

Psychometric Evaluation and Establishing Norms of Croatian SF-36 Health Survey: Framework for Subjective Health Research

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Aim To provide population norms and evaluate metric characteristics of the Croatian version of SF-36 Health Survey, an internationally used instrument for assessing subjective health.

Method The questionnaire was administered to a representative sample of Croatian adult population (n = 9070). Three standard techniques were used in data analysis: reliability tests, descriptive statistics, and factor analysis. The population norms were presented in two standard forms – the SF-36 Health Profile and percentile values for different age groups of men and women.

Results The Croatian version of the SF-36 had generally acceptable metric characteristics including its construct validity. The internal consistency of the SF-36 scales ranged from 0.78 to 0.94. Pearson bivariate correlations showed moderate associations between SF-36 scales, and factor analysis provided one latent dimension underlying all SF-36 scales which explained 63.3% of the score variance. Less favorable results were obtained concerning its discriminative validity. All SF-36 scales showed negative asymmetry of score distributions, and some had high floor and ceiling effects – skewness estimations ranged from -0.12 to -0.91, with the highest floor effect of 30% and ceiling effect of 63%.

Conclusion Presented population norms for the Croatian version of SF-36 Health Survey showed that SF-36 may be used as a valid and reliable instrument in research in subjective health of Croatian population.

Subjective health assessment by self-reported measures of health status is a standard part of epidemiological and community-based research surveys today (1). Such a wide use of subjective health assessment reflects the importance of individual's own perception of their health and the multidimensional nature of health (2). Thus, perceived health has become one of the most significant health indicators studied today (3,4). Self-ratings of health seem to be better predictors of future health in elderly population than clinical assessments (5). Subjective health assessments are also valid health status indicators in middle-aged population and can be used in cohort studies and population health monitoring (6). As surveys are ideal to assess the public opinion on health policies and the quality of health care, they have proved to be an essential tool in managing, planning, and evaluating health (2).

A lot of effort has been invested in construction of practical subjective health measurement tools appropriate for widespread use across diverse populations. As the result, several internationally recognized questionnaires have been created in the last three decades. Defined as a generic measure of health status, they are widely used in comparing general and specific population, estimating the relative burden of different diseases, differentiating the health benefits produced by different treatments, and screening individual patients (7). However, they use different subjective health measures and normative data gathered on the representative samples of general population are often lacking. In this context, the SF-36 Health Survey is a step forward in subjective health assessment. It measures eight health concepts, which were selected during two large empirical studies – the Medical Outcomes Study (MOS) and the Health Insurance Experiment (HIE). Thus, most SF-36 items have their roots in instruments that have been in use since the 1970s and 1980s, including well-known General Psychological Well-Being Inventory and Health Perceptions Questionnaire (8).

However, these eight health concepts are today the most frequently measured concepts that are affected by disease and treatment (9,10). The SF-36 Health Survey was translated and validated by researchers from all over the world gathered under the International Quality of Life Assessment (IQOLA) Project, which also established norms and documented the translations as required for their international use (8).

Within the overall strategy for health care system reform, the Croatian Ministry of Health launched the 2003 Croatia Adult Health Survey (CASH) project, funded by the World Bank, to assess the population health status in Croatia. The CASH survey included a number of questions concerning respondent's demographic characteristics, living conditions, and relevant habits and behaviors. The health status was assessed by direct questions on previous and current diseases by using the Croatian version of SF-36 Health Survey (11). We evaluated the metric characteristics and established national norms for the Croatian SF-36, with the aim to provide national data on subjective health of adult population.

Methods

SF-36 Health Survey

The SF-36 Health Survey is a multi-purpose, short-form health survey that consists of 36 questions (12,13). It represents a theoretically based (14,15) and empirically verified (8) operationalization of two general health concepts, physical and psychological, and their two general manifestations, functioning and well-being. Accordingly, the questionnaire contains four types of scales, or four conceptually different measures of health. They refer to the following assessments or indicators of health: a) functioning at the behavioral level, b) perceived well-being, c) limitations connected with social life and the realization of central life roles, and d) direct personal perception of

