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Gender, educational and age differences in meanings that underlie global self-rated health

Wim Peersman · Dirk Cambier · Jan De Maeseneer · Sara Willems

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Abstract
Objectives The single-item question on self-rated health has been widely used in surveys. This study aims to explore which frames of reference are used by respondents when answering this question, to describe differences in the used frame of reference according to gender, educational background and age, and to determine whether subgroup differences can be explained by differences in prior health experiences.
Methods Face-to-face interviews were conducted in a sample of 310 adults who were asked to rate their health using a single-item question with closed-ended answering categories and to explain the reasons for the rating they gave with open-ended probes. Different indicators of prior health experiences were taken into account.
Results Physical health problems were the most utilized referents. However, participants also mentioned reasons that go beyond the physical dimension of health. Subgroup differences were found. Prior health experiences partly explained subgroup differences for some referents, but not for others.
Conclusions Investigators using the single question on self-rated health for comparing health across different population groups should be aware that the meaning of the question varies across different socio-demographic groups.

W. Peersman (✉) · J. De Maeseneer · S. Willems
Department of General Practice and Primary Health Care, Ghent University, Campus Heymans, 1K3, De Pintelaan 185, 9000 Ghent, Belgium
e-mail: Wim.Peersman@ugent.be

W. Peersman · D. Cambier
Department of Rehabilitation Sciences and Physiotherapy Ghent, Artevelde University College, Ghent University, Campus Heymans, 1B3, De Pintelaan 185, 9000 Ghent, Belgium

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Introduction

One of the most frequently used measures of health in health surveys is a single question on self-rated health (SRH). The exact wording of this question and its response choices varies somewhat from one study to another, but respondents are asked to rate their health in general on a five-point scale, for example from 'excellent' to 'poor', or from 'very good' to 'very bad'.

This question has good test–retest reliability (Cox et al. 2009; Lundberg and Manderbacka 1996; Martikainen et al. 1999), and proved to be a powerful predictor for mortality (Idler and Benyamini 1997; Nielsen et al. 2008) and a range of other health outcomes such as functional decline (Idler and Kasl 1995; Jagger et al. 1993), future morbidity (Moller et al. 1996) and health service use (Fylkesnes 1993), independent of specific health status indicators and other relevant covariates.

Based on its easy administration and its ability to provide a concise way of summarizing the health status, the SRH question has been used extensively. It is also frequently applied as a proxy question for more thorough, complicated and expensive measurements of health status in research where health is a background variable.

It is presumed that SRH combines numerous aspects of health and when respondents answer the SRH question, they give an indication according to their own perceptual framework on health. Hereby, the response option chosen indicates the label they use to summarize their subjective health perceptions (Locker et al. 2009).

Despite the widespread use of SRH as a health indicator, the knowledge of the process underlying people's evaluation of their general health is limited and the dimensions, frames of reference and meanings that respondents use to answer the SRH question are not well known (Jylha 2009; Kaplan and Baron-Epel 2003; Quesnel-Vallee 2007).

There are essentially two possible approaches to understand what the global SRH item measures (Krause and Jay 1994). A first approach involves correlating the global health rating with other theoretically relevant external criterion measures, as physical and mental health symptoms, longstanding illness, sickness absence, leisure physical activity, body mass index, smoking, etc (Bailis et al. 2003; Singh-Manoux et al. 2006). Although this kind of studies has provided some useful insights, there are important limitations related to this approach. The measures that should be included in the analysis are based on an a priori theory about the factors that may play a role in shaping health perceptions. Most researchers address only selected parameters and thus are likely to yield only partial or confounded information on what SRH determines (Mantzavinis et al. 2005). This approach also fails to provide an indication of the extent to which these factors directly enter people's perceptual framework when judging their health or are related more outside of people's awareness. In addition, in these studies a significant proportion of variance in SRH remains unexplained.

A second approach asks people to elaborate on the reasons underlying their rating of health. Some studies take a strictly qualitative approach and identified frames of reference (Abdulrahim and Ajrouch 2010; Manderbacka 1998), while others coded according to these frames of reference and focused on simple quantitative analysis to determine subgroup differences (Krause and Jay 1994; Simon et al. 2005).

It is very relevant to know whether participants from different subgroups consider different frames of reference when they are asked to rate their overall health status. Should the meaning of the SRH question differ substantially between subgroups, then the utility of the SRH question for making subgroup comparisons may be questioned (d'Uva et al. 2008; Dowd and Zajacova 2010; Lang and Delpierre 2009; Singh-Manoux et al. 2007). In spite of this intrinsic importance, the issue of subgroup differences in the frames of reference has not been investigated in-depth. Krause and Jay (1994) reported that people in different age groups have a tendency to use different frames of reference. The same may be true with respect to race and education. Simon et al. (2005) described differences by gender and age.

