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Raija Leinonen

SELF-RATED HEALTH IN OLD AGE

A Follow-up Study of Changes
and Determinants

Esitetään Jyväskylän yliopiston liikunta- ja terveystieteiden tiedekunnan suostumuksella
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ABSTRACT

Raija Leinonen

Self-rated health in old age. A follow-up study of changes and determinants

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Finnish summary

Diss.

The purpose of the study was to examine how older people rate their health with increasing age and how they assess change in their health over a 5-year follow-up period. Further, the aim was to study the individual-related factors underlying self-rated health, as well as to explore whether self-rated health takes the form of a continuum in relation to different indicators of health status, functional performance, and physical and social activity.

This study was part of the Evergreen project and used data on the inhabitants of Jyväskylä, Finland, born in 1914. The baseline data were collected in 1989, the 5-year follow-up was conducted in 1994, and the 10-year follow-up in 1999. The data were collected by home interviews, questionnaires and examinations conducted in the study centre. The examinations in the study centre included a clinical examination and a wide range of tests of physical and cognitive performance and sensory capacity.

Stability in self-rated health was more common than change when the same question was asked at two different time points five years apart. However, when the respondents were directly asked about change in their health status, about half of them said their health had become worse. Decline in physical activity and cognitive functioning was associated with lower self-rated health. Negative self-assessed change in health was related to a deterioration in functional performance and physical activity and to an increase in number of chronic conditions as well as baseline number of chronic conditions. The four self-rated health groups constituted according to change and stability over a 5-year period seemed to reflect systematically individuals' health status, functional performance, and physical and social activity, and supported the assumption that self-rated health is a continuum.

The factors underlying self-rated health and the paths from the examined variables to self-rated health showed some gender differences and some variation between the cross-sectional and longitudinal models used. The most powerful determinants of self-rated health were the ability to perform the physical activities of daily living, number of chronic diseases, number of depressive symptoms, maximal working capacity, cognitive functioning, social functioning and physical activity. In addition, baseline self-rated health had a strong effect on 5-year follow-up self-rated health.

The results suggest that among older people self-rated health in response to a single question reflects multiple dimensions of health and functioning. Further, it seems that an active lifestyle, particularly one including a sufficient amount and variety of physical activity, is an important determinant of good self-rated health. Self-rated health seems to form a continuum when a wide range of self-reported and objectively measured indicators of the physical, psychological and social components of health are taken into account. The results also suggest that ageing people adapt to changes in their objective health and functional performance: the majority tend to assess their health as similar to or even better with increasing age despite an increase in chronic diseases and decline in functional performance. However, a negative self-assessed change in health indicates that older people are realistic about these negative changes.

A better understanding of the determinants of self-rated health can be put to use, for example, in developing preventive interventions aimed at maintaining and improving the health and quality of life of older people. In addition, such knowledge could be utilized in planning health counselling of older people.

Key words: determinants of self-rated health, change in self-assessments of health, continuum, elderly people, follow-up study

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During the recent years when I have had four teenage daughters at home I have thought of having five dissertations under work in my life. All of them are distinct and demand a lot of work, love and faith in the final outcome. The first, which has perhaps been the easiest one of these, is now in the final phase. The other four 4 Reija, Henna, Outi and Satu 4 are the most important ones and are getting ready one after another. Thank you for fulfilling my life with your sorrows and happiness, your anger and love. My husband Hannu has helped me in finishing the layout of this book and took a patient attitude when the stupid computer was not working as I had meant. Thank you for your help and understanding.

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LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following papers, which will be referred to by their Roman numerals.

- (I) Leinonen R., Heikkinen E., Jylhä M. 1998. Self-rated health and self-assessed change in health in elderly men and women. A five-year longitudinal study. *Social Science & Medicine* 46, 591-597.
- (II) Leinonen R., Heikkinen E., Jylhä M. 1999. A path analysis model of self-rated health among older people. *Aging. Clinical and Experimental Research* 11, 209-220.
- (III) Leinonen R., Heikkinen E., Jylhä M. 2001. Predictors of decline in self-assessments of health among older people - A five-year longitudinal study. *Social Science & Medicine* 52, 1329-1341.
- (IV) Leinonen R., Heikkinen E., Jylhä M. 2001. A pattern of long-term predictors of self-rated health among older people. *Aging. Clinical and Experimental Research* 13, 454-464.
- (V) Leinonen R., Heikkinen E., Jylhä M. 2002. Changes in health, functional performance and activity predict changes in self-rated health: A 10-year follow-up study in older people. *Archives of Gerontology and Geriatrics* 35, 79-92.

1 INTRODUCTION

The prevalence of chronic conditions and problems in functional ability increases with advancing age at the population level. Comorbidity is common at older ages (Guralnik et al. 1989, Heikkinen 1995) and only 10-20% of people aged 75 have no chronic conditions. However, about half of them rate their health as good (Heikkinen et al. 1983). The discrepancy between these figures shows that older people's appraisals of health are based more on other factors than morbidity alone.

Both health and aging are complex concepts and the study of their combination as 'health in old age' involves several problems. The medical definition and measurement of health have traditionally been anchored to the negative endpoint of health, morbidity. A more positive definition of health emphasises that health is a multidimensional concept affected by interacting biomedical, social and behavioural processes (Sidell 1995). This expanded definition of health leads to a question: how should health be measured?

A person's health can be evaluated in two different ways: by an expert, e.g. a medical doctor or by the person himself. The subjective and objective indicators of health are frequently related to discussions of these two different approaches to health evaluation. The subjective indicators can be understood as those based on personal feelings (Jenkinson 1994) and are equated with self-rated health, and the objective indicators as those using medically defined criteria concerning diseases. The latter are usually thought to be superior and less biased than the former ones (Manderbacka 1998) but e.g., Bjorner and coworkers (1996) propose that the subjective and objective perspectives on health deserve to be studied in their own right, and both of them can help us to improve human health and well-being.

Self-rated health, a subjective overall evaluation of health, is an important component of the quality of life of elderly people. In several studies self-rated health has proved to be a predictor of survival (e.g. Kaplan & Camacho 1983, Idler et al. 1990, Jylhä et al. 1992) and to affect the need for and use of services (Heikkinen 1989, Segovia et al. 1989). The term self-rated health is a complex concept and the interrelationships and combined impact of factors related to it

are inadequately understood. A better understanding of the factors underlying older people's self-ratings of health would enable the design of preventive interventions to maintain and improve health and the quality of life of this segment of the general population.

The aim of this study was to improve the understanding of the factors which affect self-ratings of health among older people. More specifically, the purpose was to examine how men and women rate their health with increasing age and how they assess the change in their health over time. In addition, the aim was to study the determinants of self-rated health related to the individual and the factors related to self-assessing the health as declining. Further, the aim was to examine how different indicators of health status, functional performance, and physical and social activity are related to change and stability in self-rated health and whether self-rated health takes the form of a continuum in relation to these indicators. The study group comprised all the inhabitants of the City of Jyväskylä born in 1914 who were alive at the beginning of the study in 1989. The data were collected by home interviews, questionnaires and examinations in the study centre at three time-points five years apart.

2 REVIEW OF THE LITERATURE

2.1 Concept of health in old age

Health is a term which is hard to define although we all use it and assume we understand it. Distinct definition of health is not possible as, depending on the research interest, different aspects may be stressed. In addition, health as a subjective experience is situational and individuals vary in their own explanations of health and illness depending on their current circumstances, sex, social class and ethnicity (Blaxter 1990, Stainton-Rogers 1991). Rather than defining health as a state it could be determined as a dynamic, lifelong process. One of the mysteries related to the concept of health in old age is why older people assess their health as good even though their objectively measured health is not so good (Sidell 1995).

The basic distinction between the various definitions of health is that between negative and positive definitions. The former views health as the absence of ill health, whereas the latter definitions see health more comprehensively (von Wright 1964). The biomedical model of health, which represents the negative health definition and explains health in terms of biology has a longstanding tradition and is still influential in Western culture. This disease-orientated view of health paints a negative prospect of health in old age as a time of morbidity, declining capacities and increased frailty. Increasingly, other models of health with wider social and psychological orientation, encompassing a 'holistic' account of health have been accepted in medicine. In these models the focus is still on the individual, whereas wider environmental or ecological explanations of health emphasize that health and disease arise from the relationship between people and both the natural and artificial environment. In addition to the increase in holistic definitions of health more attention is being given to how lay people define health and how it affects the quality and meaning of their everyday lives (Sidell 1995).

