor SRH.

Table 4 shows the HR for SRH stratified by sex with covariates added in three steps. Model 1 shows the mortality hazard for SRH stratified by sex and adjusted for age. Mortality hazard increased significantly as age increased in both men and women. Mortality hazard was higher for those with 'bad/very bad' SRH compared with those with 'very good/good' SRH independent of age (HR: 4.11; 95% CI: 2.72–6.23 in men; HR: 2.18; 95% CI: 1.31–3.62 in women).

In Model 2, after adjusting for socio-demographic variables, the same trend for SRH as in Model 1 (higher mortality hazard for those with bad/very bad SRH) was seen in both men and women. Mortality hazard decreased significantly by 4% (HR: 0.96; 95% CI: 0.93–0.99) with each unit increase in family size among men but not women. Mortality hazard was lower among richer socio-economic status groups in both men and women, but this trend was not significant. Education was not a significant predictor of mortality.

In the final model (Table 4), we added the WHO health and disability measures. In men, the mortality hazard for 'bad/very bad' SRH was 3.06 (95% CI: 1.93–4.87), attenuated from 4.23 in Model 2. In women, although mortality hazard was higher in

Table 2 Mortality rate per 1000 person-years among men and women aged ⩾50 years, stratified by socio-demographic characteristics, Vadu, India

Respondent characteristics	Men Mortality rate	95% CI	Women Mortality rate	95% CI
Age (years)				
50–59	12.1	8.6–16.7	11.1	7.5–15.7
60–69	28.1	22.4–34.9	22.0	16.9–28.1
70–79	60.2	48.5–74.0	46.5	35.2–60.4
80+	89.9	62.9–124.8	115.8	82.3–158.5
Education				
Primary or less	32.1	27.9–36.7	26.1	22.4–30.2
Secondary	26.1	16.4–39.7	23.5	3.9–77.7
Higher secondary or more	24.5	11.4–46.6	41.7	7.0–137.7
Spousal support				
With spousal support	26.4	22.7–30.6	14.7	11.2–18.9
Without spousal support	63.4	48.8–81.1	40.8	34.0–48.6
Socio-economic status				
First (poorest) quintile	46.2	31.7–65.1	39.8	26.7–57.1
Second quintile	36.2	25.6–49.8	24.8	15.8–37.3
Third quintile	35.1	26.0–46.4	25.9	18.2–35.8
Fourth quintile	29.1	21.4–38.9	27.6	19.2–38.5
Fifth (richest) quintile	26.7	20.2–34.5	23.0	16.7–30.9

those with bad/very bad SRH, this was no longer significant (HR: 1.64; 95% CI: 0.94–2.86). Among the WHO scores, only WHO-DAS score (in both men and women) and WHO-QoL score (in women only) were significant predictors of mortality independent of SRH and socio-demographic covariates (results not shown). Mortality hazard was significantly higher in men and women with higher disability. A unit increment in WHO-DAS *z*-score increased the mortality hazard by 23% (HR: 1.23; 95% CI: 1.08–1.40) in men and by 16% (HR: 1.16; 95% CI: 1.01–1.33) in women. Neither WHO-QoL nor WHO-HSS remained significant predictors of mortality when adjusted for WHO-DAS. Lack of spousal support was significantly and independently associated with higher mortality hazard in men (HR: 1.67; 95% CI: 1.23–2.26) and women (HR: 1.71; 95% CI: 1.21–2.41). There was no significant interaction between socio-demographic covariates (spousal support, socio-economic status, education) or disability measure (WHO-DAS) and SRH in predicting mortality either in men or women (results not shown).

Discussion

Our study confirmed that 'bad/very bad' SRH was a strong predictor of mortality for rural Indians aged ⩾50 years. This association was independent of age,

Table 3 Mortality HR for SRH (95% CIs in parenthesis) among men and women aged ⩾50 years, stratified by each individual socio-demographic characteristic, Vadu, India