Differences in the frame of reference by subgroups could be attributed to prior experiences with ill health (Krause and Jay 1994; Simon et al. 2005). For example, because older people are more likely than younger individuals to experience chronic health problems, it may not be surprising that older people think in terms of health problems when answering the SRH question (Krause and Jay 1994). Examining subgroup differences after the effects of prior health experiences, such as physical health status or health care utilization had been controlled statistically, would be valuable (Krause and Jay 1994). Yet, due to a rather small sample size or the absence of other health status measures, the previous studies were not able to provide insight into this question (Krause and Jay 1994; Simon et al. 2005).

The aim of this study is (1) to explore which frames of reference are used by survey respondents when answering a single SRH question, (2) to describe differences in the used frame of reference according to gender, educational background and age, and (3) to determine whether subgroup differences can be explained by differences in prior health experiences.

Methods

Study population and procedure

Respondents were randomly selected from the list of patients of a community health center. This is a clinic staffed by an interdisciplinary group of general practitioners, nurses, social workers and health promotion workers. The center provides accessible and affordable primary health care to the inhabitants of a traditionally deprived neighborhood in Ghent (Belgium) which experienced now an inflow of young, higher educated families. Inclusion criteria were that they should be aged 18 years or over and that they should understand the Dutch language. The staff of the health community center excluded all patients whose medical condition would not allow a face-to-face interview (e.g., because of a severe psychiatric disorder, because the patient had Alzheimer disease, etc). All selected subjects were informed by mail by the community health center regarding the study. Trained interviewers approached and interviewed them face-to-face at home about their health and about their opinion regarding the community health center. The data were collected for the purpose of community-oriented primary care (COPC). COPC combines individual patient and physician practice data with public health data at the community level, leading to a 'community diagnosis' (Gavagan 2008).

Measures

Self-rated health

After asking study participants to respond to the question "how is your health in general?" by selecting a closed-ended answer (i.e., very good, good, fair, bad or very bad), subjects were asked to explain why they selected a particular closed-ended response with two open-ended probes: first subject was asked "why did you select that particular answering category and not a better category" followed by "why did you not select a worse category". To avoid any influence, these questions were asked before other health related questions. The answers were transcribed 'near verbatim'.

Socio-demographic variables

Date of birth, gender and level of education were recorded. For this study, subgroups were created by grouping the participants by age ('below 36', 'between 36 and 55' and 'above 55') and education (participant had a degree of higher education or not). Participants still studying were categorized into the level of their study.

Prior health experiences

Five indicators of various prior health experiences were taken into account. First, the number of chronic diseases and conditions the respondent had indicated on a list of 30 presented items was used. Also the scales 'physical functioning' (10 items), 'mental health' (5 items) and 'vitality' (4 items) from the Medical Outcomes Study 36-Item Short Form (SF-36) survey were included. The SF-36 is a generic health-related quality of life questionnaire constructed for use in medical outcomes studies (McHorney et al. 1993; Ware and Sherbourne 1992). Finally, contact with a GP past 3 months (yes/no) was used as an indicator for prior health care utilization.

Coding procedure

The transcripts of the open-ended questions were coded according to the following procedure. Two researchers (WP and SW) independently reviewed and coded 20 interviews and independently developed a preliminary categorization scheme based on the answers given by the respondents. The results were compared and discussed to come to a generic categorization scheme. In a second step, both researchers independently applied this categorization scheme to 80 interviews. The results were again compared, the categorization scheme was adapted and discrepancies were resolved. Finally, both researchers coded all other interviews independently, compared results and consensus was found.

The final categorization scheme that was used for coding the answers consists of several domains. For each domain, the distinction was made between aspects and referents with a positive undertone and referents with a more negative connotation. While some answers were simple and referred to a single frame of reference, others were more complex and could not be captured by means of a single category and required the allocation of multiple categories of the categorization scheme.

Data-analysis

In a series of bivariate logistic regression analysis, odds ratios were calculated to see whether the referents mentioned varied by gender, education and age. A separate logistic regression analysis was performed for every category of the categorization scheme that was mentioned at least by 12 respondents. Next, the odds ratios were calculated again, this time adjusted for prior health experiences.

Results

Response rate

In total, 457 patients were invited to participate, 310 (67.8%) were interviewed at home, 45 (9.8%) refused to participate, 23 (5%) were not found at home and from 79 (17.3%) the contact details were inaccurate. Response was higher for female and older respondents. Complete data on all health status measures were available for 299 cases. Their characteristics can be found in Table 1.

Referents used in answering the SRH question

In the answers the respondents gave on the open-ended probes, 10 domains, each with a positive and a negative side, could be identified. Further, in the domain 'health comparisons' a distinction between 'health comparisons with others' and 'health comparisons with oneself in the past' could be made. This resulted in a categorization scheme with 22 categories or referents (see Table 2). In Appendix Table 6 the description of the referents is given and illustrated with quotes.

