

A comparison of subjective and objective measures of health status

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Abstract: Two types of categories for measuring health status are distinguished, the subjective and the objective. This study aims to shift from a subjective measure of Self-rated health (SRH) to a health index that is more objective. The research question asks about the advantages and disadvantages of each. Some positive aspects of the subjective method may be drawn from its simplicity, from accessibility of data collection, from low survey costs, from popularity, from the large use by researchers. It may be considered problematic because it relies on respondents' perceptions, which can change when reassessing health. There may also be problems with data accuracy. As for the health index, it can be recognized as easy to interpret, easy to solve econometric problems, i.e. problems related to multicollinearity. The difficult part is the construct of the index and the fact that data may change over time. This comparison can help researchers when choosing or updating a health measure, but also might contribute on health policy-decision-making.

Keywords: self-rated health, health index, measuring health, SF-36, EQ-5D

Introduction

In the 1800s, the first indicators of health status were very simple, such as infant mortality rate and life expectancy (Etches et al, 2006). According to the analysis of Etches et al. (2006), over time, standardized comparisons between populations, disease incidence, quality of life, health expectancy, health gaps, cumulative qualitative and quantitative indicators, etc., have also emerged (Etches et al., 2006). Clearly, health status at the individual level is based on an observation from a whole, and the overall sum of observations forms a group or population. According to a text from the Association of Faculties of Medicine of Canada (AFMC Primer on Population Health, 2024), population health still focuses on the health of the individual, but has a broader perspective, including economics, environmental sustainability, social equity, etc. At the individual level, health can mean for example well-being, energy or strength, the ability to carry out daily activities (Cox et al.,

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1987, 1993), but also anatomical, physiological and psychological integrity (Stokes et al., 1982).

There are also some shades in population and individual level. Mathers et al. (2003) emphasized that generating population-level statistics by aggregating individual-level data quickly becomes difficult when multiple issues are considered and when comparisons over time, between groups or before and after a medical intervention are desired. Another issue is that a population-level measure is constrained by individual-level data which may change over time. Both the perception of respondents and the precise data can change over time. The issue that arises is about the representativeness of the population, about how individuals are chosen for a given population and how accurate the survey data are. In addition, some respondents may underestimate or overestimate health status and misreport. It is important that the individual-level data are accurate and representative for the population, as they can influence the population-level analyses. Such data may shape a population from which powerful statistical results can be performed. Not all measures can be applied at a population level. Some of these drawbacks will also be reflected in the presentation of subjective and objective methods in the following lines. Thus, the question arises about which methods describes the best health status?

Health status measurement is complex, aiming to measure health on both subjective and objective levels. This journey starts by presenting some positive and negative aspects of subjective and objective measures. Lastly, two health indexes of widely recognized health surveys are presented - the SF-36 and the EQ-5D and also some measurement issues. It is essential to have a clear view of the advantages and disadvantages of these two methods of measuring health status in order to choose the most appropriate measure for a particular study. Choosing the best measure for a particular population may also mean developing health policies. This discussion may help researchers, statisticians and health policy makers on their decisions. Some statisticians are faced with the situation of choosing either SRH or health index for measuring health status. It is important to motivate this choice. This direction of research is important because the methods for measuring health status are the basis for statistical analysis, from which results can be used by public health to create health policies.

1. Subjective measure of health

On a subjective level, it is difficult to present a clear and complete picture of self-assessed health, as there is more debate than results. The questions at first glance that may be asked include whether it is valid and reliable, whether it can be considered a measure of a population, whether it can predict mortality and certain diseases, whether it is affordable, popular, whether it can change over time, whether it is consistent with clinical measurements. It can be seen that it has taken many resources over time to answer all these questions. These answers most likely led to

the choice of this measure over others for a particular study. After all, what interests a health researcher, for example, is the valid measure that best fit for his study. Perceived health status is already tested for validity (DeSalvo et al., 2006) and reliability (Cox et al., 2009; Martikainen et al., 1999), which supports its use in population-level surveys. At the same time, there remains a question mark due to the subjectivity of responses which can change, because, as Bailis, Segall and Chipperfield (2003) say, subjective or self-assessed health status takes into account respondents' perceptions which often change according to time, lifestyle, alcohol and tobacco consumption, physical activity, etc. and that health can change due to many factors, which is why it is important to reassess it. In addition, a positive aspect can be inferred from the fact that the simplicity of the item supports low survey costs and data can be easily collected being a single scale question. There are many results in the literature, which makes the measure intensely debated and interesting.

