General introduction
Background

With the increase in life expectancy and a decrease in birth rate, the proportion of older people in Western societies shows an impressive increase and will continue to rise in the nearby future. In The Netherlands in 2011, 2.6 million people were aged 65 years and older, almost 16% of the population. In 2040 this number is expected to have increased to 4.6 million, almost 26% of the total population. The share of people aged 80 and older will increase substantially as well: from 0.7 million in 2011 to 1.5 million in 2040, then constituting 33% of those aged 65 and over.

The current life expectancy at birth is around 82 years for women and 78 years for men. A shift in causes of death underlies this historically high life expectancy. From the end of the nineteenth century, mortality from infectious diseases at younger ages strongly decreased. From then onwards, mortality at older ages due to chronic diseases began to dominate. Since a few decades, survival from certain chronic diseases has been improving. Someone who reaches the age of 65 can still expect to survive to the age of 86 (women) or 83 (men). Due to improved detection and medical care, the increase in life expectancy can be found particularly in those with diseases or disability. For example, mortality rate after being hospitalised for myocardial infarction has substantially declined in recent years. As a result, concerns have arisen regarding the quality of life of older people. With a changed focus, from reducing mortality (‘adding years to life’) to increasing quality of life at older ages (‘adding life to years’), insight into the health status and level of well-being of older people is needed. In addition, the increase in longevity places pressure on health care systems and knowledge of older people’s health and well-being can improve health care decision making.

Self-rated health

A simple and pragmatic tool that researchers often use to measure overall health status is self-rated health (SRH). SRH reflects an individual’s own concise evaluation of his or her health status and is closely related to well-being and quality of life. This health measure most often consists of only one item and preset responses on a 5-point scale (in the current study, ‘How is your health in general? very good, good, fair, poor, very poor’). SRH has been included in sociological and epidemiological studies since the 1950s, but gained interest in particular after it was identified as a predictor of mortality. Many studies confirmed this finding, even when mortality-relevant indicators such as gender, socio-economic status and more objective measures of health were taken into account. SRH also predicts other negative health outcomes, such as hospitalisation, disability and the onset of chronic diseases. The WHO includes SRH in the World Health Survey, for monitoring the health of populations and outcomes associated with the investment in health systems. SRH has also been recommended as an indicator for healthy life expectancy (i.e. the number of years a person is expected to live in good health) and has been described as a useful concept in prevention and clinical medicine.
At the same time, ongoing debate exists on the appropriateness of using SRH as a measure of overall health status. There is a need for more specific recommendations regarding its use in population health research, both in older and younger populations. Recommendations for using SRH in longitudinal and trend studies in particular are lacking. The primary goal of this thesis is to investigate the ability of SRH, as a simple and pragmatic measure, to reflect the overall health status of older people. A seeming contradiction exists at older ages between on the one hand people’s physical health, which often declines with increasing age, and on the other hand their stable or even improving level of wellbeing or subjective health. This discrepancy is also known as the ‘paradox of ageing’ or ‘disability paradox’. In this first chapter, the theoretical background of SRH and its relationship with more objective health indicators are described and the objectives and methods of the following chapters are presented.

Paradox of ageing

Johnson and Wolinsky have proposed and tested a model to describe how different health problems experienced by older adults negatively influence their evaluation of health. A slightly simplified version of this model is shown in Figure 1.

![Figure 1. The structure of health status, adapted from Johnson and Wolinsky, 1993](image)

Chronic diseases are defined as long-term diseases or diseases with long-term consequences. With advancing age, the prevalence of chronic diseases typically increases. Among a wide range of chronic diseases, affecting all types of organic systems, the diseases with the highest prevalence among Dutch people aged 55 years and over are diabetes mellitus, arthritis, cardiac disease, stroke, cancer and chronic non-specific lung-disease. Multimorbidity (defined as having two or more chronic diseases) has a high prevalence in the older population as well: more than 50% of all adults aged 55 and over currently has at least two chronic conditions. Almost all chronic diseases are associated with having more functional limitations and using more health care. Some chronic diseases contribute to the risk of a fatal course, such as diabetes, cardiac disease and cancer; others are not related to mortality, like arthritis. Non-fatal diseases generally show a higher disabling impact and fatal diseases show a stronger relation with health care use.
Different conceptualizations of the level of functioning have been proposed, of which the most well-known is the one by Verbrugge & Jette. Their conceptualization of the disablement process describes the pathway from pathology, via impairment and functional limitations to disability. Functional limitations were defined as limitations in specific body systems; disability was defined as difficulty doing activities in any domain of life due to health or a physical problem. The prevalence of functional limitations and disability increases with age: among Dutch people aged 65 to 74 years the prevalence of having any functional limitation or disability is about 30%, while those aged 80 and over more than 50% report one or more functional limitations or disabilities.