Any reference to disease or 'body'-oriented problems or complaints was considered to be an aspect of the categories 'absence' or 'presence of physical health problems'. These categories were the most frequently mentioned categories. References to physical functional abilities or limitations were considered to be an aspect of the domain 'physical functioning'. For this domain, the category with a positive

Table 1 Characteristics of the participants ($n = 299$) (Ghent, Belgium, 2000)

Gender, no. (%)	
Male	126 (42.1)
Female	173 (57.9)
Age (years), no. (%)	
<36	101 (33.8)
36–55	124 (41.5)
+56	74 (24.7)
Education[a], no. (%)	
No higher education	151 (51.2)
Higher education	144 (48.8)
Health status, no. (%)	
Very good	73 (24.4)
Good	149 (49.8)
Fair	70 (23.4)
Bad	7 (2.3)
Very bad	0 (0.0)
Number of Chronic diseases, mean (SD)	2.2 (2.0)
SF36—physical functioning, mean (SD)	85.1 (21.4)
SF36—mental health, mean (SD)	70.8 (17.1)
SF36—vitality, mean (SD)	63.1 (19.5)
GP visit, no. (%)	
Yes	188 (62.9)
No	111 (37.1)

[a] $n = 295$

Table 2 Referents used in self-ratings of health: number (%) of respondents that mentioned each category ($n = 299$) (Ghent, Belgium, 2000)

Absence of physical health problems and illnesses	129 (43.1)
Presence physical health problems and illnesses	155 (51.8)
Physical functioning: positive connotation	52 (17.4)
Physical functioning: negative connotation	19 (6.4)
Medical treatment: positive connotation	27 (9.0)
Medical treatment: negative connotation	28 (9.4)
Mental health: positive connotation	7 (2.3)
Mental health: negative connotation	24 (8.0)
Vitality: positive connotation	0 (0.0)
Vitality: negative connotation	22 (7.4)
Health comparisons with others: positive connotation	20 (6.7)
Health comparisons with others: negative connotation	0 (0.0)
Health comparisons with oneself in the past: positive connotation	13 (4.3)
Health comparisons with oneself in the past: negative connotation	29 (9.7)
Coping: positive connotation	21 (7.0)
Coping: negative connotation	8 (2.7)
Medical risk factors: positive connotation	2 (0.7)
Medical risk factors: negative connotation	13 (4.3)
Positive health behavior	9 (3.0)
Negative health behavior	20 (6.7)
Wellbeing: feeling good	82 (27.4)
Wellbeing: feeling bad	6 (2.0)

connotation was mentioned almost thrice more than the category with a negative connotation. The domain 'medical treatment' grouped all references to (not) visiting a GP, using medication or passed surgery. The domain 'mental health' was used for referents to depression, nervousness or emotional problems. This domain was more frequently used as a referent with a negative connotation. References to feeling (not) tired, fatigued or energetic were considered to be an aspect of the 'vitality' domain. For this domain, only answers with a negative undertone were registered. On the contrary, those who compared their health to others did this only with a positive undertone. Any reference to a positive or negative attitude toward health in general or a current illness or having adapted to its limitations is considered to be an aspect of the 'coping' domain. The category 'medical risk factors' included all references to medical risk factors (i.e., blood pressure, cholesterol, and weight). The 'health behavior' domain referred to any answer referring to health behavior, such as smoking and doing sports. References to feelings without any further justification (e.g., 'I feel good' or 'I feel bad') were classified in the 'wellbeing' domain. 'Feeling good' was mentioned by more than a quarter of the respondents, 'feeling bad' was not very common.

Differences by gender

Table 3 shows the differences in the use of referents by gender. Men were less likely to express referents from the category 'absence of physical health problems' and more likely to mention '(problems with) physical functioning'. When prior health experiences were taken into account, especially the SF-36 scale physical functioning, the differences were even more pronounced. The largest differences between men and women were found for 'negative health behavior' which was the most reported by men. Also the categories 'medical risk factors with a negative connotation' and 'feeling good' were more mentioned by male subjects. These results remained after adjustment for prior health experiences. No significant gender differences could be observed in the other categories.

Differences by education

The respondents with a higher education were more likely than those without a higher education to include the absence of physical health problems and illnesses in their answer and less likely to refer to the presence of physical

Table 3 Results of logistic regression analysis with the categories of the categorization scheme as dependent variables, and gender as independent variable: odds ratio's (95% CI) are comparing male versus female (= reference category) to refer a particular category before and after adjustment for prior health experiences ($n = 299$) (Ghent, Belgium, 2000)