The World Health Organization (WHO 1958) has proposed what is probably the most well known positive definition of health as "a state of complete

physical, mental and social well-being and not merely the absence of disease or infirmity". Although this definition has been criticised for its generality, it underlines the multidimensionality of health and emphasises the connection of health with other forms of welfare. Antonovsky (1984) argues that health should be viewed more salutogenically and that the ways of achieving health should be explored. He suggests that people should be located along a continuum of health, which he calls 'health-ease-dis-ease' rather than be categorized as either healthy or diseased. This would disincline us to stereotype 'the elderly' as diseased and would give us a possibility to reconceptualize questions about health in older age to concentrate on older people's use of adaptation and coping with chronic conditions and disability (Sidell 1995).

Increased interest has been shown in lay perspectives on the concept of health over the last two decades. A common finding has been that people have a range of views of health. Herzlich (1973) established in her study of an adult middle class population that the concept of health contains not just one health but several healths which can be ordered along three dimensions: health as the absence of disease, health as a reserve and health as a state of equilibrium. These dimensions appeared either separately or in parallel. The study by Blaxter and Paterson (1982) focused on the health beliefs of two generations of working class mothers. The respondents emphasised the functional aspect of health by expressing health as the ability to function normally and to go about their daily business.

In a later study by Blaxter (1990) which was based on the data of the large Health and Lifestyle survey both younger and older people saw health as psychosocial well-being. The respondents expressed more than one definition of health. Blaxter narrowed the different definitions down to four main categories: health as (1) absence of disease, (2) physical fitness and energy, (3) being functionally able, and (4) being psychologically fit. Among older respondents health was seen as energy or vitality more than as physical fitness; likewise maintaining social relationships and having the energy to help others were important definitions of health. The view of health as a psychosocial sense of well-being rather than the absence of illness was particularly emphasised among the older respondents who had a chronic illness.

2.2 Concept of self-rated health

Self-rated health is a tool that has been used frequently in gerontological and health research over the last five decades. The first generation of researchers who worked with this variable were not interested in subjective ratings in themselves, but sought a simple measure as a useful substitute for clinical examinations. In the 1980s, after the finding that self-rated health was a significant independent predictor of survival (Mossey & Shapiro 1982), the debate on the nature of self-rated health changed. Researchers began to show increased interest in establishing the correlates and determinants of self-rated health itself.

Self-rated health is based on the individual's perception and evaluation of

his or her health, and is usually founded on age-peer comparison either consciously or unconsciously (Bjorner et al. 1996). The logic according to which people assess their health is relative and varies socio-culturally. Age seems to be one important factor in this logic so that older people relate their health to that of their age-peers (Jylhä et al. 1992). The use of a global question about self-rated health forces the respondent to summarize assessments on different health statuses into a single rating. This task may be difficult since people may feel differently about different aspects of health. Most people interviewed do not simply opt for one of the alternative responses but describe and explain their status (Jylhä 1994).

The research on self-assessments of health displays a wide range of terms, the use of which varies depending on the research methodology employed. In epidemiological research, for example, the terms self-rated health (Rodin & McAvay 1992), self-assessed health (Moum 1992), self-evaluated health (Fylkesnes & Førde 1992), subjective state of health (Kaplan et al. 1988), self-perceived health (Schroll et al. 1991) and perceived health (Svärsudd & Tibblin 1990) have all been used. According to Bjorner and colleagues (1996) these different terms can be seen as representing the same concept. In the present study I will mainly use the terms self-rated health and self-assessment of health.

Models of self-rated health

Approaches to the investigation of self-rated health have been very varied and thus no overall 'grand model' for self-rated health exists (Bjorner et al., 1996); rather different models have appeared in the literature, e.g. an information processing framework by Leventhal (1986), a measurement model by Ware (1995), and structural models proposed by Liang and colleagues (1991) and by Johnson and Wolinsky (1993).

The information processing framework (Leventhal 1986) is based on the idea that input from perceptual organs interacts with pre-existing knowledge (symptom schemata and illness schemata) to form mental representations such as health assessments. Symptom and illness schemata are affected by age, sex, personality, reference group and culture. A basic feature of cognitive psychology models is that choosing the mental representation is a result of active searching for information which fits into the schemata in question. Global self-rating of health may be seen as an outcome which integrates various symptoms and illness schemata. Further, self-rated health may also be affected by discussions with surrounding people such as medical personnel, friends and family. Idler (1993a) distinguished the inductive model (self-rated health as an end-point) from the deductive model which suggests that the global assessment of health may also influence the perception and interpretation of symptoms.

The measurement model (Ware 1995) focuses on three concepts: general health, physical health and mental health. According to the model, although the measures of physical and mental health are not associated with each other, both of them are associated with measures of general health. The model includes a spectrum of health concepts from specific to generic concepts, global self-rated health residing at the most generic end of the spectrum (Ware 1995).

The structural model by Liang and coworkers (1991) states that medical health (operationalized as chronic disease) and functional ability together with age, sex, education and marital status are all determinants of self-rated health. The four latter determinants influence self-rated health both directly and indirectly through medical health and functional ability. More or less similar models have also been proposed by other researches (e.g. Cockerham et al. 1983, Jylhä et al. 1986, Whitelaw & Liang 1991, Moum 1992, Johnson & Wolinsky 1993).

The Structure of Health Status Model (Johnson & Wolinsky 1993) includes four constructs at different levels: disease, disability (measured as upper and lower body limitations), functional limitations (measured as basic ADLs, household ADLs, and advanced ADLs) and perceived health at the final stage. Johnson and Wolinsky expected that the pathway would not only progress sequentially from one stage to another but also affect the upper levels without passing through an intermediate level.

Is self-rated health a continuum?

An interesting question still lacking consensus is whether self-rated health forms a continuum: is self-assessment of health from poor to good determined by the same or different factors? This topic has been examined in only a few cross-sectional studies with populations drawn from different age groups. Mackenbach et al. (1994) suggested that sociodemographic and behavioural determinants mirror self-ratings of health from excellent to poor health. According to Manderbacka et al. (1998) self-rated health forms a continuum from poor to good health in relation to risk factors (BMI, exercise, alcohol consumption) and ill health (longstanding illnesses, limitations in mobility, short-term disability, somatic symptoms and psychological symptoms). However, Smith and colleagues (1994) suggested that poor self-rated health is primarily related to the presence of ill health, whereas good health relates to sociodemographic and behavioural factors and less to the absence of ill health. Kempen and coworkers (1998) found that differences between good, fair, and poor health were strongly reflected by nine domain-specific measures of health, whereas the differences between very good and good perceived health were not.

2.3 Measurement of self-rated health

Self-rated health has been measured by a single question and by scales. Several ways of measuring self-rated health by a single question are found in the research literature (see Idler & Benyamini 1997). These can be classified in three main categories: non-comparative, age-comparative, and time-comparative self-rated health (Bjorner et al. 1996). The non-comparative way of measuring self-rated health is based, e.g. on the question "How would you rate your health at the moment?" The response categories usually include four or five alternatives, e.g. excellent, good, fair or poor. In the age-comparative question the respondent is asked to compare his or her health to that of subjects of same age and in

the time-comparative question to assess present health compared to health, e.g. one year ago. Non-comparative questions are the type most frequently used in studies of self-rated health. The justification for use of scales in the measurement of self-rated health is the multidimensional nature of health, and, from a psychometrical point of view, multi-item scales give more reliable data and greater statistical power. However, to attain these psychometrical benefits the scales have to meet certain standards (Bjorner et al. 1996).

2.4 Self-rated health in old age

The results from cross-sectional studies concerning the association of age and self-rated health are conflicting, whereas longitudinal studies and, in particular studies focusing on individual transitions in self-rated health (chapter 2.4.1) suggest that stability or improvement in self-ratings is more common than decline. This positive trend in self-rated health is found despite the fact that at the population level morbidity increases and functional performance declines with age. The contradictory results found in cross-sectional studies may be in part due to, e.g. the cohort studied or the form of the self-rated health question.