Some important results of studies on self-rated health are presented next, in order to understand this measure more deeply. The more aspects, both positive and negative, are presented, the more interesting the debate becomes. First, according to Hamplova et al. (2022), the general self-rated health question is the most common measure of health status in large population-based surveys, a perspective that underscores its notoriety. It is a very popular measure of health status (Layes et al., 2012). The item can also have different choices. According to a review (Idler & Benyamini, 1997), several collective studies have been presented reporting the association between self-rated health status and mortality. Idler & Benyamini (1997) present some differences in wording can be seen here for Self-rated health (SRH), but several variants for SRH used in the selected studies, including: "For your age, in general, would you say your health is: Excellent, Good, Fair, Poor, Bad" (Mossey & Shapiro, 1982), "Do you consider yourself a ... person: Healthy, Fairly healthy, Sick, Very sick" (Kaplan et al., 1988), "How is your health, compared with others your age: Better, Same, Worse" (Ho, 1991), "Would you say your health in general is: Excellent, Very good, Good, Fair, Poor" (Wolinsky et al., 1994). Subjectivity is undoubtedly present in all. According to Bailis et al. (2003), self-assessment of health is not only a spontaneous appraisal of health status. Jylha (2009) highlights the importance of this measure by stating that almost no other measure of health is more widely used and less understood than perceived health status. It is included in large surveys such as EHIS (European Health Interview Survey), SF-36 (Short Form 36 items) and according to World Health Organization, Statistics Netherlands, (1996), directly cited by Jylha, it is recommended as a standard part of health surveys.

Although these drawbacks for SRH are noted, this measure is still included in large surveys (Kohn, 2012) and is still chosen by researchers. This makes it a desirable and practical measure, mainly because it consists of a single question with multiple items and is easy to use. Regarding the limitations of the SRH, Kohn (2012) refers to econometric and theoretical issues associated with the use of this ordinal

discrete variable SRH, namely bias, measurement error issues. He mentions that a health index would solve these problems. It is also recommended to use multi-item health measures instead of SRH. SRH should only be used when there is no other alternative (Van Ginneken & Groenewold, 2012). Does it truly reflect the health status of a population? For this, the objective measure is still being debated, especially as Wu et al. (2013) found that SRH is consistent with objective health status which will be presented in the next section. After that will be emphasized that objective measure which is given by a health index which tends towards objectivity with respect to SRH.

2. Objective measure of health

A person's objectively measured health is based on direct evidence, clinical findings, diagnosis and treatment often established based on medical history, symptoms, current and previous diagnosed illnesses (Wu et al, 2013). One of the negative aspects of objective health could be that the patient assessment often lacks health-related questions that cannot always be tested, such as well-being, quality of life, emotional health, nutrition, etc. Usually, at the hospital, the patient is required to do the clinical protocol which may include laboratory samples, blood pressure measurement, taking a health history, presentation of current medications, etc. (Goldman et al, 2004). Wu et al. (2013) used physician-diagnosed disease prevalence and clinical parameters examined in the hospital, taking into account some health risk factors, to objectively measure. Study participants were questioned about the presence of chronic diseases, including hypertension, diabetes, cerebrovascular disorders and chronic bronchitis. Among the clinical parameters that were measured were hemoglobin, total cholesterol, triglycerides, plasma glucose, BMI (Body Mass Index). There are some cases where self-report health is in agreement with the results of clinical tests and diagnosis (Wu et al., 2013), but there are cases where they do not match. Body Mass Index (BMI) may suffer differences if not calculated based on patients' actual measurements (Hill & Roberts, 1998). Hypertension for some who do not measure it may be considered absent (Gupta et al., 2010). Objective measures help to shape respondents' perception of their own health, i.e. contribute to subjective measurement.