total health. At the manifested level, each of the questionnaire items refers to one of the following eight different health indicators (12): physical functioning (10 items); role-physical, referring to the limitations in performing important life roles due to physical health (4 items); bodily pain (2 items); general health (5 items); vitality (4 items); social functioning (2 items); role-emotional, referring to the limitations in performing important life roles due to emotional problems (3 items); mental health, referring to the absence of anxiety and depression (5 items); and one final self-evaluated health transition item (five levels from “much better than a year ago” to “much worse than a year ago”), which is not used in the score of any of the scales but is useful in estimating average change in health status over a year before its administration. Five questionnaire scales – physical functioning, role-physical, bodily pain, social functioning, and role-emotional – define health as the absence of limitations and inability, so they represent continual and one-dimensional health measures. The three remaining scales – general health, vitality, and mental health – are bipolar, meaning they measure a much wider range of negative and positive aspects of health. The physical functioning, role-physical, and bodily pain scales refer to the general factor of physical health, and social functioning, role-emotional, and mental health scales measure psychological health. Scales vitality and general health are moderately connected with both factors. The total result is most often shown in the form of the profile defined with eight points that represent the measure of individual aspects of health transformed into a unique scale whose theoretical minimum is a score of 0 and the maximum a score of 100. On all scales, higher results indicate better subjective health.

The Croatian version of SF-36 questionnaire was licensed to Andrija Štampar School of Public Health (16). After the standard procedure of translation (17), a pilot study was carried out in 1998. Trained interviewers applied the Croa-

tian version of the SF-36 survey to the sample of 5048 adult population. Collected data provided preliminary results on metric characteristics of the Croatian version of the SF-36 (18); the scales showed good internal consistency, and the scores were within the expected ranges.

Sample and data collection

The Croatian version of SF-36 survey was incorporated in the 2003 Croatia Adult Health Survey (CAHS), the questionnaire that covers a wide range of health-related variables. A multi-stage stratified sample design was adopted to define a representative sample of general adult population. The survey targeted persons aged ≥ 18 years living in private households in the Republic of Croatia. Persons living in non-conventional households, institution staff, full-time serving members of the Croatian Armed Forces, and the residents of certain remote regions were excluded from the survey. The 2001 Croatian Census was used to select a representative sample of households to be included in this survey (19). The Croatian Bureau of Statistics provided the health survey team with 11 345 randomly selected building addresses from six officially defined regions of Croatia (ie, Northern, Eastern, Southern, Western, Central, and the City of Zagreb). No other individual data were used for the sample definition. In total, 10 766 households were selected to participate in the 2003 CAHS. The response was obtained from 9070 individuals, which gave the overall response rate of 84.3%.

The questionnaire was administered by trained public health nurses in face-to-face interviews with respondents. Data were collected over three months, from April to June 2003. Survey results were representative of the regional, sex, and age structure of Croatian adult population, ie, three age groups of 18-39, 40-64, ≥ 65 years of both men and women were represented.

Statistical analysis

In data analyses, we used weighted individual scores. A particular weight corresponded to the number of persons represented by the respondent for the entire population. The population estimates (ie, weights) were based on the 2001 Census of household counts by taking the total number of individuals living in a private households in a given age-sex group in a given region. First, sub-weight was computed to reflect the selection of towns, municipalities or districts. Then person-level weight was created according to sex, age, education, and region. Reliability test (Cronbach α coefficient of internal consistency), descriptive statistics, and factor analysis (principal component extraction) were used as standard techniques to assess the psychometric properties of the Croatian version of the SF-36 survey.

We used t tests for independent samples to determine differences in scores between men and women. Statistical Package for Social Sciences for Windows, version 10.0 (SPSS Inc., Chicago, IL, USA) was used for data processing. Values of $P < 0.05$ were considered statistically significant.

Results

Psychometric evaluation

Cronbach α coefficient of internal consistency was used to estimate the reliability of the eight scales and two summary measures (Table

1). In all cases, its value exceeded the minimum standard of 0.70. Cronbach α ranged from 0.78 (for general health and social functioning) to 0.94 (for physical functioning and role physical). Physical functioning, role physical, bodily pain, and role emotional scales had a reliability of >0.90 , which is a suggested minimum score for analyzing an individual patient's result.

Calculations for skewness revealed all scales to have negative asymmetry of score distributions – more individuals were found above than below the particular scale means (Table 1). The values ranged from -0.12 for general health to -0.91 for social functioning. The highest floor effect was observed for the role physical (30%) and role emotional (26%), which also had a substantial ceiling effect (53% and 63%, respectively). Ceiling and floor effects show percentage of individual's results corresponding to the theoretical maximum or minimum. Both effects for the three bipolar scales – general health, vitality, and mental health, were minimal. This was expected, because similar findings were obtained with the original US version of SF-36 (13,20). The values of skewness and floor and ceiling effects in this study were lower than those in studies using US version of SF-36 (13,20).