Some of the cross-sectional studies have shown older people to have more positive rating of their health, whether measured by a non-comparative or age-comparative question (e.g. Maddox 1962, Ferraro 1980, Linn & Linn, 1980, Cockerham et al. 1983, Liang et al. 1991, Damian et al. 1999). This relation has also been found after adjustment for social class, education, number of chronic conditions, number of symptoms and functional status (Cockerham et al. 1983, Damian et al. 1999). However, some other studies have shown younger age-groups to have the best self-rated health (e.g. Murray et al. 1982, Lindgren et al. 1994), and some have found no difference between age groups (Tornstam 1975).

In a 6-year follow-up study respondents in the old-old age-group were more likely to rate their health at baseline as very good compared to their age-peers than were subjects in the young-old group. In addition, the proportion of subjects in the good or very good group increased significantly over the follow-up period (Denning et al. 1998). Improvement in a non-comparative self-rated health was found in the Yale Health and Aging Project in New Haven (Idler 1993b): the oldest persons self-rated their health as better than expected and improved their self-ratings over the 6-year follow-up period.

A decline in the proportion of subjects reporting good non-comparative self-rated health was found by Fletcher and Hirdes (1996) in a 7-year follow-up in Canadians aged over 55 years and by Hoeymans and coworkers (1999) in a 5-year follow-up among men aged 65-85 years at the beginning of the study. In the 8-year longitudinal study among people aged 60 and over by Markides and Lee (1990), a slight decrease in the mean value of self-rated health was reported. However, in these studies individual transitions were not examined and the overall decline in these groups masked the stability or improvements reported by certain people.

2.4.1 Earlier studies of individual change and stability in self-rated health

There are only a few longitudinal studies on either individual change in self-rated health among elderly people or self-assessed change in health. In addition, most of these studies have put subjects over 60 years into one group, thus not taking into consideration possible differences between young-old and old-old subjects.

Most of the earlier studies of individual transitions in self-rated health have found relatively strong stability in self-assessments by older people. In the Duke University 15-year longitudinal study among voluntary subjects initially aged from 60 to 94 years (Maddox & Douglas 1973) and in the 5-year follow-up study among elderly residents aged 60 years and above of Alameda County (Minkler & Langhauser 1988) two-thirds of the self-ratings were stable over the follow-up period. In the longitudinal study by Rodin and McAvay (1992) subjects aged 62 and older had nine interviews spaced at varying time intervals over a 3-year follow-up period. At each follow-up interview they assessed how they had felt since the previous interview. The answers were grouped in three categories: very good or good, fair and very poor or poor. The participants were divided into two groups according to whether they had declined in perceived health or not between any two consecutive time points. Comparing the first and last interviews the stability in perceived health was 75% and in pairwise comparisons between each of the two consecutive time points, the gamma measures ranged from 0.726 to 0.807. However, only 40% (106 out of 251) of the participants did not report a negative change in perceived health between any two time points of the study.

In the Tampere Longitudinal Study on Ageing, in Finland (Jylhä et al. 1992) the follow-up period was 10 years and the participants were divided into two groups according to age. More than half of the 60-69 and 70-79 year-old people self-rated their health the same at baseline as at follow-up 10 years later. However, between the men in the younger cohort and the women in the older cohort a significant net change towards worse health was found. Jylhä and colleagues also asked the respondents to compare their health status with the situation ten years earlier. Even though the changes in self-rated health were relatively minor over the ten years, two-thirds of the participants reported that their health had become worse over this time period.

2.4.2 Determinants of self-rated health

The determinants of self-rated health have been investigated by quantitative and qualitative approaches. The first approach, until now more frequently used, applies interview, questionnaire or “objectively” measured data to examine the association between self-rated health and other factors, whereas the second approach focuses on the components of self-rated health as revealed through discussions with respondents or in-depth interviews. The present study applies the quantitative approach.

I shall now review the factors related to self-rated health which have proved to be important determinants of self-rated health in previous studies. In

addition, these determinants represent the dimensions of self-rated health which are included in the theoretical model adopted in my study and presented in chapter 3.

Diseases, medication and symptoms

Low number of chronic conditions has been reported to be associated with better self-rated health both in cross-sectional (Cockerham et al. 1983, Jylhä et al. 1986, Pilpel et al. 1988, Heikkinen et al. 1997, Kempen et al. 1998, Damian et al. 1999) and longitudinal studies (Bryant et al. 2000). The absence of severe diseases has also proved to be related to better self-rated health at follow-up (Idler 1993b). Goldstein and colleagues (1984) found in their one-year follow-up study that decline in self-perceived health was related to a higher total number of chronic and acute illness episodes. In a 3-year longitudinal study among older community-dwelling people Rodin and McAvay (1992) found that increased number of illnesses, worsening of pre-existing conditions, and increased number of physician's visits were related to a decline in self-assessed health.

In the studies using diagnosis as separate variables in the models mixed results have been obtained. Atherosclerosis, hypertension and coronary heart disease had a significant direct effect on self-rated health in a SEM analysis made by Johnson and Wolinsky (1993). Smith and colleagues (1994) reported in a study of middle aged women that different diagnoses were related differently to three response categories in an age-comparative study of self-rated health: women with high blood pressure and arthritis were more likely to report 'same health as peers' than 'better health than peers'. Cancer was the only diagnosis that was related to an assessment of 'worse health than peers' when the reference category was 'same health as peers'. In a Danish study (Schultz-Larsen et al. 1992) none of the seven diagnoses asked about were related to self-rated health after controlling for four indices of functional ability.

Use of medication has proved to be associated with poor self-rated health (Schulz et al. 1994, Mulsant et al. 1997) and to be related to a decline in self-rated health (Rodin & McAvay 1992). Results from several studies have shown that a higher number of physical and psychological symptoms have a significant independent association with poor self-rated health (Cockerham et al. 1983, Jylhä et al. 1986, Smith et al. 1994, Kempen et al. 1998, Manderbacka et al. 1998).

Functional ability

Functional ability, usually measured by the index of activities of daily living (ADL), has proved to be a strong correlate with self-rated health. This relation has been reported in both cross-sectional (e.g. Kempen et al. 1998, Damian et al. 1999) and longitudinal studies and show that better baseline functional ability is associated with better follow-up self-rated health (Markides & Lee 1990, Idler 1993b, Bryant et al. 2000, Atchley 1999). Using 5-year longitudinal data Hoeymans and colleagues (1997) reported that the relation between self-rated health and disability level was significant but became less strong with increasing age and disappeared among the oldest-old group (80-90 years). In a 1-year follow-

up study among frail elderly people Kim and coworkers (1997) found that from 0 to 3 months and from 3 to 12 months after hospitalisation a decrease in intermediate activities and in basic activities in daily living was related to a decline in perceived health. Hoeymans and colleagues (1997) reported that when participants assessed their general health status, self-assessed current disability level was more important than changes in disability over a 5-year follow-up period.

Functional performance

According to the few previous cross-sectional studies on associations between self-rated health and performance-based measures, better self-rated health is related to higher cognitive performance, auditory perception and isometric muscle strength (Christensen et al. 1994, Heikkinen et al. 1997), better lung functions as measured by peak flow or forced expiratory volume, and better walking speed (Schulz et al. 1994, Jylhä et al. 2001).

In a study with disabled women Jylhä and colleagues (2001) reported that after adjusting for age and several self-reported and objectively measured indicators of health and functional performance subjects with slower walking speed had an increased probability of poor or fair self-rated health. In a 5-year longitudinal study among men aged 70 and older standing balance, walking speed, time to do five chair stands, and external shoulder rotation were all associated with self-rated health (adjusted for age and survey year). However, after adjusting for disability only walking speed and chair stand remained associated with self-rated health. Adjustment was not made in respect of any other important determinants of self-rated health, e.g. chronic diseases or depressiveness (Hoeymans et al. 1997).

Socio-economic and cultural factors

The results concerning the relationship between age and self-rated health reported at the beginning of chapter 2.4 showed that age is an important determinant of self-rated health. The results for sex and self-rated health are contradictory. Some of cross-sectional studies suggest that older men more often evaluate their health as good than do women (e.g. Fillenbaum 1979, Kozarević et al. 1989, Schroll et al. 1991), although opposite results have also been reported (Stump et al. 1997) in addition to results reporting no gender effect (Pilpel et al. 1988, Lindgren et al. 1994, Schultz et al. 1994). In a follow-up study by Fletcher and Hirdes (1996) women were more likely to report poor self-rated health at follow-up compared with men when baseline self-rated health, body mass index and health habits were included in the same model. In a study by Jylhä and coworkers (1998) after adjusting for several health-related variables, no substantial gender difference in self-rated health was found.