Respondent characteristics	Men HR (95% CI) Very good/Good SRH	Moderate SRH	Poor/Very poor SRH	Women HR (95% CI) Very good/Good SRH	Moderate SRH	Poor/Very poor SRH
Age (years)						
50–59	1.0	0.67 (0.3–1.5)	3.81* (1.1–12.7)	1.0	1.16 (0.6–2.5)	1.14 (0.2–8.7)
60–69	1.0	1.37 (0.9–2.2)	2.92* (1.2–6.9)	1.0	1.08 (0.6–1.9)	2.73* (1.2–6.3)
70–79	1.0	2.15*** (1.4–3.4)	5.51*** (2.8–10.7)	1.0	1.46 (0.8–2.6)	1.96 (0.7–5.2)
80+	1.0	0.81 (0.4–1.8)	3.89** (1.6–9.4)	1.0	1.05 (0.5–2.2)	2.05 (0.8–5.4)
Education						
Primary or less	1.0	1.55** (1.2–2.1)	4.97*** (3.2–7.7)	1.0	1.21 (0.9–1.7)	2.64*** (1.6–4.4)
Secondary	1.0	1.13 (0.4–3.0)	8.69** (1.9–38.9)	1.0	–	–
Higher secondary +	1.0	1.78 (0.4–8.0)	8.24 (0.9–73.9)	1.0	–	–
Spousal support						
Spousal support	1.0	1.41* (1.0–1.9)	6.09*** (3.9–9.5)	1.0	1.95* (1.1–3.4)	4.20** (1.6–11.1)
No spousal support	1.0	1.43 (0.8–2.4)	2.37 (0.8–6.8)	1.0	0.88 (0.6–1.3)	1.83* (1.0–3.3)
Socio-economic status						
First (poorest) quintile	1.0	1.49 (0.7–3.3)	5.16** (1.8–14.9)	1.0	1.02 (0.5–2.3)	1.91 (0.5–6.8)
Second quintile	1.0	1.34 (0.6–2.9)	7.51*** (3.2–17.6)	1.0	0.76 (0.3–2.0)	2.05 (0.6–7.4)
Third quintile	1.0	1.11 (0.6–2.0)	1.58 (0.5–5.2)	1.0	1.22 (0.6–2.5)	2.48 (0.7–8.6)
Fourth quintile	1.0	2.63** (1.4–4.9)	4.87* (1.4–16.5)	1.0	2.92*** (1.4–6.2)	–
Fifth (richest) quintile	1.0	1.40 (0.8–2.5)	7.48*** (3.2–17.2)	1.0	1.18 (0.6–2.3)	4.65*** (1.8–11.8)

Note: * = *P*-value < 0.05; ** = *P*-value < 0.01; *** = *P*-value < 0.001.

Table 4 Factors influencing mortality in adults aged ⩾50 years (Cox proportional HR), stratified by sex, Vadu, India

Respondent characteristics	Men			Women		
	Model 1[a]	Model 2[b]	Model 3[c]	Model 1	Model 2	Model 3
SRH						
Very good, good	1.0	1.0	1.0	1.0	1.0	1.0
Moderate	1.37* (1.04–1.81)	1.31 (0.99–1.74)	1.20 (0.90–1.60)	1.20 (0.88–1.64)	1.15 (0.84–1.57)	1.10 (0.80–1.50)
Bad, very bad	4.11*** (2.72–6.23)	4.23*** (2.80–6.40)	3.06*** (1.93–4.87)	2.18** (1.31–3.62)	2.05** (1.23–3.40)	1.64 (0.94–2.86)
Age (years)						
50–59	1.0	1.0	1.0	1.0	1.0	1.0
60–69	2.28*** (1.53–3.40)	2.18*** (1.46–3.25)	2.13*** (1.42–3.18)	2.00** (1.29–3.12)	1.83** (1.17–2.86)	1.81** (1.15–2.82)
70–79	4.71*** (3.17–6.98)	4.26*** (2.86–6.35)	4.02*** (2.69–6.01)	4.18*** (2.65–6.57)	3.41*** (2.13–5.46)	3.30*** (2.06–5.29)
80+	6.37*** (3.94–10.31)	5.69*** (3.49–9.27)	5.43*** (3.3–8.85)	10.43*** (6.38–17.06)	7.78*** (4.62–13.09)	7.29*** (4.31–12.32)
Spousal support						
Spousal support		1.0	1.0		1.0	1.0
No spousal support		1.70*** (1.26–2.30)	1.67*** (1.23–2.26)		1.72** (1.22–2.42)	1.71** (1.21–2.41)
Family size		0.96* (0.93–0.99)	0.96* (0.93–0.99)		1.00 (0.97–1.04)	1.01 (0.97–1.04)
Education						
Primary or less		1.0	1.0		1.0	1.0
Secondary		1.33 (0.83–2.13)	1.30 (0.82–2.08)		1.61 (0.40–6.52)	1.71 (0.42–6.98)
Higher secondary+		1.47 (0.71–3.03)	1.48 (0.72–3.04)		1.77 (0.44–7.15)	1.79 (0.44–7.25)
Socio-economic status						
First (poorest) quintile		1.0	1.0		1.0	1.0
Second quintile		0.91 (0.56–1.49)	0.90 (0.55–1.47)		0.64 (0.36–1.14)	0.62 (0.35–1.10)
Third quintile		0.81 (0.51–1.29)	0.79 (0.50–1.25)		0.73 (0.44–1.21)	0.71 (0.43–1.19)
Fourth quintile		0.74 (0.46–1.19)	0.72 (0.45–1.17)		0.73 (0.43–1.22)	0.72 (0.43–1.21)
Fourth (richest) quintile		0.69 (0.44–1.10)	0.70 (0.44–1.12)		0.65 (0.40–1.07)	0.65 (0.40–1.06)
WHO-DAS *z*-score			1.23*** (1.08–1.40)			1.16* (1.01–1.33)
WHO-HSS *z*-score			0.97 (0.80–1.18)			0.92 (0.74–1.16)
WHO-QoL *z*-score			1.06 (0.94–1.19)			0.92 (0.79–1.06)