Johnson & Wolinsky showed that, among older people, chronic diseases have a negative impact on perceived health, partly via their negative effect on functioning. Many studies have confirmed these associations. At the same time, there is strong evidence that the link between symptoms, diagnosed conditions and poor functioning on the one hand and SRH on the other hand weakens with age, i.e. the ageing paradox. SRH shows a rather strong stability, as opposed to changes in chronic disease status and functioning that usually occur in the ageing process. Given a comparable level of chronic diseases and functioning, older olds rate their health more positively than younger olds and are less likely to change their evaluation of health in response to changing disease status. It seems that age attenuates the negative impact of health problems on SRH.

![Figure 2. Age and the impact of diseases and functioning on SRH](image)

A relatively optimistic view on health or wellbeing among older people may result from cohort differences or selective survivorship. For example, more recent birth cohorts may think differently about their health because of different health care experiences. However, most studies have explained this ageing paradox by mechanisms of adaptation in response to health declines, for example social comparison mechanisms. The resulting age differences in the association between SRH and health problems challenge the interpretation of SRH as a proxy for underlying health status across age groups or in ageing individuals over time. Can SRH still be viewed as a valid indicator of underlying health status in older ages?
The conceptual meaning of SRH in older age

Why do associations between chronic diseases and functioning on the one hand and SRH on the other hand change with age? It has been noted by Tissue that SRH ‘represents a summary statement of several health dimensions that are taken into account and that are shaped by a personal perceptual framework’\(^4\). Following this, Jylhä (2009) proposed a model for the evaluation of one’s health (Figure 3). The model consists of three steps which are discussed in the following section: respondent should (1) select relevant health aspects, (2) use a frame of reference to value these aspects, and (3) select one of the pre-set response options. These steps, not always consciously or successively taken, may explain why older people may rate their health differently than younger people.

First, respondents need to select health aspects relevant to them. Four groups of explanatory factors had strong and consistent associations with SRH: medical diagnoses, physical symptoms, physical function and mental symptoms\(^5\). Qualitative studies confirm the importance of these health aspects for SRH\(^6\). Thus, next to traditional somatic measures of health, SRH includes an evaluation of mental well-being, or the absence of psychological stress\(^6\). Also associated with SRH are behavioural factors\(^3\) and a wide set of biomarkers\(^6\). SRH may include present health states as well as any improvements or declines that have occurred or are expected to occur\(^6\). Sociodemographic characteristics are also associated with SRH, because they influence the likelihood that certain health aspects are considered relevant\(^6\). The decreasing association between physical health problems and SRH with age\(^4\), suggests that these health problems become less relevant for SRH. Remarkably enough, some qualitative studies, albeit not all\(^6\), suggest that older people and those in worse health increasingly mention physical health problems as important aspects when rating their health\(^5\). For instance, one study showed that younger people more often referred to health behaviours, while health problems were more often mentioned by older people\(^6\). Also within the older population, older olds may have an altered meaning of health compared to younger olds\(^6\).

Second, respondents should view these relevant health aspects in reference of other factors to come to a valuation of ‘my health’. People often make comparisons with one’s previous health (temporal comparison) or with age peers (social comparison)\(^5\), even though the SRH question does not ask to make such comparisons. Social comparison plays an important role in maintaining and enhancing the self in the face of health decline: a poor health state may be compared to that of others who are worse off, resulting in preserved good SRH\(^3\). Older people may also compare their health to a stereotype of a frail older person, so that their own health still can be considered as good\(^3\). In addition, they may take into account the medical history and longevity of their parents and grandparents\(^1\). The aspiration level that people have plays a role in determining if a given health status is considered good or poor\(^7\), which may further explain why older people and those with existing chronic rate their health differently than those without chronic illnesses\(^5\). For example, the older old may expect declining health and thus evaluate new diagnoses as ‘on-time’ rather than ‘off-time’ events\(^6\). Finally, the...
model includes dispositional optimism and depressive feelings as factors that influence whether a certain health state is rated as good or poor.

"How is your health in general? Is it excellent, very good, good, fair, or poor?"

Contextual frameworks of evaluation
Culturally and historically varying conceptions of "health"

Evaluation of own health status
What constitutes "health"? What are the relevant components of my health?

Review of
- information of medical diagnoses
- observations of functional status
- experienced bodily sensations and symptoms
- formal signs of illness: prescribed drugs, sick leave, disability pension
- risks and strengths expected to influence future health (behaviour, genetics)

How is my health in general, taking into consideration
- my age
- the situation of other people I know
- my earlier health status
- the expected development of my health?

Which of the preset options best describes my health? Which of them appears to be the normal, ordinary one?

What is my situation like compared to that?