Compared to elderly people with lower socio-economic status those with higher socio-economic status have better opportunities to maintain good health and functional capacity (House et al. 1990, Longino 1990). Several studies have shown that people with more years of formal education self-rate their health

better (e.g. Wan 1976, Goldstein et al. 1984, Markides & Lee 1990, Stump et al. 1997) and people with a higher income have a greater probability of maintaining good self-rated health (Hirides & Forbes 1993, Schulz et al. 1994).

Studies of self-rated health as well as studies of the meaning of health in different ethnic groups are fairly rare but show differences between ethnic groups. In a 15-year longitudinal study in the USA reported by Ferraro and colleagues (1997) black people had worse self-assessments at all three measurement points and declined more rapidly in their assessments than their white age-peers. Silverman and coworkers (2000) found differences between older African Americans and whites in the meaning of healthy and not healthy. The black respondents cited the presence of medical conditions and physical symptoms more than whites when they talked about these two different states of health. In addition, the blacks did not mention psychological attributes in relation to health, whereas the whites did when they defined the meaning of healthy. Also Krause and Jay (1994) reported that non-whites may think more about health problems when they rate their health, whereas whites may be more likely to use general physical functioning as a frame of reference.

According to international studies, there also seem to be cross-national differences in self-rated health across age groups. These differences are strongly associated with the number of health complaints and presence of disease (Koza-reviĖet al. 1989, Schroll et al. 1991, Jylh a et al. 1998).

Lifestyles

In longitudinal studies subjects engaging in preventive health practices such as participation in physical exercise, balanced diet, non-smoking, and moderate drinking have proved to report good self-rated health more often at follow-up (Hirides & Forbes 1993, Atchley 1999). In an 8-year follow-up study among subjects aged 25-74 years smoking, physical inactivity and obesity increased substantially the risk of poor health compared to non-smoking, physically active, and normal-weight persons (Johansson & Sundquist 1999). However, the writers concluded that physical activity protects against poor health irrespective of an increased body mass index and smoking. Subjects who increased their physical activity over the follow-up period also improved in their health assessment. In a study by Fletcher and Hirides (1996) high body mass index, current smoking, and nondrinking were important determinants of poor self-rated health at follow-up among subjects aged 55 and over at the beginning of the study.

Psychological well-being and social relations

Longitudinal studies among older people have shown that low distress (Farmer & Ferraro 1997) and better satisfaction with life (Hirides & Forbes 1993) are related to better self-rated health at follow-up. Bryant and coworkers (2000) reported that absence of depression was one of the most important determinants of good follow-up self-rated health in a 12-months' follow-up study. In a 3-year longitudinal study among older community-dwelling people Rodin and Mc-

Avay (1992) found a decline in psychosocial factors (decreased self-efficacy and increased depression) to be related to lower self-assessment of health.

The role of social support in maintaining health among elderly people has been reported in many studies (Broadhead et al. 1983, Seeman et al. 1987, Sugisawa et al. 1994), although some results indicating no relation between health and social support have also been reported (Krause 1995). The findings reported by Minkler and Langhauser (1988) emphasized the importance of having relatives and friends one feels close to and of having frequent contacts with these individuals. However, the results concerning the association between marital status and self-rated health are contradictory. Some studies have found no association between self-rated health and marital status (e.g. Minkler & Langhauser 1988, Pilpel et al. 1988, Sugisawa et al. 1994), whereas Wan (1976) reported that married people self-rated their health better and divorced persons poorer than others.

Adaptation processes

According to previous studies, adaptation to worsening health conditions seems to play an important role in older people's assessments of their health; consequently, a decline in their health may not be reflected in their subjective evaluations. Successful adaptation to the aging process involves the ability to maintain a consistent view of the self over time. To adapt successfully an individual has to accommodate the physical changes brought about by aging; these accommodations are facilitated by coping strategies which improve an individual's emotional state and help to find ways to make practical changes to compensate for losses incurred in functioning (Whitbourne & Cassidy 1996).

Authors have expressed different explanations for this adaptation process. It may be that older people adapt to the deterioration that comes with increasing age by altering their expectations and norms (Idler 1993b), or that they also regard it as a part of the normal ageing process and hence adjust their standards of good health accordingly (Pilpel et al. 1988, Jylhä et al. 1992). In addition, since age-related deterioration is usually a gradual process, the process of adaptation is likely to be slow. Thus, older people may adjust their norms and expectations little by little, without simultaneously modifying their self-assessed health (Hoeymans et al. 1997).

According to Baltes and Baltes (1990) selective optimisation and compensation are the key concepts describing general process of adaptation. Selection refers to active or passive decrement in goals in order to concentrate on those domains which are of high priority, and optimisation means the best possible performance in the selected domains. When specific behavioural capacities are lost or fall below a level required for adequate functioning the person has to adopt a means of compensation which involve aspects of the mind and technology. Pörn (1993) expressed health as an equilibrium between the individual's repertoire, environment and goal profile. Equilibrium can be maintained by various means, e.g. by compensation, rehabilitation, making changes in the environment and changing the goal profile.

According to social comparison theory (Festinger 1954) people tend to compare themselves to those who are in some respect similar to them. It seems that an individual's social comparison behaviour may reflect the motive to hold positive beliefs about his or her opinions and abilities and the desire to obtain evidence that his performance is better than others. Suls and colleagues (1991) proposed that elderly people compare themselves with a cognitively constructed stereotype of frailty rather than specific persons. Because few elderly people fit this stereotype, most of them feel at an advantage and rate their health as good when health evaluations are requested. Comparing with age peers is done, even if the respondent is not prompted to make age comparison (Idler 1993b).

The alterations in the motivational structure among elderly people were conceptualised by Tornstam (1975), and also supported by Ferraro (1980). Tornstam (1975) suggested that the aspiration level regarding health, which is partly determined by the reference groups the individual is comparing himself to, decreases with advancing age and thus the requirements for good health become lower. Aspiration level operates as a mechanism which allows the individual system to be in balance despite decline and problems in health; the decrease of aspiration level makes it possible to experience health as satisfactory, even though it might be worse than before. One explanation suggested by Peck (1968), and later empirically supported by Borawski and coworkers (1996), is that to adapt successfully to old age elderly people develop an orientation which values social and personal characteristics rather than physical health. Due to these changed values elderly people rate their health as good although they have more chronic conditions and disability as they age.

According to the reference group theory (e.g. Tornstam 1975, Rakowski & Cryan 1990), elderly people diminish the importance of physical status in judging their health by adjusting the base of comparison to the overall higher levels of morbidity and disability found among their age peers. Elderly people tend to overestimate poor health and disability among their counterparts and judge their own health positively. Albert (1977) also proposes that temporal comparisons that present evidence of decay or decline are not as favoured as comparisons presenting evidence of maturation, progress, or growth.

Health optimism, pessimism and realism seem to affect the way people develop their self-assessments (van Doorn 1999). In the study by van Doorn (1999) health optimists in addition to rating their health as better were also more likely to give positive reasons for their assessments, whereas poor-health realists tended to be more negative. Both groups had at least one serious health problem. Optimists appeared to have several ways of maintaining a positive view of their health. Studies on the relation between personality factors and self-rated health are relatively rare and in only a few of them have medical health and functional ability been carefully measured. Barsky and colleagues (1992) concluded in their study among medical outpatients that hypochondria and somatization were important correlates of self-rated health.

2.4.3 Summary of previous studies

Studies focusing on individual transitions in self-ratings of health and factors related to decline in self-assessments of health are rare. According to the studies that have been done self-rated health seems to be relatively stable among older people aged 60 years and older over follow-up periods from 3 to 15 years, whereas results concerning change and stability over shorter time periods, e.g. from few months to one year are contradictory. Comparing change in self-assessments of health based on two different methods: self-assessed change in health over time and difference in self-ratings of health between assessments performed at two different time-points has not been done before.