	Crude odds ratios	Adjusted for				
		Chronic diseases	Physical functioning	Mental health	Vitality	GP visit
Absence of physical health problems and illnesses	0.66†	0.56*	0.51**	0.62*	0.62*	0.59*
	[0.41–1.05]	[0.24–0.92]	[0.31–0.84]	[0.39–1.00]	[0.39–1.00]	[0.36–0.95]
Presence physical health problems and illnesses	0.83	0.97	1.01	0.90	0.91	0.88
	[0.53–1.32]	[0.60–1.57]	[0.63–1.64]	[0.56–1.44]	[0.57–1.45]	[0.55–1.40]
Physical functioning: positive connotation	1.22	1.21	1.35	1.24	1.22	1.37
	[0.67–2.22]	[0.66–2.22]	[0.73–2.51]	[0.68–2.80]	[0.67–2.23]	[0.74–2.54]
Physical functioning: negative connotation	2.50†	2.59†	2.94*	2.51†	2.69*	2.68*
	[0.95–6.53]	[0.98–6.86]	[1.09–7.91]	[0.95–6.61]	[1.02–7.14]	[1.01–7.12]
Medical treatment: positive connotation	0.94	0.92	0.83	0.96	0.89	0.78
	[0.42–2.10]	[0.78–1.19]	[0.37–1.88]	[0.43–2.15]	[0.40–2.01]	[0.34–1.78]
Medical treatment: negative connotation	1.03	1.15	1.10	1.03	1.04	1.29
	[0.47–2.27]	[0.52–2.55]	[0.49–2.45]	[0.47–2.27]	[0.47–2.30]	[0.58–2.90]
Mental health: negative connotation	0.54	0.60	0.54	0.68	0.64	0.61
	[0.22–1.34]	[0.24–1.51]	[0.22–1.37]	[0.26–1.75]	[0.25–1.64]	[0.24–1.52]
Vitality: negative connotation	0.95	0.96	0.84	0.98	1.06	0.76
	[0.39–2.29]	[0.40–2.35]	[0.34–2.05]	[0.40–2.39]	[0.43–2.61]	[0.31–1.89]
Health comparisons with others: positive connotation	0.57	0.55	0.62	0.58	0.55	0.59
	[0.21–1.52]	[0.20–1.48]	[0.23–1.69]	[0.22–1.57]	[0.20–1.47]	[0.22–1.61]
Health comparisons with oneself in the past: positive connotation	1.19	1.53	1.61	1.51	1.53	1.41
	[0.39–3.62]	[0.48–4.9]	[0.50–5.19]	[0.48–4.80]	[0.48–4.87]	[0.46–4.38]
Health comparisons with oneself in the past: negative connotation	0.59	0.58	0.65	0.61	0.56	0.61
	[0.26–1.34]	[0.25–1.33]	[0.28–1.51]	[0.27–1.39]	[0.24–1.27]	[0.27–1.40]
Coping: positive connotation	0.67	0.75	0.73	0.71	0.67	0.61
	[0.26–1.71]	[0.29–1.93]	[0.28–1.88]	[0.28–1.84]	[0.26–1.72]	[0.23–1.57]
Medical risk factors: negative connotation	3.25†	3.40*	3.21†	3.26†	3.24†	3.53*
	[0.98–10.8]	[1.01–11.4]	[0.95–10.9]	[0.97–10.9]	[0.97–10.8]	[1.05–11.9]
Negative health behavior	3.48**	3.31*	3.48*	3.91**	4.00**	3.27*
	[1.30–9.33]	[1.23–8.91]	[1.28–9.46]	[1.43–10.7]	[1.46–10.9]	[1.21–8.88]
Wellbeing: feeling good	2.04**	1.94**	1.85*	1.98**	2.00**	2.05**
	[1.22–3.42]	[1.16–3.26]	[1.09–3.13]	[1.18–3.32]	[1.19–3.35]	[1.21–3.45]

* $p < 0.05$

** $p < 0.01$

† $p < 0.10$

health problems (Table 4). The differences decreased when chronic diseases or physical functioning was brought into the analysis. Physical functioning, both with a positive undertone and with a negative connotation, was more referred to by the higher educated. The association enhanced when the SF-36 scale 'physical functioning' was taken into account.

The respondents with a degree of higher education more frequently used statements that refer to vitality to describe their health. The differences became even more pronounced when the SF-36 scales 'mental health' and 'vitality' were brought into the analysis. Participants with lower level of education referred more often to their better health in the past to describe their current health status.

Differences by age

Examining the age variation (Table 5) revealed that older age groups were more likely to mention 'physical health problems'. This association diminished when chronic diseases or physical functioning were taken into account. 'Medical treatment', especially when it was expressed

Table 4 Results of logistic regression analysis with the categories of the categorization scheme as dependent variables, and education as independent variable: odds ratios (95% CI) are comparing the category 'higher education' versus 'no higher education' (= reference category) to refer a particular category before and after adjustment for prior health experiences ($n = 295$) (Ghent, Belgium, 2000)