Self-rating of health

Figure 3. The process of individual health evaluation

Third, respondents need to choose one of the pre-set response options that best fits their health evaluation. A topic that has been highlighted recently is that of differences in the reporting of SRH: given a level of health, some groups may systematically rate their health better than other groups. This might be due to differences in other steps of the health rating process, for
example to a different conceptualization of health or a different frame of reference, but also to differences in what respondents view as the normative category for health. For example, in one culture ‘good’ may be viewed as normal, whereas in other cultures ‘fair’ may be viewed as the normal category. Linguistic differences in the SRH items or in response options were also found. To our knowledge, no studies have investigated age differences in how the response options of SRH are being used.

### Existing health problems and self-rated health

The previous section indicated that the meaning of SRH may change with increasing age or with deteriorating objective health status. This implies that in older individuals who are in poor health already, further declines in health and functioning may not affect SRH to the same extent as before. The first part of this thesis further explores how SRH responds to new health declines across different levels of ‘baseline’ health status. Two topics are becoming increasingly relevant in the older population, but have not been examined before.

First, there is a high prevalence of multimorbidity in the older population, but studies have focused far more often on the effect of separate chronic diseases on SRH than on the effect of multiple diseases. Due to adaptation to existing health problems, the negative impact may decrease with each additional chronic diseases. On the other hand, due to interactions between the symptoms of multiple diseases, SRH may be poorer than would be expected based on just summing their separate effects. Co-occurring diseases also may show a simple additive impact on SRH. This thesis examines whether first chronic diseases have a smaller, larger or similar impact on SRH compared with subsequent chronic diseases, and whether results differ across age groups.

Second, it is unknown if SRH is still sensitive to changes in chronic diseases and functioning among the oldest olds, e.g. those aged 90 years and over. With the increasing life expectancy, these ‘nonagenarians’ are a rapidly growing age group. Morbidity prevalence is quite high, but more than half still rate their health as good or very good. This indicates that the discrepancy between SRH and objectively measured health status may have reached a maximum. This thesis examines longitudinal change in SRH in nonagenarians, as well as the predictive value of changes in chronic diseases and functioning on decline in SRH.

### Response shift

In the second part of thesis it will be examined which changes (i.e. the selection of relevant health problems or the use of a particular reference frame) explain the stability of SRH that often occurs despite health decline. In the field of medical psychology, changes over time in how people rate their health or wellbeing have been termed *response shift*. Response shift is
defined as “a change in the meaning of one’s self-evaluation of a target construct as a result of a change in internal standards (recalibration), a change in values or priorities (reprioritization), or a change in the definition (reconceptualization) of that target construct”. The three types of response shift partly overlap with the first two steps identified by Jylhä. So far, no studies have been conducted that examined reprioritization, reconceptualization and recalibration response shifts in the measurement of SRH in older people.

Due to shifts in how respondents rate their health, prospectively measured change in SRH may not be reflecting change in underlying health status accurately. A so-called then-test asks for a renewed judgment of one’s health, for example a few years earlier or before a specific adverse health event (e.g., 'how was your health three years ago?'). The underlying assumption of the then-test is that SRH measured at follow-up and SRH measured with the then-test are rated according to the same concept and standard of health, since both are rated at the same time. Hence, the difference between these measures may better reflect actual change in health than the difference between SRH at baseline and SRH at follow-up. Moreover, a retrospective measure of change in SRH would be an efficient alternative to collecting longitudinal data to measure changes in SRH, for which resources are often not available. The predictive value for mortality of a retrospective measure of change in SRH will be compared with that of prospectively measured change in the current thesis.

**Trends in health and self-rated health**

The third part of this thesis examines the association between SRH and chronic diseases and functioning in trend studies. In Figure 3, historically varying conceptions of health are depicted as a contextual factor influencing which health aspects are viewed as relevant by older people, but this has not been examined previously. Therefore, it is unknown to what extent trends in SRH reflect underlying trends in other health dimensions. Similar to the effect that ageing has on SRH, it might be that over historic time, older people take different health aspects into account when rating their health, or use a different standard to evaluate their health. Previous studies on trends in SRH have shown conflicting results, which may partly be explained by cross-national differences in health trends or variations in methodology or time periods between studies. However, within countries concurrent trends in chronic diseases and disability are also not always reflected in SRH trends, which indicates that the influence of these health indicators on SRH changes over time. This thesis investigates whether associations between SRH, chronic diseases and disability change over time.

As a final research question, we will study changes in the reporting of chronic diseases in the recent decades. When comparing self-rated health with self-reported measures of overall health, bias may occur: the same reporting behaviour that influences SRH may also affect the reporting of chronic diseases, although the reporting of chronic diseases was shown to be fairly accurate. If trends in chronic diseases and in their association with SRH is considered, it might
well be that trends in associations are masked if the reporting of both measures has changed. We will compare self-reports of chronic diseases and multimorbidity with reports of general practitioners at two points in time. This way, the interpretation of trends in self-reported chronic diseases, an important determinant of SRH, may be improved.