As the literature above show an abundance of correlates with self-rated health has been found. However, studies including factors from multiple domains are relatively rare, and in particular studies on long-term or performance-based determinants of self-rated health even rarer. In addition, the results of the few cross-sectional studies which have examined the question whether self-rated health forms a continuum have been conflicting.

Studies using multivariate analysis in examining determinants of self-rated health have included a variety of variables in the models and thus rendering comparison. The explained variance for self-rated health in older people has varied in regression analyses between 0.35-0.44 (e.g. Moum 1992, Schulz et al. 1994, Benyamini et al. 2000, Bryant et al. 2000) and in cross-sectional LISREL analyses from 0.40 (Stump et al. 1997) to 0.75 (Jylhä et al. 1986). In National Health and Nutrition Examination Survey I LISREL analyses were performed with 10- and 15-year follow-up data among subjects aged 25 to 74 at baseline. In different models the explained variance for self-rated health varied from 0.28 (Farmer & Ferraro 1997) to 0.38 (Ferraro et al. 1997) over the 10-year period, whereas at the 15-year follow-up it rose as high as 0.82 (Ferraro et al. 1997).

3 AIM OF THE STUDY

The purpose of the present study was to examine how older men and women rate their health, and how their assessments change with increasing age. In addition, the aim was to examine the determinants of self-rated health and whether self-rated health takes the form of a continuum. More specifically, the purpose was to examine:

- 1) how older men and women assess their health at the age of 75 and five years later at the age of 80, and how they assess the change in their health over the 5-year follow-up period
- 2) the individual-related determinants of self-rated health at baseline and at the 5-year follow-up
- 3) whether deterioration in the indicators of health status and functioning are related differently to two subjective measurements of decline in health over a 5-year period
- 4) how different indicators of health status, functional performance, and physical and social activity are related to change and stability in self-rated health over two 5-year periods
- 5) whether self-rated health takes the form of a continuum in relation to different indicators of health status, functional performance, and physical and social activity.

Theoretical model of the determinants of self-rated health

A schematic presentation of the determinants of self-rated health is given in figure 1. This is a quantitative model and a part of it was used as the model for the statistical analyses. Basically, the model assumes that as people self-rate their health they take into account health habits, chronic conditions, physical and cognitive performance, psychosocial well-being, and functional ability. On the basis of recent studies it is also assumed that impairments in physical, cognitive and sensory capacity significantly increase problems in functional ability (e.g. Avlund 1994, Laukkanen et al. 1994, Salive et al. 1994, Era et al. 1997,

Laukkanen et al. 1997) and negatively affect self-assessments of health (e.g. Cockerham et al.1983, Jylhä et al.1986, Schultz-Larsen et al. 1992, Schulz et al. 1994, Heikkinen et al.1997, Kivinen et al. 1998). In addition, several studies have shown that chronic diseases and unhealthy behaviours such as a sedentary lifestyle are risk factors for decline in physical (Voorrips et al. 1993, Rantanen et al. 1997, Rantanen & Heikkinen 1998) and cognitive performance (Suutama & Ruoppila 1998), functional ability (e.g. Guralnik et al. 1989, LaCroix et al. 1993, Avlund et al. 1994) and self-rated health (Fletcher & Hirdes 1996, Heikkinen et al.1997). Social relationships and participation have also been associated with health and well-being in elderly people (Krause 1987, Jylhä & Aro 1989, Sugisawa et al. 1994, Su & Ferraro 1997); consequently, the model assumes that active social functioning has an important influence on assessing health as good. It was expected that the pathway in the model would not only progress sequentially from one stage to another but also affect the upper levels without passing through an intermediate level.

Sociodemographic, socio-economic and cultural factors may affect self-rated health directly or through factors underlying it; e.g. individuals from different cultures may differ in self-rated health, even if their medical health status is equal, or socio-economic status may affect medical health status and lifestyles, and consequently have an effect on self-rated health. The adaptation processes which modificate self-evaluations, e.g. comparison with age-peers, a changing level of health aspirations and values may influence the pathway of self-rated health. These different processes may have an important role among older people as a decline in the factors underlying self-rated health is not always manifested as a similar decline in self-rated health.

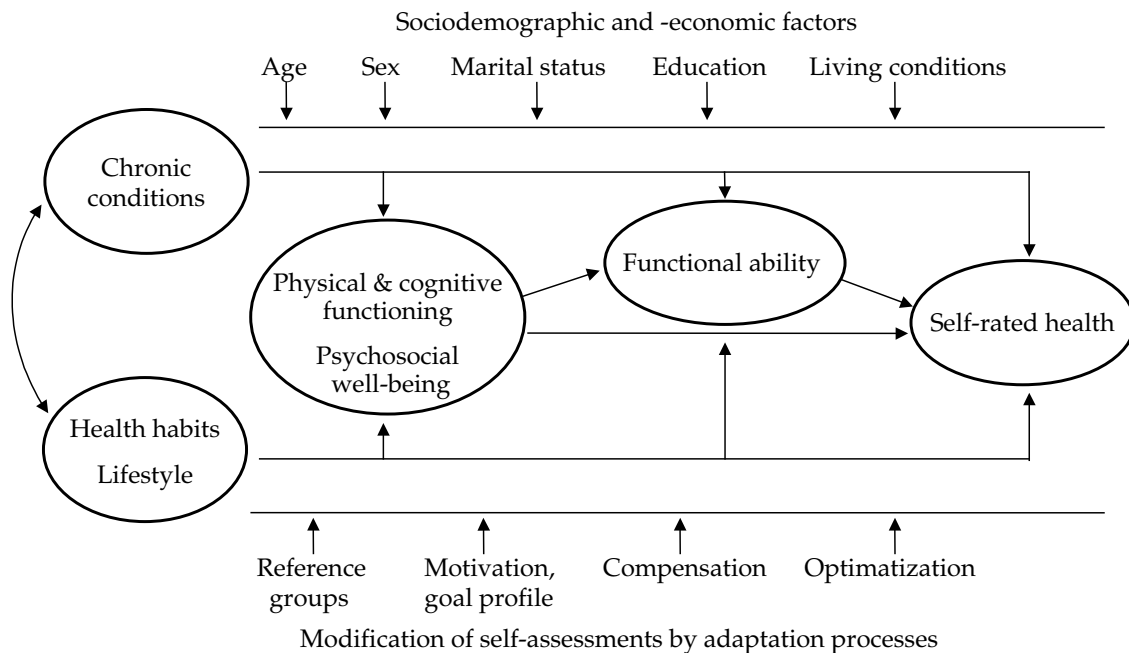


FIGURE 1 Theoretical model of the determinants of self-rated health among older people.

4 MATERIAL AND METHODS

The study is a part of the Evergreen project, a major research and development project being carried out in Jyväskylä, central Finland. The main aim of the project is to describe the levels and predictors of health and functional capacity in elderly people. The design of the project and methods used are described in detail elsewhere (Heikkinen, 1997, 1998). The baseline data were collected in 1989, the 5-year follow-up was conducted in 1994, and the 10-year follow-up in 1999, by home interviews, questionnaires and examinations held at the study centre. In the present work the main focus is on the baseline and the 5-year follow-up measurements.

4.1 Material

The target population of the study consisted of all the inhabitants of Jyväskylä born in 1914 who were alive at the beginning of 1989 (N=388). As six of them died before the baseline interview, the study group contained 382 eligible persons. The participation rates in the different parts of the study at the three measurement points are shown by sex in table 1. At baseline 67.3%, at the 5-year follow-up 67.5% and at the 10-year follow-up 73.0% of the study group were women. The participation rates in the interview varied between 86.2-95.2% among the men and 77.2-89.9% among the women and in the study centre examinations between 66.0-83.2% and 56.7-74.3% for the men and women, respectively. About one fifth (22.3%) of those who participated in the baseline measurements died during the first 5-year follow-up period. At the beginning of the 10-year follow-up study the corresponding figure was 47.6%. Moving out of the area was infrequent: only 12 persons (3.4%) moved to another locality during the 10-year period.

TABLE 1 Participation in interviews and study centre examinations at baseline in 1989, at the 5-year follow-up in 1994 and at the 10-year follow-up in 1999 among persons born in 1914.