	Crude odds ratios	Adjusted for				
		Chronic diseases	Physical functioning	Mental health	Vitality	GP visit
Absence of physical health problems and illnesses	2.13**	1.76*	1.69*	2.01**	2.05**	2.06**
	[1.33–3.40]	[1.08–2.87]	[1.03–2.75]	[1.24–3.26]	[1.28–3.29]	[1.28–3.30]
Presence physical health problems and illnesses	0.59*	0.77	0.76	0.68	0.64†	0.60*
	[0.37–0.93]	[0.47–1.23]	[0.47–1.23]	[0.42–1.10]	[0.40–1.02]	[0.38–0.96]
Physical functioning: positive connotation	2.07*	2.13*	2.73**	2.27*	2.08*	2.22*
	[1.11–3.83]	[1.12–4.05]	[1.38–5.40]	[1.18–4.34]	[1.12–3.88]	[1.19–4.17]
Physical functioning: negative connotation	3.15*	3.59*	4.82**	3.34*	3.47*	3.25*
	[1.10–8.97]	[1.20–10.7]	[1.49–15.6]	[1.12–9.96]	[1.20–10.1]	[1.13–9.31]
Medical treatment: positive connotation	0.56	0.54	0.47†	0.59	0.54	0.50
	[0.24–1.32]	[0.22–1.29]	[0.20–1.11]	[0.24–1.42]	[0.23–1.26]	[0.21–1.20]
Medical treatment: negative connotation	0.77	0.92	0.83	0.74	0.77	0.85
	[0.35–1.68]	[0.41–2.10]	[0.37–1.89]	[0.33–1.67]	[0.35–1.70]	[0.38–1.89]
Mental health: negative connotation	1.16	1.52	1.20	2.65†	1.53	1.24
	[0.49–2.71]	[0.62–3.73]	[0.49–2.93]	[0.95–7.39]	[0.62–3.75]	[0.52–2.91]
Vitality: negative connotation	3.02*	3.43*	2.69†	3.70*	3.73**	2.79*
	[1.15–7.95]	[1.25–9.42]	[0.99–7.30]	[1.31–10.4]	[1.37–10.2]	[1.05–7.43]
Health comparisons with others: positive connotation	1.05	1.00	1.30	1.14	1.02	1.08
	[0.42–2.61]	[0.39–2.55]	[0.49–3.41]	[0.44–2.93]	[0.41–2.53]	[0.44–2.70]
Health comparisons with oneself in the past: positive connotation	0.64	1.03	1.11	1.03	0.84	0.70
	[0.21–2.01]	[0.30–3.46]	[0.32–3.87]	[0.30–3.60]	[0.26–2.74]	[0.22–2.20]
Health comparisons with oneself in the past: negative connotation	0.44*	0.41*	0.50	0.45†	0.41*	0.45†
	[0.19–0.99]	[0.18–0.95]	[0.21–1.18]	[0.19–1.04]	[0.18–0.94]	[0.20–1.02]
Coping: positive connotation	0.62	0.77	0.70	0.71	0.63	0.60
	[0.25–1.55]	[0.30–1.99]	[0.27–1.83]	[0.27–1.83]	[0.25–1.57]	[0.24–1.49]
Medical risk factors: negative connotation	1.24	1.31	1.16	1.21	1.21	1.27
	[0.41–3.77]	[0.41–4.17]	[0.36–3.67]	[0.38–3.82]	[0.39–3.73]	[0.41–3.89]
Negative health behavior	1.05	0.91	0.99	1.25	1.18	1.00
	[0.42–2.61]	[0.36–2.32]	[0.39–2.52]	[0.48–3.27]	[0.47–2.98]	[0.40–2.50]
Wellbeing: feeling good	0.82	0.70	0.65	0.73	0.78	0.81
	[0.49–1.36]	[0.41–1.19]	[0.38–1.12]	[0.43–1.24]	[0.47–1.31]	[0.48–1.35]

* $p < 0.05$

** $p < 0.01$

† $p < 0.10$

with a negative undertone, was also more used by the older age groups. The oldest age groups were also more inclined to use the category 'health comparisons with oneself in the past with a negative connotation' to motivate their answer on the SRH questionnaire. Bringing prior health experiences into the analysis did not change the association.

The data also suggest that the youngest age group was considerably more likely to use 'negative health behavior' as a referent. This category was almost exclusively mentioned by the participants from this age group.

Discussion

This study tried to answer three questions. First, it wanted to explore the frames of reference respondents apply to respond to global SRH. As in the previous studies, this study found a wide variation in the aspects playing a role in how respondents assess their health. The physical health dimension was most dominant and proved to be a pivotal factor in the self-assessment of health. Nevertheless, some people thought in terms of more general physical functioning, or made a comparison with others or with their

Table 5 Results of logistic regression analysis with the categories of the categorization scheme as dependent variables, and age as independent variable: odds ratios (95% CI) are comparing the categories '36–55 years' and '+56 years' versus '<36 years' (= reference category) to refer a particular category before and after adjustment for prior health experiences ($n = 299$) (Ghent, Belgium, 2000)