Pearson bivariate correlations showed moderate associations between SF-36 scales, ranging from 0.45 between Mental Health and Physical Functioning to 0.68 between General Health and Vitality. The exception was a slightly higher correlation of 0.75 between mental health and

Table 1. Descriptive statistics and features of score distribution for the SF-36 scales administered to a representative sample of general adult population ($n = 9070$) in Croatia in 2003

SF-36 scales	No. of items	No. of levels	Cronbach α	Score distribution*			
				mean \pm SD [†]	skewness [†]	floor (%) [†]	ceiling (%) [†]
Physical functioning	10	21	0.94	69.1 \pm 30.0	-0.73	2.8	22.6
Role physical	4	5	0.94	61.5 \pm 44.8	-0.47	29.6	52.6
Bodily pain	2	11	0.91	64.6 \pm 30.5	-0.24	2.2	32.2
General health	5	21	0.78	54.8 \pm 22.6	-0.12	0.7	1.2
Vitality	4	21	0.85	53.2 \pm 22.7	-0.25	1.0	1.2
Social functioning	2	9	0.78	73.8 \pm 27.8	-0.91	2.4	35.5
Role emotional	3	4	0.93	68.6 \pm 43.7	-0.80	26.1	62.7
Mental health	5	26	0.87	61.9 \pm 21.4	-0.47	0.1	2.0

*All scores ranged from 0 to 100.

[†]Weighted values according to the number of persons represented by the respondent for the entire population.

vitality scales. Factor analysis with principal component extraction method provided one latent dimension underlying all SF-36 scales. The extracted factor explained 63% of the variance.

General population norms

Arithmetic means of individuals' scores on the eight scales define the SF-36 Health Profile; it is a standard review of the data obtained by application of this instrument to a sample of subjects (12). To facilitate its interpretation, the SF-36 profile orders scales from left to right in the standard manner – from the best physical health measure (physical health) to the best mental health measure (mental health). Thus, differences between samples on the left side of profiles reflect physical health status, whereas differences on the right side of profiles reflect mental health status. The SF-36 Health Profile obtained on a representative sample of general adult population of a particular country represents a national norm.

The height and shape of the Croatian norms was in accordance with profiles obtained in other national studies, which confirms a cross-cultural validity of the instrument. The “peaks” and “valleys” in the SF-36 Health Profile for the general Croatian population corresponded to that obtained in US adults (Figure 1). Five of the highest average scores were observed for scales that require only the absence of limitations to achieve the highest possible score – physical functioning, role physical, bodily pain, social functioning, and role emotional. Furthermore, the three lowest average scores were observed for scales that require the presence of positive states to achieve the highest possible score (general health, vitality, and mental health). As expected, average health status declined with age, and women had inferior subjective health than men (Figure 2). Significant differences were found between men and women on the physical functioning, role physical, social functioning, and role emotional scales (*t* test, *P*<0.001). According to these findings, separate norms were needed for valid interpreta-

tion of the SF-36 Health Profile for different age groups of men and women (Table 2).

The percentages in reported health transition for different age groups of men and women summarize subjects' ratings of the amount of change in their health in general over a one-year period. This rating was not used to score any of the eight multi-item scales and could be analyzed as a separate variable to provide useful information on actual changes in health status over a year

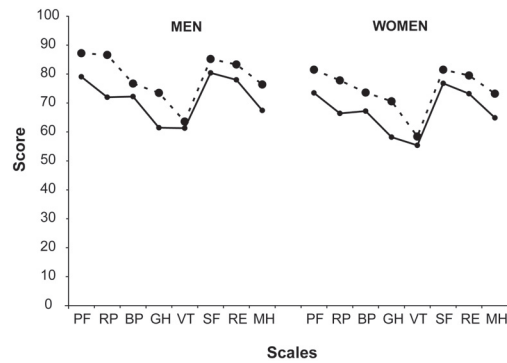


Figure 1. SF-36 Health Profile obtained on representative samples of Croatian (n = 9070; in 2003) and US (n = 2474; in 1990) adult population. Scores are scale mean values for men and women. PF – physical health; RP – role physical; BP – bodily pain; GH – general health; VT – vitality; SF – social functioning; RE – role emotional; MH – mental health; full lines – profile of Croatian norms; dotted lines – profile of US norms.