	Baseline (75 years)						5-year follow-up (80 years)						10-year follow-up (85 years)					
	Total		Men		Women		Total		Men		Women		Total		Men		Women	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Eligible	382	(100.0)	125	(100.0)	257	(100.0)	268	(100.0)	87	(100.0)	181	(100.0)	174	(100.0)	47	(100.0)	127	(100.0)
Interview	350	(91.6)	119	(95.2)	231	(89.9)	234	(87.3)	75	(86.2)	159	(87.8)	139	(79.9)	41	(87.2)	98	(77.2)
Proxy interview	5	(1.3)	0	(0.0)	5	(1.9)	16	(6.0)	8	(9.2)	8	(4.4)	19	(10.9)	2	(4.3)	17	(13.4)
Refused/not found	27*	(7.1)	6*	(4.8)	21*	(8.2)	18	(6.7)	4	(4.6)	14	(7.7)	16	(9.2)	4	(8.5)	12	(9.4)
Participation in the study centre examinations	295	(77.2)	104	(83.2)	191	(74.3)	191	(71.3)	65	(74.7)	126	(69.6)	103	(59.2)	31	(66.0)	72	(56.7)
Died after the previous wave	-		-		-		79		27		52		90		40		50	
Moved out of the area after the previous wave	-		-		-		8		5		3		4		0		4	

* Excluded from the follow-up examinations

4.2 Methods

A summary of the measurements used in the thesis is shown in table 2. The methods are described in more detail in the original articles (I-V).

4.2.1 Interviews and questionnaires

The structural home interviews dealt with socio-economic status, lifestyle, ADLs and depressive symptoms and were carried out by students from the University of Jyväskylä who received special training for the purpose. At baseline and at the 5-year follow-up the participants filled in a health questionnaire at home and it was checked when they attended the examinations held at the study centre. At the 10-year follow-up the questionnaire was interviewed.

Self-rated health (SRH) was elicited by a non-comparative question: 'How would you yourself describe your health during the last year? 1 = unusually good, 2 = good, 3 = not so good, rather bad, 4 = extremely bad.' For the statistical analysis, the scaling of the question was reversed (e.g. 1 = extremely bad). This question has been used e.g. in the Danish Health and Morbidity Survey (Rasmussen 1984). *Change in SRH* between two consecutive time-points was calculated for each individual separately by taking the difference between SRH in 1994 and SRH in 1989, and between SRH in 1999 and SRH in 1994 (I, III, V).

Self-assessed change in health (SACH) over the five years was elicited at the 5-year follow-up by the question 'In your own opinion, how has your health changed during the past five years? 1 = become much better, 2 = become better, 3 = remained about the same, 4 = become worse, 5 = become much worse' (I, III). For the statistical analysis, the scaling of the question was reversed (e.g. 1 = become much worse). This time-comparative question was drawn up for use in the Evergreen project's follow-up studies. Similar questions with different time-periods have been used in previous studies (e.g. Jylhä et al. 1992)

Functional ability was studied by means of a PADL test which included 10 questions (Laukkanen et al. 1994). A zero score indicated that the person was able to manage all 10 items without difficulty, and a higher score indicated a higher number of disabilities.

Depressive symptoms were measured on the basis of the 20-item CES-D scale. Each item is scored from 0 to 3, yielding a maximum score of 60 points. 16 points or more indicates depressiveness (Radloff 1977, Heikkinen et al. 1995).

The estimation of habitual *physical activity* was based on a standardized question taken with modifications from the classification of physical activity among elderly people presented by Grimby (1986). For the statistical analysis, physical activity was recoded into 1 = 'light physical activity', 2 = 'moderate physical activity', and 3 = 'heavy physical activity'.

Social functioning was examined by *social contacts* and participation in social activities (*hobby index*). The first mentioned was measured as the number of personal contacts at least once a week with children, grand/great-grandchildren, relatives, close friends, acquaintances and neighbours (range 0-6). Persons who had contacts with 3-6 different network groups every week

were categorized as having many contacts = 1. The rest were categorized as having few contacts = 0 (Avlund et al. 1997). Hobby index was defined as the sum score of involvement in 19 different hobbies, ranging from 1 = never to 6 = daily. A higher score indicated a higher amount of social activity (Heikkinen et al. 1997).

4.2.2 Examinations in the study centre

Examinations in the study centre took about six hours focusing on health status, anthropometric characteristics, physical and sensomotor performance, and cognitive functioning.

A physician performed the medical examination and also evaluated possible contraindications to the assessment of muscle strength and to participation in a bicycle ergometer test according to the guidelines laid down by the American College of Sports Medicine (1986). Morbidity was described by the sum score of *chronic conditions* (Laukkanen et al. 1994).

Maximal walking speed (m/s) over 10 metres was measured in the study centre corridor (Aniansson et al. 1980). *Climbing ability* was measured by a step-mounting test using boxes 10 cm in height, which could be stacked to form steps with heights of 10, 20, 30, 40 and 50 cm (60 cm at the follow-ups) (Aniansson et al. 1980). Body-height-related values (cm/m) were used in the analysis.

Maximal isometric strength of hand grip and knee extension were measured on the side of the dominant hand in a sitting position (Heikkinen et al. 1984). Maximal isometric trunk extension and flexion were measured in a standing position according to Viitasalo, Komi and Karvonen (1977). The body weight-related values of the results (N/kg) were used in the analysis.

Maximal working capacity (W) was measured using an indirect continuous stepwise bicycle ergometer test (Era 1994), and *vital capacity* (litre) was measured by electronic spirometry (Medikro 202) in a standing position. The best of three attempts was chosen in the analysis (Suominen 1992).

Cognitive functioning was measured by three psychometric tests: Word Fluency (Schaie 1985), Digit Symbol (Wechsler 1955) and Raven's Standard Progressive Matrices (Raven 1958, Raven et al. 1977).

Balance tests were carried out using a force platform (Era & Heikkinen 1985), and postural *balance* was defined as the mean velocity moment (mm^2/s) adjusted for body height standing normally with eyes closed (Era et al. 1996).

Auditory perception (dB) was measured as the mean of the air-conducted auditory threshold in the better ear (Era 1987), and *visual acuity* with or without lens correction of the better eye (Era et al. 1996).

4.2.3 Statistical methods

The statistical significance of differences between means was analysed by Student's t-test and one-way analysis of variance followed by Least Significance Difference test (LSD), and differences between distributions of discrete variables by cross-tabulation and χ^2 test. 2×2 transition tables were used to analyse change and stability in self-rated health. The net changes in the transition tables

and the symmetry of changes were studied by testing the marginal homogeneity with McNemar's χ^2 test. In the special case when the cross-classification is a double dichotomy (2 x 2 transition table) the marginal homogeneity is equivalent to symmetry (Bishop et al. 1980). Logistic regression was used to create a multivariate model to investigate the associations between the changes in the independent variables and the change in SRH and SACH. The analyses were carried out using the SPSS 6.0 and 9.0 program (Norusis 1994).

The determinants of self-rated health were analysed by the path analysis model, one of the techniques included in structural equation methods using LISREL, which enables simultaneous study of the factors influencing the dependent variable as well as their interrelations (Bollen 1989, Jöreskog & Sörbom 1993a). The path analysis models were based on Pearson product-moment correlation coefficients between the continuous variables, polychoric correlation coefficients between the discrete variables and polyserial correlation coefficients between the continuous and discrete variables computed using PRELIS 2 (Jöreskog & Sörbom 1993b). The multivariate procedures were accomplished using LISREL 8 program (Jöreskog & Sörbom 1993a).

TABLE 2 The variables used in the original papers

Variable	Paper	Reference
Interview / questionnaire:		
Self-rated health	I-V	Rasmussen 1984
Self-assessed change in health	I, III	
Functional ability	II-V	Laukkanen et al. 1994
Depressive symptoms, CES-D	II-V	Radloff 1977, Heikkinen et al. 1995
Physical activity	II-V	Grimby 1986
Hobby index	IV, V	Heikkinen et al. 1997
Social contacts	IV	Avlund et al. 1997
Study centre examinations:		
Number of chronic conditions	II-V	Laukkanen et al. 1994
Maximal walking speed	III, V	Aniansson et al. 1980
Climbing ability	III, V	Aniansson et al. 1980
Maximal isometric strength of limbs and trunk	II-V	Viitasalo et al. 1977, Heikkinen et al. 1984
Maximal working capacity	II,IV	Era 1994
Vital capacity	II-V	Suominen 1992
Cognitive functioning	II-V	Wechsler 1955, Raven 1958, Raven et al. 1977, Schaie 1985
Balance	II, IV	Era & Heikkinen 1985, Era et al. 1996
Auditory perception	II-V	Era 1987
Visual acuity	II-V	Era et al. 1996

5 RESULTS

Here, the results of the five original articles have been combined to provide answers to the research questions.