	Crude odds ratios	Adjusted for				
		Chronic diseases	Physical functioning	Mental Health	Vitality	GP visit
Absence of physical health problems and illnesses						
35–55	0.69	0.70	0.72	0.68	0.66	0.67
	[0.41–1.17]	[0.41–1.21]	[0.42–1.23]	[0.40–1.15]	[0.39–1.13]	[0.39–1.14]
+56	0.66	0.77	1.07	0.63	0.58	0.67
	[0.36–1.21]	[0.41–1.45]	[0.55–2.08]	[0.34–1.17]	[0.31–1.09]	[0.36–1.24]
Presence physical health problems and illnesses						
35–55	1.84*	1.84*	1.78*	1.96*	2.06**	1.87*
	[1.08–3.13]	[1.06–3.20]	[1.04–3.06]	[1.12–3.32]	[1.19–3.58]	[1.10–3.19]
+56	2.27**	1.93*	1.50	2.53**	3.01***	2.24**
	[1.23–4.19]	[1.02–3.65]	[0.77–2.90]	[1.34–4.76]	[1.57–5.79]	[1.21–4.14]
Physical functioning: positive connotation						
35–55	1.15	1.15	1.11	1.15	1.15	1.18
	[0.57–2.32]	[0.57–2.33]	[0.55–2.26]	[0.57–2.33]	[0.57–2.33]	[0.58–2.41]
+56	1.24	1.26	0.96	1.25	1.24	1.20
	[0.56–2.73]	[0.57–2.81]	[0.40–2.26]	[0.57–2.76]	[0.56–2.77]	[0.54–2.66]
Physical functioning: negative connotation						
35–55	1.50	1.50	1.45	1.50	1.56	1.52
	[0.49–4.63]	[0.48–4.61]	[0.47–4.48]	[0.49–4.63]	[0.51–4.84]	[0.49–4.70]
+56	1.39	1.36	0.98	1.39	1.54	1.37
	[0.39–4.99]	[0.37–4.93]	[0.24–3.97]	[0.39–4.98]	[0.42–5.59]	[0.38–4.93]
Medical treatment: positive connotation						
35–55	1.70	1.71	1.77	1.71	1.65	1.63
	[0.61–4.69]	[0.62–4.74]	[0.64–4.91]	[0.62–4.73]	[0.59–4.57]	[0.59–4.56]
+56	2.19	2.29	3.15*	2.22	2.02	2.38
	[0.74–6.46]	[0.77–6.81]	[1.02–9.67]	[0.75–6.54]	[0.67–6.06]	[0.80–7.10]
Medical treatment: negative connotation						
35–55	6.81*	6.71*	6.80*	6.82*	6.96*	7.52**
	[1.52–30.5]	[1.49–30.2]	[1.52–30.5]	[1.52–30.6]	[1.55–31.2]	[1.66–34.1]
+56	8.64**	7.77**	8.50**	8.66**	9.13**	8.43**
	[1.85–40.3]	[1.65–36.5]	[1.75–41.2]	[1.86–40.4]	[1.94–43.0]	[1.79–39.7]
Mental health: negative connotation						
35–55	1.10	1.05	1.07	1.24	1.22	1.14
	[0.44–2.71]	[0.42–2.64]	[0.43–2.65]	[0.48–3.22]	[0.48–3.10]	[0.46–2.84]
+56	0.43	0.34	0.34	0.34	0.51	0.41
	[0.11–1.65]	[0.09–1.36]	[0.08–1.45]	[0.08–1.42]	[0.13–2.02]	[0.11–1.58]
Vitality: negative connotation						
35–55	1.25	1.23	1.27	1.26	1.33	1.19
	[0.49–3.18]	[0.48–3.15]	[0.50–3.26]	[0.49–3.22]	[0.52–3.43]	[0.46–3.07]
+56	0.32	0.31	0.39	0.33	0.37	0.34
	[0.07–1.57]	[0.06–1.51]	[0.08–2.01]	[0.07–1.59]	[0.08–1.82]	[0.07–1.67]
Health comparisons with others: positive connotation						
35–55	1.32	1.34	1.29	1.34	1.30	1.34
	[0.42–4.18]	[0.42–4.24]	[0.41–4.09]	[0.43–4.23]	[0.41–4.13]	[0.43–4.25]
+56	2.01	2.12	1.60	2.04	1.92	1.97
	[0.61–6.59]	[0.64–7.07]	[0.45–5.78]	[0.62–6.70]	[0.57–6.43]	[0.60–6.50]