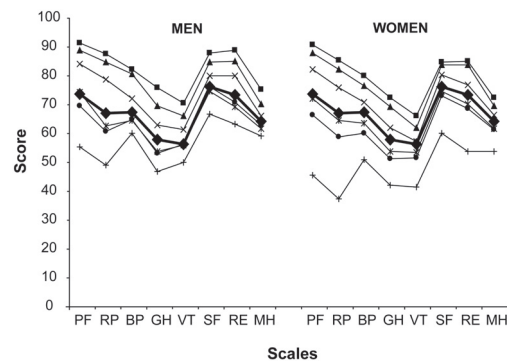


Figure 2. SF-36 Health Profile obtained on a representative sample of general adult population (n = 9070) of Croatia in 2003: Weighted-scale mean values for general population and different age groups of men and women. PF – physical health; RP – role physical; BP – bodily pain; GH – general health; VT – vitality; SF – social functioning; RE – role emotional; MH – mental health; diamond – population profile; square – profile for 18-24-year age group; triangle – profile for 25-34-year age group; cross – profile for 35-44-year age group; star – profile for 45-54-year age group; circle – 55-64-year age group; multiplication sign – profile for ≥65-year age group.

Table 2. The SF-36 national norms for adult women and men in Croatia in 2003 by age group (n = 9070) presented in percentile ranks corresponding to the lowest one fourth of the scores, median value, and the highest one fourth of the scores

SF-36 scale percentiles	Age groups (y)											
	women						men					
	18-24	25-34	35-44	45-54	55-64	≥65	18-24	25-34	35-44	45-54	55-64	≥65
Physical functioning:												
25th	95	90	80	60	50	20	100	95	85	60	55	30
50th	100	100	95	80	75	45	100	100	95	85	80	60
75th	100	100	100	95	90	70	100	100	100	100	95	85
Role physical:												
25th	100	100	75	25	0	0	100	100	75	0	0	0
50th	100	100	100	100	75	25	100	100	100	100	100	50
75th	100	100	100	100	100	100	100	100	100	100	100	100
Bodily pain:												
25th	72	62	52	41	41	31	72	62	52	41	41	41
50th	100	84	74	62	61	42	100	100	84	72	64	62
75th	100	100	100	100	100	74	100	100	100	100	100	100
General health:												
25th	62	57	50	40	40	30	70	57	50	40	40	30
50th	77	75	67	57	55	45	77	75	67	57	55	47
75th	90	87	80	72	67	57	95	90	82	72	72	67
Vitality												
25th	60	55	50	40	40	25	60	60	50	45	45	35
50th	70	65	60	55	55	40	75	70	65	60	60	50
75th	80	80	70	70	70	60	90	80	80	75	75	70
Social functioning:												
25th	75	75	75	62.5	62.5	37.5	87.5	87.5	75	62.5	62.5	50
50th	100	100	87.5	87.5	75	62.5	100	100	87.5	87.5	87.5	75
75th	100	100	100	100	100	87.5	100	100	100	100	100	100
Role emotional:												
25th	100	100	66.7	33.3	33.3	0	100	100	100	33.3	33.3	0
50th	100	100	100	100	100	66.7	100	100	100	100	100	100
75th	100	100	100	100	100	100	100	100	100	100	100	100
Mental health:												
25th	64	60	60	52	52	40	68	64	56	52	52	48
50th	76	76	72	64	64	56	80	76	72	64	68	64
75th	88	84	80	76	76	72	88	84	80	80	80	76

time before the administration of the SF-36. As expected, the percentage of people feeling generally worse than a year before increased with age (Figure 3). Aggravation of subjective health was most evident for people in the oldest age group. In younger population, the majority reported their health was the same.