5.1 Self-rated health (SRH) at baseline and at the 5-year follow-up

Both in 1989 and 1994 about half of the participants assessed their health during the previous year as good or unusually good (table 3). Men and women assessed their health quite equally at baseline and at the 5-year follow-up.

TABLE 3 Self-rated health during the last year among the 75-year-old men and women interviewed at baseline in 1989 and at the 5-year follow-up in 1994. Per cent distributions and number of participants (I).

Self-rated health	Men				Women			
	1989		1994		1989		1994	
	%	(n)	%	(n)	%	(n)	%	(n)
Extremely bad	3.4	(4)	4.0	(3)	2.6	(6)	3.2	(5)
Bad	41.5	(49)	37.3	(28)	46.7	(106)	44.9	(71)
Good	52.5	(62)	52.0	(39)	47.6	(108)	46.8	(74)
Unusually good	2.5	(3)	6.7	(5)	3.1	(7)	5.1	(8)
Total	100.0	(118)	100.0	(75)	100.0	(227)	100.0	(158)

Statistical significance of the difference between men and women analysed in two categories: 1 = bad (extremely bad + bad) and 2 = good (good + unusually good)

1989: $\chi^2(3) = 1.08, p = 0.241$

1994: $\chi^2(3) = 1.31, p = 0.333$

The difference in SRH at baseline among all those interviewed and those who survived over the 5-year follow-up period was not statistically significant ($p = 0.151$). Likewise, the difference in SRH among those persons interviewed only and those who entered the study centre was not statistically significant at baseline ($p=0.471$) or at the 5-year follow-up ($p=0.086$).

Table 4 shows the transition tables for dichotomised SRH separately for men and women between the baseline and the 5-year follow-up. About two thirds of the men and the women were in the same category of SRH at both baseline and at the 5-year follow-up. Statistically significant net changes were not found and the probability of change category was equal in both directions over the 5-year period.

TABLE 4 Self-rated health among the men and the women at the ages of 75 and 80 years. Transition tables showing distributions as number of cases. Transition probabilities shown in parentheses. Results of tests for independence and marginal homogeneity (I).

Self-rated health 1989	Self-rated health 1994		Row total
	Good	Bad	
<u>Men:</u>			
Good	32 (.70)	14 (.30)	46 (1.00)
Bad	12 (.41)	17 (.59)	29 (1.00)
<u>Column total</u>	44	31	75
$\chi^2_{ind}(1) = 5.8, p = 0.016$ $\chi^2_{hom}(1) = 0.04, p = 0.845$			
<u>Women:</u>			
Good	58 (.69)	26 (.31)	84 (1.00)
Bad	24 (.32)	50 (.68)	74 (1.00)
<u>Column total</u>	82	76	158
$\chi^2_{ind}(1) = 21.1, p = <0.001$ $\chi^2_{hom}(1) = 0.02, p = 0.888$			

5.2 Self-assessed change in health in five years (SACH)

About 55% of the women reported a decline in their health during the preceding five years and none of them assessed their health as better, whereas only 45% of the men assessed their health as having declined and almost 10% reported that their health had become better (table 5). The gender difference was statistically significant.

TABLE 5 Self-assessed change in health from the age of 75 to 80 years. Percentage distributions, number of cases and statistical significance of differences (χ^2 test) between men and women (I).

Self-assessed change in health	Change from 75 to 80 years			
	Men		Women	
	%	(n)	%	(n)
Much worse	10.8	(8)	11.8	(18)
Worse	33.8	(25)	43.1	(66)
Same	48.6	(36)	45.1	(69)
Better	6.8	(5)	0.0	(0)
Much better	0.0	(0)	0.0	(0)
Total	100.0	(74)	100.0	(153)

Difference between men and women analysed in three categories:

1 = worse (much worse + worse), 2 = same, and 3 = better (better + much better)

$\chi^2(2) = 11.5, p = 0.003$

5.3 Correspondence between self-assessed change in health and the difference in self-ratings of health between the years 1989 and 1994

The correspondence between SACH and the 5-year change in the SRH was examined with reference to the data from the first 5-year period (I). The greatest inconsistency between these two measurements was seen among those men and women who assessed their health as having become worse during the last five years. At the 5-year follow-up, about two-thirds rated their health (SRH) the same or better than at baseline. Among the men and women who assessed their health as having remained about the same over the last five years, two-thirds also gave the same rating at follow-up as at baseline (tables 6-7).

TABLE 6 Self-assessed change in health over five years by difference in self-rated health among the men. Percentage distributions and number of cases (I).

Self-assessed change in health	Difference in self-rated health 1994-1989						Row total	
	Better		Same		Worse			
	%	(n)	%	(n)	%	(n)	%	(n)
Better	60.0	(3)	40.0	(2)	0.0	(0)	6.8	(5)
Same	19.4	(7)	61.1	(22)	19.4	(7)	48.6	(36)
Worse	18.2	(6)	51.5	(17)	30.3	(10)	44.6	(33)
Column total	21.6	(16)	55.4	(41)	23.0	(17)	100.0	(74)

$\chi^2(4) = 6.6, p = 0.178$

TABLE 7 Self-assessed change in health over five years by difference in self-rated health among the women. Percentage distribution and number of cases (I).

Self-assessed change in health	Difference in self-rated health 1994-1989						Row total	
	Better		Same		Worse			
	%	(n)	%	(n)	%	(n)	%	(n)
Better	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)
Same	26.1	(18)	65.2	(45)	8.7	(6)	45.1	(69)
Worse	15.5	(13)	52.4	(44)	32.1	(27)	54.9	(84)
Column total	20.3	(31)	58.2	(89)	21.6	(33)	100.0	(153)

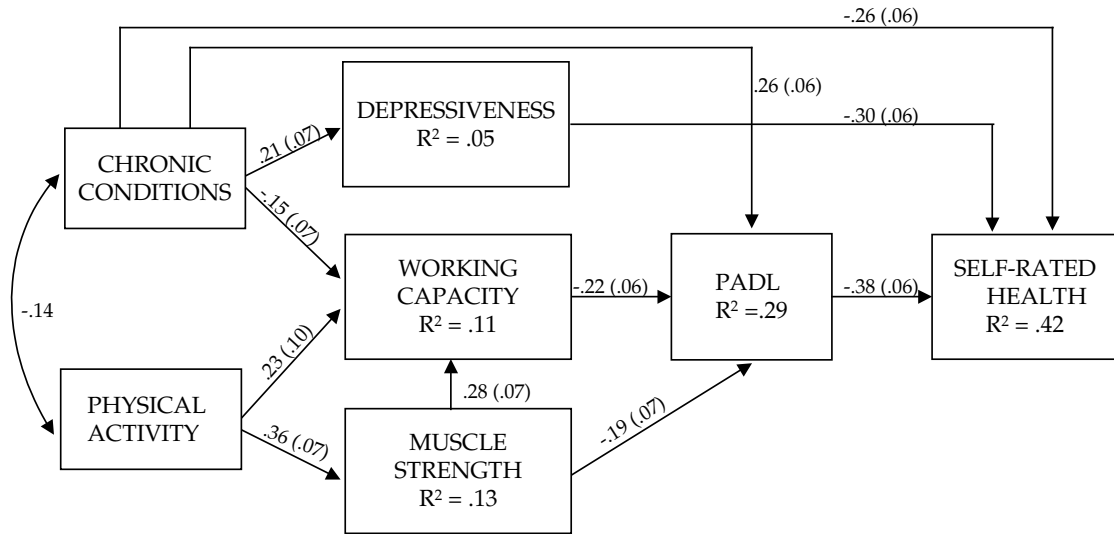
$\chi^2(2) = 12.8, p = 0.002$

5.4 Determinants of self-rated health

In order to examine the simultaneous associations of the determinants of SRH multivariate analyses using LISREL program were performed. First, the determinants of SRH were examined using the baseline cross-sectional data (II) and, second, the long-term effect of the baseline variables on SRH over the 5-year follow-up was studied (IV). For the LISREL analyses a force factor was constructed from the different strength measurements to describe maximal strength as an entity. In addition, the test scores of the three psychometric tests were standardized using z-points and a sum score was calculated. The higher the sum score the better the participant's cognitive functioning. The correlation coefficients for the selected variables used in constructing the path analysis models are shown for the cross-sectional analyses in appendices 1-2 and for the follow-up analyses in appendices 3-4. Fitted into the first models were those of the selected variables that correlated significantly ($p < 0.05$) with SRH.