Table 5 continued

	Crude odds ratios	Adjusted for				
		Chronic diseases	Physical functioning	Mental Health	Vitality	GP visit
Health comparisons with oneself in the past: positive connotation						
35–55	0.48	0.43	0.41	0.51	0.51	0.49
	[0.11–2.04]	[0.10–1.90]	[0.09–1.83]	[0.12–2.21]	[0.12–2.24]	[0.12–2.13]
+56	1.39	1.01	0.55	1.35	1.76	1.33
	[0.39–4.99]	[0.26–3.83]	[0.12–2.56]	[0.36–4.99]	[0.47–6.64]	[0.37–4.79]
Health comparisons with oneself in the past: negative connotation						
35–55	8.77*	8.93*	8.76*	8.93*	8.71*	8.86*
	[1.10–69.7]	[1.12–71.1]	[1.10–69.7]	[1.12–71.1]	[1.10–69.3]	[1.11–70.4]
+56	32.1***	35.0***	31.9***	33.1***	31.6***	31.9***
	[4.18–247]	[4.51–271]	[4.04–251]	[4.29–255]	[4.07–244]	[4.14–245]
Coping: positive connotation						
35–55	0.93	0.89	0.90	0.95	0.93	0.91
	[0.32–2.65]	[0.31–2.57]	[0.31–2.58]	[0.33–2.72]	[0.33–2.68]	[0.32–2.59]
+56	1.19	1.00	0.91	1.21	1.21	1.22
	[0.38–3.68]	[0.32–3.19]	[0.26–3.16]	[0.39–3.76]	[0.38–3.83]	[0.39–3.81]
Medical risk factors: negative connotation						
35–55	2.96	2.95	3.03	2.95	2.95	3.00
	[0.60–14.6]	[0.60–14.5]	[0.61–14.9]	[0.60–14.5]	[0.60–14.6]	[0.61–14.8]
+56	2.83	2.78	3.41	2.81	2.79	2.78
	[0.50–15.9]	[0.49–15.8]	[0.58–20.2]	[0.50–15.8]	[0.49–16.0]	[0.50–15.6]
Negative health behavior						
35–55	0.18**	0.18**	0.17**	0.18**	0.18**	0.17**
	[0.06–0.55]	[0.06–0.56]	[0.05–0.53]	[0.06–0.56]	[0.06–0.57]	[0.06–0.53]
+56	0	0	0	0	0	0
	na	na	na	na	na	na
Wellbeing: feeling good						
35–55	1.81†	1.87*	1.90*	1.80†	1.78†	1.81†
	[0.99–3.34]	[1.01–3.46]	[1.03–3.52]	[0.98–3.32]	[0.97–3.28]	[0.98–3.33]
+56	1.51	1.69	2.18*	1.47	1.43	1.52
	[0.75–3.03]	[0.83–3.44]	[1.04–4.57]	[0.73–2.96]	[0.70 – 2.90]	[0.76 – 3.05]

na not applicable

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

† $p < 0.10$

own health in the past, or mentioning just feeling good. The referents identified in this study are in accordance with the categories uncovered in the previous studies (Abdulrahim and Ajrouch 2010; Borawski et al. 1996; Kaplan and Baron-Epel 2003; Krause and Jay 1994; Manderbacka 1998; Simon et al. 2005) notwithstanding the fact that the number and labels of categories differed between studies. Also in line with the previous studies (Krause and Jay 1994; Locker et al. 2009; Simon et al. 2005) is the observation that respondents refer, respectively, to different aspects of the concept of health as well as to points of reference to compare themselves with (age-peers, their earlier health).

The second aim concerned subgroup differences in these frames of reference. The data suggested that the tendency to use a particular referent was associated with socio-demographic factors such as gender, education and age.

This study demonstrated that men were more inclined to mention the physical functioning aspect compared with women. This was also found by Simon et al. (2005). They suggested that men, more than women, have incorporated

the functional definition of health as 'being able to perform the necessary duties' (Simon et al. 2005).

The results also revealed that people with different educational background had a tendency to use one frame of reference more instead of another. The differences were most pronounced for the dimension physical functioning. Although problems with physical functioning occur more frequently among people with lower level of education, respondents with higher educational attainment were more inclined to consider (problems with) physical functioning as a referent when answering the SRH question.

Also some significant age differences were detected. The observation that older respondents were more inclined to refer to physical health problems, utilization of medical care and a decline of their health when they answered the SRH question is in concordance with the fact that older people are more confronted with health problems, are in fact utilizing more frequent medical care and are confronted with a deterioration of their health. On the other hand, the category negative health behavior was almost exclusively used by younger respondents. Also Krause and Jay (1994) found that younger people tend to use health behavior more often as a referent. An explanation is not available yet. Further research should find out the reason.

The observed subgroup differences are in accordance with other studies that show SRH has a different association with biological risk factors and mortality in different population groups (Benyamini et al. 2003; Deeg and Kriegsman 2003; Dowd and Zajacova 2007, 2010; Franks et al. 2003; Huisman et al. 2007; Singh-Manoux et al. 2007), even though other studies found no significant interactions (e.g., (Burstrom and Fredlund 2001; McFadden et al. 2009).

The third aim of this study was to explore the possibility that was opted by Krause and Jay (1994) who suggested that the subgroup differences in frames of reference reflect underlying differences in the health status or other prior health experiences. The results of this study suggested that for some referents, prior health experiences could partly explain the differences. For example, people with lower lever of education are more confronted with physical health problems. As expected, this category was more used as a referent by the respondents with lower level of education, and when the number of chronic diseases or the SF-36 scale 'physical functioning' was taking into account, the association diminished. This observation confirmed that prior health experiences could be an explanation for the differences. However, frequently opposite results could be found. The dimension 'physical functioning' was more mentioned by people with higher level of education and this association enhances when adjusted for health status. Clearly, more research is needed to disentangle this issue.

Strengths and limitations

A key strength of this study was the utilization of several indicators of prior health experiences to explain subgroup differences in frames of reference. This was the first study to test the hypothesis that subgroup differences in frames of reference reflect prior health experiences. An important limitation was that only self-reported measures of prior health experiences were available. The possibility exists that the indicators used in the current study do not cover the ill health experienced by the respondents sufficiently. This could potentially be an alternative explanation why the subgroup differences were not fully explained by adjusting for prior health experiences.