[a]Model 1: Cox PH regression of SRH on mortality adjusted for age.
[b]Model 2: Socio-demographic factors included as second step in Cox PH regression Model 1.
[c]Model 3: WHO health and disability measures included in Cox PH regression Model 2.
Note: * = *P*-value < 0.05; ** = *P*-value < 0.01; *** = *P*-value < 0.001.

sex and other socio-demographic factors like spousal support, education, family size and socio-economic status. This is consistent with other studies in developed and developing countries.[11,37,48,49]

Of the WHO health measures, WHO-DAS was the strongest predictor of mortality in both men and women, independent of age, SRH, spousal support and other socio-demographic covariates; neither WHO-HSS nor WHO-QoL appeared to increase the predictive ability of our models. Furthermore, disability (WHO-DAS score) seemed to play a large role as a health determinant in moderating the predictive value of SRH on mortality in both men and women. We did not see education and household socio-economic status modify the relation between SRH and mortality, as in the study from Indonesia.[37] Our study highlighted the strong influence of spousal support independent of age, sex and other socio-economic factors in predicting mortality, which is seen in other studies.[50–52] However, we could not examine whether spousal caring influenced mortality.[53]

The lack of a significant association between education and mortality could be due to small numbers in the higher education groups as well as stronger competing predictor effects of other covariates. This needs to be verified in other populations with low literacy. SRH prediction of mortality is stronger when the medical illness leading to death (e.g. diabetes) is known by the person at the time of self-assessment and is weaker for causes of death like violence.[28,30,54]) SRH adds predictive value to traditional risk factors such as smoking, obesity and hypertension in predicting stroke.[55] The effect of SRH on mortality and disease is known to be modified by preventive health behaviours like smoking and physical activity. Our study using the shortened SAGE version was constrained by the lack of information on known

illnesses suffered by respondents or their lifestyle risk factors. We were not able to study the effect of SRH on cause-specific mortality, such as stroke or cardiovascular disease, owing to small numbers in any of the death groups.

The role of bodily sensations and feelings affecting SRH is little studied. It was beyond the scope of this article to study these issues, although there was evidence that levels of disability influenced SRH in this population.

Our study was limited to an extent by survivor selection bias because the study design excluded individuals who died before attaining 50 years of age. As poor SRH is associated with higher mortality, the mortality hazard of SRH was likely to be underestimated in the survivor group ($\geqslant$50 years of age). However, this underestimation was likely to be small, as the mortality hazard is lower for younger adults.

Our study highlights the strength of nesting such surveys within the context of HDSS that allow accurate estimation of person-years of follow-up or survival time, taking into account migration and death information in reliably estimating mortality rate or risk.

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Conflict of interest: None declared.

KEY MESSAGES

- SRH is a strong predictor of mortality in rural Indian men aged $\geqslant$50 years, independent of age, education, socio-economic status and self-rated disability.
- Lack of spousal support is associated with higher mortality.
- Disability plays a large role in moderating the predictive role of SRH on mortality in both men and women.
- Education and household socio-economic status do not modify the relation between SRH and mortality.

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Commentary: Self-rated health and mortality in low income settings

Bo Burström

Karolinska Institutet, Department of Public Health Sciences, Division of Social Medicine, SE-171 77 Stockholm, Sweden.
E-mail: Bo.Burstrom@ki.se

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Self-rated health is a widely used measure in population health surveys and clinical settings. The question to respondents commonly reads: 'How in general would you describe your health?' with 3–5 response alternatives ranging from poor to excellent.[1] The first studies suggesting that poor self-rated health predicted increased mortality among elderly persons were published in the early 1980s.[2,3] These were followed by numerous studies confirming that this simple self-reported measure can predict subsequent mortality, often more accurately than doctors.[4]

Why does self-rated health predict mortality? Self-rated health often retains an independent effect even when controlling for other health-related measures.[1] Different explanations have been proposed, including (i) that self-rated health is more inclusive than the covariates used in many studies; (ii) self-rated health is a dynamic evaluation also judging the trajectory of health; (iii) self-rated health influences behaviours that subsequently influence health status; and that self-rated health reflects resources to cope with health threats.[1,4]

However, most previous studies have been conducted in high income settings, and there have been criticisms that the conclusions drawn from these studies cannot be applied to lower income settings. Amartya Sen, for instance, has claimed, based on data from different states in India, that self-reports of morbidity suggest poorer health among the population in Kerala than among the population in Bihar, whereas life expectancy in fact was considerably lower in Bihar,[5] which would render self-rated health less useful in such settings. A more recent study[6] also based on data from Kerala and Bihar, however, found that self-ratings of health were in line with observed prevalence levels of morbidity and life expectancy in the two states, and concluded that self-rated ill-health has construct validity