Coming back to the health index, they have been constructed to be easier to interpret in order to solve some econometric problems (Kohn, 2012). A single index would be easier to interpret than a discrete variable with multiple categories. An index avoids multicollinearity problems and allows precise inferences regardless of excluded categories (Kohn, 2012). SRH is generally a good predictor for mortality, but a health index with multiple items may be a stronger predictor of mortality according to Van Ginneken & Groenewold (2012). An index is not objective but tends towards the objective, unlike SRH. It has a more objective character given by the items that relate to specific questions about mental, physical, social health, etc.

The literature contains many surveys from which health indices have been constructed. For example, Ginneken & Groenewold (2012) developed a multiscale health index based on the World Health Survey questionnaire. It claims that it is multidimensional. The questionnaire includes SRH and a set of questions about functional limitation in activities of daily living, i.e. mobility, self-care, pain, physical discomfort, anxiety and depression. Each item has 5 categories ranging from “No difficulty” to “Extremely Difficult/Impossible”. It used Principal Component Analysis to construct the health index. The index is an interval-level variable with values between 0 (perfect health) and 1 (in very bad health) (Ginneken & Groenewold, 2012). Kohn (2012) illustrated a health index constructed using Multiple Correspondence Analysis. Shan et al. (2023) used a weighted index comprising 14 chronic diseases to evaluate the objective measure. There are several surveys that have attempted to construct a health index. Many of these already include SRH in their calculation. This already joins the two measures, taking both into account. It joins several characteristics of the same respondent, through some statistical methods. The result may reflect reality better than single SRH. The SF-36 survey is presented first, followed by the EQ-5D.

3. Health indexes

The SF-36 has clearly delimited physical and mental dimensions (Ware, 1993). It consists of a set of easy to administer, generic and consistent measures of quality of life that have been widely used (36-Item Short Form Survey (SF-36), n.d.). It was developed for the assessment of health status, and was specifically designed for research and clinical practice, general population surveys, and health policy evaluations (Ware & Sherbourne, 1992). The SF-36 considers two dimensions-physical and mental, with eight health domains: physical functioning (10 items); physical role limitations (four items); bodily pain (two items); general health perception (five items); energy/vitality (four items); social functioning (two items); emotional role limitations (three items); and mental health (five items) (Burholt & Nash, 2011).

According to Figure 1 (Ware, 2000), physical health is divided into four scales. They are precise items, which measure how limited the respondent is with respect to some usual activities. These items capture aspects of a person’s physical aspects, i.e. walking, moving around, self-care, etc. The last scale is General Health, which is subjective. Interestingly, this measure is integrated within physical health. A debate arises again about what Self-Rated Health can measure. In the SF-36 it is part of physical health, which hints that much of SRH may focus on the physical side, i.e. mobility, illness, etc. Mental health is also given by four items according to the same figure 1 (Ware, 2000). The first scale is Vitality, which is expressed by energy, exhaustion, fatigue. The second scale is Social Functioning, which includes items related to the influence of emotional problems and physical health that affected

social activity with family, friends, neighbours or other groups. The third scale is Role Emotional, which has three items related to problems with work or other activities as a result of emotional problems. Mental Health is the last scale which takes into account nervousness, depression, calmness, energy and exhaustion.

Figure 1. SF-36 measurement model

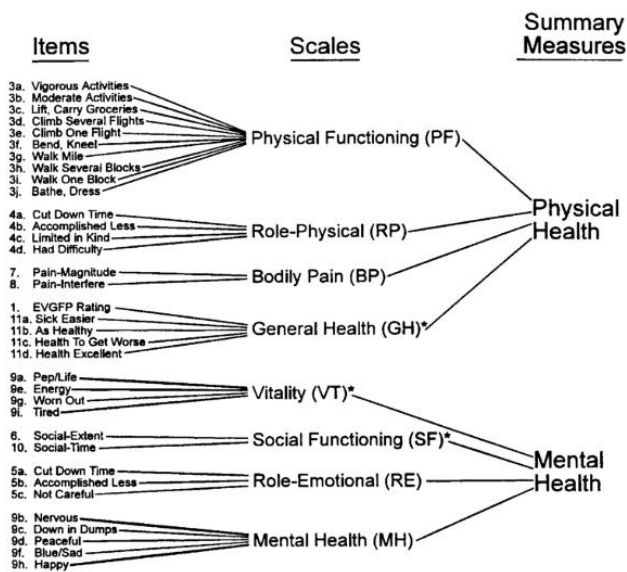


Figure 1. SF-36 measurement model. *Significant correlation with other summary measure.