**Objective and outline of this thesis**

The following chapters address three main research questions. Each question concerns a comparison between SRH and overall health status in the older population. Overall health status is defined in this thesis by the number of chronic diseases and a measure that captures both functional limitations and disability.

1. **Does the impact of additional health problems on SRH depend on the amount of existing health problems?**
   - *Chapter 2* investigates the impact of additional chronic diseases on SRH, conditional on the presence of existing chronic diseases. The moderating effect of age is examined as well.
   - In *Chapter 3*, the ability of SRH to reflect changes in chronic diseases and functioning among nonagenarians (those aged 90 years and over) is examined.

2. **Which change occurs in response to additional health problems, thereby contaminating the measurement of longitudinal change in SRH: (1) the selection of health aspects or (2) the use of a particular frame of reference?**
   - *Chapter 4* applies response shift theory to explain the stability in SRH despite apparent objective health declines. The occurrence of reprioritization, reconceptualization and recalibration response shifts in the measurement of SRH will be investigated.
   - In *Chapter 5*, the ability of a retrospective change measure (which is expected to be less prone to changes in standards) to predict mortality is compared to that of a prospective change measure of SRH.

3. **Is SRH a useful measure of overall health in trend studies among older people? Can self-reported chronic diseases be used to measure these trends?**
   - The perspective of *Chapter 6* is different from that of the previous chapters. Changes in SRH are not studied in people who age, but in same-aged groups across different years. Trends in SRH between 1992 and 2009 will be compared to trends in chronic diseases and functional limitations.
   - The final study, described in *Chapter 7*, investigates the agreement between self-reported and general practitioner reported chronic diseases. The agreement in reporting is compared between 1992 and 2009.
In the general discussion in **Chapter 8**, results will be summarised, discussed and compared with results found in the literature. In addition, directions for future use of and research on SRH are provided.

**Cohort studies**

In all chapters, data from the Longitudinal Aging Study Amsterdam (LASA) are used, except for Chapter 4, which uses data from the Finnish Vitality 90+ Study. General characteristics of these studies are described below. More information on the specific number of participants included in the studies in this thesis and characteristics of these samples are provided per chapter.

LASA is an ongoing multidisciplinary study focusing on predictors and consequences of changes in well-being and autonomy in the older population\(^2\). A random sample of older adults (55-85 years), stratified by age and gender according to expected 5-year mortality, was drawn from the population registries of 11 municipalities in three geographical regions of The Netherlands in 1992. Sample members were approached first for the NESTOR program ‘Living arrangements and Social Networks of older Adults’ (N=3,805; cooperation rate 62%)\(^3\), and after an average of 10 months the participants were approached for the LASA baseline measurement (N=3,107; response rate 82%). The Medical Ethics Committee of the VU University Medical Center approved the LASA study; informed consent was obtained from all respondents. Respondents were examined in their homes by trained and supervised interviewers once every three years. In 2002, a group of 1,002 new respondents (55-65 years; cooperation rate 62%), sampled from the same sampling frame as the original cohort, was added to the sample. This was done so that the age group 55-65 years old could continue to be studied and different cohorts later on in the study could be compared. Seven waves of data collection have been conducted so far, in 1992-93, 1995-96, 1998-99, 2001-03, 2005-06, 2008-09 and 2011-12. This thesis is based on data collected between 1992 and 2009.

Figure 4. Overview of LASA measurements between 1992 and 2009

The Vitality 90+ Study is a prospective multidisciplinary population-based study of people aged 90 years or over in Tampere, the third largest city in Finland. The aims of this study are to explore well-being and functioning among people aged 90 years and over and to assess predictors of longevity and healthy ageing\(^4,5\). Six waves of data collection have been conducted through mailed surveys in 1996, 1998, 2001, 2003, 2007 and 2010. In this thesis, data from the 2001
data collection onwards are used, including people living independently as well as people in assisted living facilities, residential homes or hospital. The response rate in 2001 was 79% (aged between 90 and 106 years). Each wave was approved by the Research Ethics Committee of the City of Tampere.

<table>
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<tr>
<th>Year</th>
<th>Sample Size</th>
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<td>1996</td>
<td>N=415</td>
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<tr>
<td>1998</td>
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<td>2001</td>
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<tr>
<td>2010</td>
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*Figure 5. Overview of Vitality 90+ Measurements*
References


Chapter 1


Goebeler S. Health and Illness at the Age of 90 [ Tampere: University of Tampere, School of Public Health; 2009.