Discussion

Performed psychometric evaluation of the Croatian version of the SF-36 showed that it has acceptable metric characteristics. The internal consistency of the scales was high, confirming the content validity of chosen items for the Croatian setting. Less favorable results were obtained for its discriminative validity. All SF-36 scales showed negative asymmetry of score distributions and some had high floor and ceiling ef-

fects. These characteristics diminished the survey's ability to differentiate individuals according to their health status, which was especially obvious from the results converted into the standardized or norm-values (eg, reported percentiles). The obtained discriminative validity limited a di-

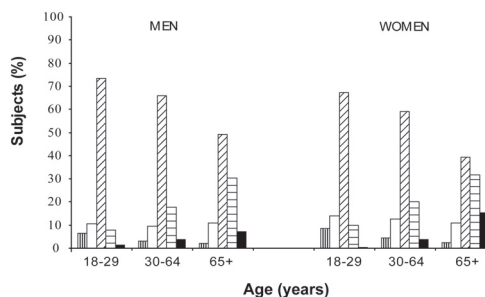


Figure 3. SF-36 Reported Health Transition according to the population age and sex (n = 9070) in Croatia in 2003. Vertically-lined bars – much better; open bars – somewhat better; diagonally-lined bars – same; horizontally-lined bars – somewhat worse; closed bars – much worse.

agnostic power of the SF-36 to detect intra- and inter-individual differences in health status, as found in other countries (21). The SF-36 Health Survey was constructed to achieve minimum standards of precision necessary for group comparisons in eight health areas. In that way, this study supported its reliability and discriminative validity.

The SF-36 Health Survey was developed in the United States, but for purpose of use in international research. Translating, validating, and establishing norms of the SF-36 in 14 countries, including Austria, Belgium, Canada, Denmark, France, Hong Kong, Italy, Japan, the Netherlands, Norway, Spain, Sweden, UK, and US (Chinese translation) were coordinated under the International Quality of Life Assessment (IQLA) Project (22). The Project results were described in the November 1998 issue of the *Journal of Clinical Epidemiology*. In the second wave, 40 Western and Eastern European countries, including Croatia, and non-European countries were included in the project. Results generally supported the cross-cultural validity of the SF-36 Health Survey, making possible comparisons of health-related quality of life across countries and encouraging a wide use of this instrument.

In our study, we compared Croatian and US norms for men and women. The SF-36 Health Profiles obtained on representative samples of Croatian adult population depict a same pattern, but lower average values than the American profiles. For both men and women, the largest difference was observed for the role physical scale (14.6 points) and the lowest for the vitality scale (2.3 points). The comparisons with other European and non-European countries confirmed these tendencies – Croatian national norms had lower values than Australian (20), Dutch (23), Italian (24), French (25), or Danish (26). This is in accordance with previous findings that differences in average health status reflect the differences in socioeconomic status, ie, that wealthier societies have healthier population and vice versa (27,28).

It also confirmed the necessity of national norms for the interpretation of SF-36 Health Profile on both individual and group level.

In the present study, we performed the psychometric evaluation of the Croatian version of the SF-36 (18), and provided the first norms for Croatian population comparable with other countries. However, both cross-cultural validity of this instrument and its applicability in the Croatian setting have some limitations. They primarily concern the constructive validity of the Croatian version of SF-36, which needs to be tested further by use of factor analysis. The SF-36 was constructed to represent two major dimensions of health – physical and mental – that need to be confirmed on Croatian national sample by extraction of the same two latent dimensions underlining the SF-36 scores. We also need criterion-based tests of validity, which will include other measures, and data that are gathered concurrently (concurrent validity) or after a certain interval (predictive validity). Significant correlations between the SF-36 scores and other measures of known validity (eg, objective medical tests), and expected differences between known groups would confirm its diagnostic validity.

The SF-36 was also constructed to yield a profile of scores that would be useful in understanding population differences in physical and mental health status, the health burden of chronic diseases and other medical conditions, and the effect of treatments on general health status. Since its publication in 1992, the reliability and diagnostic and construct validity of the SF-36 have been proven in many studies conducted not only in Anglo-Saxon countries. Today, this is the most frequently used instrument in scientific and professional research in subjective health. A recently published extensive manual and interpretation guide for SF-36 lists 158 topics investigated in clinical trials of treatment effects that use SF-36 Health Survey and are registered with the Medical Outcomes Trust (12). The two probably largest current studies, the Nation-

al Breast Cancer Prevention Trial and the Prostate Cancer Prevention Trial, administer the US, Mexican-American, and French-Canadian SF-36 version at regular intervals over 5-7 years to 15 000-20 000 adults. Psychometric evaluation and norms reported in this paper could be the frame for such studies in Croatia and countries with similar socioeconomic status.

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