Source: Ware Jr., 2000

One of the downsides to the SF-36 score is that there is no standardized way to calculate a global SF-36 index of health-related quality of life, given the multitude of ways to create the index (Lins & Carvalho, 2016). Lins & Carvalho (2016) conducted a systematic review to see how the SF-36 total score for health-related quality of life was calculated. According to this review, most studies did not specify the method used, some summed the scores of the 8 domains, some arithmetic averaged the 8 domains, some arithmetic averaged the Physical and Mental Component Summaries, and only one study included well-being across the 8 domains and the Physical and Mental Component Summaries. The SF-36 is very popular for health-related quality of life and is not specific for general health, but nevertheless, the overall score indicates the health status of patients (Ogura et al., 2021).

A version of the SF-36 health index for a Greek population considers mental, physical health and general well-being (Anagnostopoulos et al., 2005). They added a third factor - General Well-being - consisting of the items General Health and

Vitality. Of the 1426 respondents chosen for the study, only 1007 agreed to participate. The responses for each item were coded, summed and transformed into a scale from 0 (worst possible health) to 1 (best possible health). To test construct validity, they used SEM analysis (Anagnostopoulos et al., 2005). Another algorithm to create the two aggregated scores of the two components - physical and mental - is presented by Taft, Karlsson & Sullivan (2001) in the work of Laucis et al. (2015). First the 8 subscales (from 0-100) are standardized using linear z-score transformation. The eight scale scores are calculated, a z-score is determined for each by subtracting the scale mean of a sample of the general U.S. population from the scale score of an individual and then dividing by the standard deviation of the general U.S. population. Each of the eight z-scores is then multiplied by the corresponding factor score coefficient for the scale. There are two different sets of factor scoring coefficients, one for the PCS and one for the MCS. The products of the z-scores and the factor scoring coefficients for the PCS are then summed, and a similar calculation is performed for the MCS. Each resulting sum is multiplied by 10 and added to 50 to linearly transform the PCS or MCS into the T-score metric, which has a mean of 50 and a standard deviation of 10 for the general U.S. population (Laucis et al., 2015).

The EQ-5D is a questionnaire consisting of two parts, the EQ-5D and the EQ VAS (EuroQol Research Foundation, 2019). Each part captures either the objective measure of health status or the subjective measure. Historically and theoretically, the EQ-5D is a health status measure developed by the EuroQol Group in the 1980s (Devlin & Brooks, 2017). According to Brooks (2003), the EQ-5D was specifically designed to complement other health-related quality of life (HRQoL) measures such as the SF-36, NHP, SIP or disease-specific measures. The EQ-5D considers the societal perspective, i.e. health economics, whereas the EQ VAS is used more in clinical assessments and surveys of some populations (EuroQol Research Foundation. EQ-5D-5L User Guide, 2019). From the EQ-5D, health profiles can be created from which sets of values are formed that can be concretized into a health index. The EQ VAS is separate from this index, aiming to subjectively measure health based on the perceptions of the respondents. In terms of structure, page 1 contains optional demographic questions, page 2 is the EQ-5D, and page 3 the EQ-VAS. The socio-demographic questions are related to age, gender, smoking, education, medical work, activity category (EuroQol Research Foundation. EQ-5D-5L User Guide, 2019).

The five dimensions of EQ-5D are: mobility, self-care, usual activities, pain/discomfort and anxiety/depression, of three levels each (Devlin & Brooks, 2017). The levels range from “no problems” to “extreme problems/unable to” (EuroQol Research Foundation. EQ-5D-5L User Guide, 2019). According to the same user guide (EuroQol Research Foundation. EQ-5D-5L User Guide, 2019), these levels are coded from 1 to 5 for each response option of each dimension. Only one correct answer is possible and missing values are coded as 9. Uncertain values

are treated as missing values. The merging of the five dimensions for a case reflects a health state. For example, a respondent's answer of 1 for all 5 items represents health status 11111, which means no problems for all five dimensions. Respondents' health states can be summarized by this five-digit coding or they can be summarized in an index given a single value. This index expresses how good or bad the health status is taking into account the assessments of the general population in a region/country.