Idler et al. (1999) have criticized the practice to use the first responses only, when summarizing and quantitatively analyzing qualitative data, as Krause and Jay (1994) did, because it should lead to a substantial loss of information and masks the complexity and multilayered character of health ratings. The present study included all aspects which participants mentioned (multiple-reference study). In addition, a different approach was used to elicit the referents using two open-ended probes instead of one question to explain the initial response to the SRH question. This approach may be closer to people's actual decision-making processes and probably produced data that reflect the multilayered character of health ratings in a more valid way. Even though that for some domains the positive or negative side was not very common, or even absent, the procedure to use a positive and a negative side for each of the different domains in the categorization scheme was in accordance with the method to use two open-ended probes. This made it possible to show important subgroup differences that otherwise could not have been detected. As a consequence, this approach facilitated the understanding of the complexity of the meanings that underlie global SRH questions for survey respondents. However, the answers the respondents gave, may still be limited to a shorter list of the most salient factors, and/or to factors that people feel were legitimate to report in such an interview.

Another strength was the large sample size compared with the previous studies (Krause and Jay 1994; Simon et al. 2005), which made it possible to determine subgroup differences in a more valid way. In spite of this, the sample size of this study was still limited, resulting in wide confidence intervals and the interpretation of the results should be done carefully. Some results provide strong evidence of subgroup differences in the used frame of reference while for other aspects, the evidence of subgroup differences is only weak. For some categories no statistical significant subgroup differences were found, but because of limited statistical power, it is not possible to draw a final conclusion for those categories.

There were only seven people who rated their health as bad and no one assessed it very bad. Because the two (out of five) most badly categories of the SRH question are hardly covered, there is the possibility that some aspects related to ill health were missed.

Another potential limitation arises when continuous measures like age are arbitrarily partitioned into ordinal categories. To address this potential problem, the data were reanalyzed using different cut-off points. The results from these additional analyses (not shown) were quite close to those presented in Table 5.

Implications

To conclude, as Mallinson (2002) has stated: "The issue of meaning is absolutely central to understanding subjective views and without more assessment of peoples' understandings of survey questions it is difficult to see how one can establish their validity as subjective health measures." The findings of the present study are important for investigators who use SRH as an easy and inexpensive way to compare health across different population groups. Comparisons should be made with caution and researchers should be aware of the different meanings that SRH has in different groups. Using anchoring vignettes to take into account socio-demographic differences in health reporting behavior could be a solution, though further research to develop this method is necessary (d'Uva et al. 2008).

Conflict of interest Authors do not have any conflict of interest.

Appendix

See Table 6.

Table 6 Categories of the categorization scheme illustrated with examples (Ghent, Belgium, 2000)

Category	Examples
Absence of physical health problems and illnesses	"I don't have any health problems", "At the moment, I don't have any physical complaints", "I don't have pain"
Presence physical health problems and illnesses	"I have pain in my stomach", "As soon as I go out, I'll get a cough", "I have diabetes"
Physical functioning: positive connotation	"I'm still able to work", "Nothing restricts my daily life", "I can do a lot of things myself", "I regularly go out"
Physical functioning: negative connotation	"I cannot go to work", "I'm not in top form", "I'm not able to do all the things I want to do"
Medical treatment: positive connotation	"I never see the doctor", "I don't take any medication", "I visit the doctor rarely"
Medical treatment: positive connotation	"I have to take medication", "I undergo surgery", "I was in hospital"
Mental health: positive connotation	"I'm free of worries", "I feel mental well", "I'm emotional fine"
Mental health: negative connotation	"I'm having a lot of stress at work", "I'm nervous", "I cannot concentrate", "I'm depressed"
Vitality: positive connotation	/
Vitality: negative connotation	"I'm without any energy", "I'm feeling weary", "I'm tired"
Health comparisons with others: positive connotation	"Other people of my age have more problem than me", "Other people have been more unlucky"
Health comparisons with others: negative connotation	/
Health comparisons with oneself in the past: positive connotation	"I'm better than last year", "I'm making progress", "I change for the better"
Health comparisons with oneself in the past: negative connotation	"Because of my age", "I'm having old people's complaints", "Because of complaints that come with my age"
Coping: positive connotation	"I'm an optimist", "In spite of my illness, I still can smile", "I don't want to feel bad", "My doctor told me that I'll become 100"
Coping: negative connotation	"A persons health can never be very good", "Today I'm fine, but tomorrow I can be dead", "Maybe I'm sick but I don't know yet"
Medical risk factors: positive connotation	"My blood pressure is ok", "I have good resistance to illnesses"
Medical risk factors: negative connotation	"My blood pressure is high", "I have a cholesterol problem"
Positive health behavior	"I frequently work out", "I stop smoking", "I play sport every week"
Negative health behavior	"I smoke", "I smoke and drink, I eat irregular and I don't exercise", "I smoke to much"
Wellbeing: feeling good	"I'm feeling well", "I'm not feeling bad", "I'm feeling good"
Wellbeing: feeling bad	"I'm feeling bad", "I'm not feeling good", "I'm not super"

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