The collection of the index values of all EQ-5D States is called the value set (EuroQol Group, n.d.). To create the health index, one needs to specify the value set for a given country/region, and then calculate the mean, standard deviation, minimum, median and maximum scores for that specific population (EuroQol Research Foundation. EQ-5D-5L User Guide, 2019). The value set is already available for most countries and can be used in the analysis (EuroQol Group, n.d.). The method, model, covariates and fixed effects will be chosen according to the study (e.g. ANCOVA) (EuroQol Research Foundation. EQ-5D-5L User Guide, 2019). EQ-VAS represents the perceived health state on a Visual Analogue Scale (VAS) from 1 to 100, from "best imaginable health state" to "worst imaginable health state" (Brooks et al., 2003). EQ VAS focuses on the patient's perspective and reflects the patient's point of view (EuroQol Research Foundation. EQ-5D-5L User Guide, 2019). Note that the health index does not include the EQ VAS, i.e. the subjective item - perceived health status. These are separated. Can observe that a health index is more complex than SRH and considers more aspects. Regardless of which measure is to be applied in a study or a survey, statisticians have to deal first with measurement issues. The next section covers some aspects related to measurement.

4. Measurement issues

Subjective and objective health measures, i.e. clinical tests and health indicators, have a sort of error (AFMC Primer on Population Health, 2024). Traditional reliability considers only random errors, while validity testing considers bias (Dowell, 2006). It is important how respondents were chosen, whether the sample is representative, whether everyone has an equal chance of being selected. There may be respondents who do not wish to participate even though they have been selected, which may cause bias. Also, the clinic has all the data recorded, but after a while people may not remember them and report erroneously when asked (AFMC Primer on Population Health, 2024). In health care, many measurement issues can arise and indicators may or may not work well, which is why reliability and validity are tested (Ebrahim & Bowling, 2005).

Subjective measures are more concerned with the perception of health status, which takes into account several aspects, which is why it has been tested for reliability and validity, among others. According to Nunnally (1978) and

Helmstadter (1964) (direct quotation from Ware, 1993), comparisons between individuals require high reliability, with values greater than 0.90, and comparisons between groups do not require high reliability (values between 0.50 and 0.70 or higher are acceptable). Validity is generally the degree to which an instrument measures what it is designed to measure (Culyer, 2005). The construct is a theoretical measure of something that cannot be measured directly, such as “quality of life” or “severity of illness” (Culyer, 2005). The literature shows that self-rated health status is a very reliable measure for estimating health (Ringen, 1995). It is difficult to separate the objective measure from the subjective measure and to impose a particular approach, which is why they may be more successful together in assessing health attributes (Barofsky, 2012). Wu et al. (2013) found that SRH is consistent with objective health status. There are some situations where people’s reporting of their own health is in agreement with clinical test results and diagnosis respectively (Wu et al, 2013), but there are situations where these do not coincide. Body Mass Index (BMI) can be subject to discrepancies if not calculated based on patients’ actual measurements (Hill & Roberts, 1998). Hypertension for some who do not measure it may be considered absent (Gupta et al, 2010).

Conclusions

Health measurement methods are complex and it is challenging to choose one for a particular study. Both subjective and objective are very important and interconnected. From a statistical point of view, there can be seen differences in data, statistical analysis and results. For health representatives, these results may be useful in developing health policies. In this way, the choice of the best method is still up to the researchers. A combination of subjective and objective measurement would be ideal for measuring health status, i.e. the health index from SF-36. In this study, the advantages and disadvantages were presented, and a better picture of the two types of measures was drawn. Subjective health could be about low costs and simplicity, but may be a challenge when it comes to reassess health over time due to the perception which is about to change most likely. On the other side, in general, the health index facilitates statistical analysis, is easy to interpret, is a strong predictor of mortality, and solves some econometric problems. Both SRH and health index need to consider the individual and population level, more precisely the representativeness of the population, the data accuracy, as well as the reassessment of health as a result of changes that may occur over time. Both measures seems to be valid and reliable and popular. The fact that they are being consistent with one another highlights a research direction that involves updating or creating health measures that include subjective and objective elements.

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