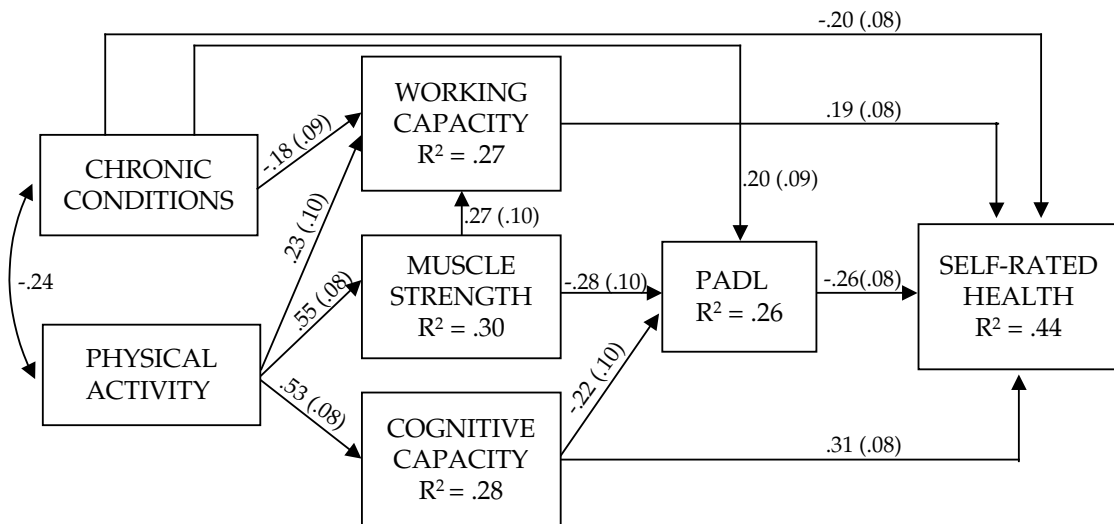
Cross-sectional path analyses models

Among the women, better functional ability (PADL) and a lower number of chronic conditions and depressive symptoms were the most powerful determinants of SRH (fig. 2). In the men, a lower number of chronic diseases and better functional ability (PADL), cognitive functioning and maximal working capacity were related to better SRH (fig. 3). Among both sexes muscle strength, physical activity and chronic conditions and, in addition, among the women maximal working capacity had a statistically significant indirect effect on SRH. The final models showed good fit with the data among both sexes. The explanatory power of the path analysis model for SRH was 44% for the men and 42% for the women.



$\chi^2(9)=6.21, p=0.72$ GFI=0.99 RMR=0.035

FIGURE 2 The path analysis model of baseline self-rated health for 75-year-old women. The numbers in the figure show the maximum likelihood of the path coefficients, standard errors given in parentheses. R², squared multiple correlations; GFI, Goodness-of-Fit Indices; RMR, root mean square residuals (II, reproduced with permission of Editrice Kurtis s.r.l., November 23, 2001).



$\chi^2(7)=11.56, p=0.12$ GFI=0.97 RMR=0.051

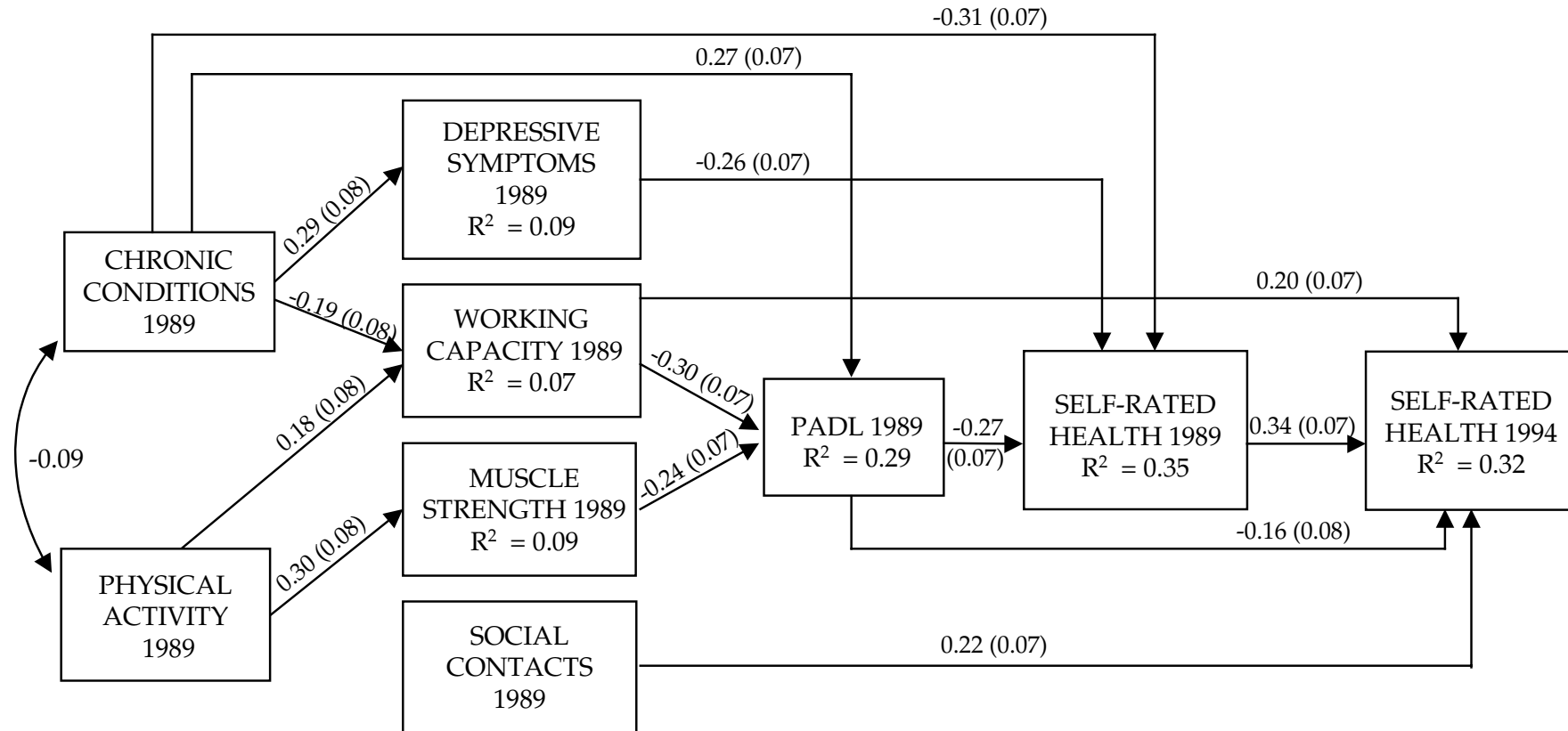
FIGURE 3 The path analysis model of baseline self-rated health for 75-year-old men. The numbers in the figure show the maximum likelihood of the path coefficients, standard errors given in parentheses. R², squared multiple correlations; GFI, Goodness-of-Fit Indices; RMR, root mean square residuals (II, reproduced with permission of Editrice Kurtis s.r.l., November 23, 2001).

Determinants of self-rated health over the 5-year follow-up

Among the women better baseline SRH and functional ability, better maximal working capacity, and a higher number of social contacts at baseline had the most powerful effect on SRH at the 5-year follow-up (fig. 4). In addition, functional ability (PADL), depressive symptoms, maximal working capacity, muscle strength, chronic conditions, and physical activity had a statistically significant indirect effect on follow-up SRH. The model showed good fit with the data among the women. The explanatory power of the path analysis model for SRH at the 5-year follow-up was 32%.

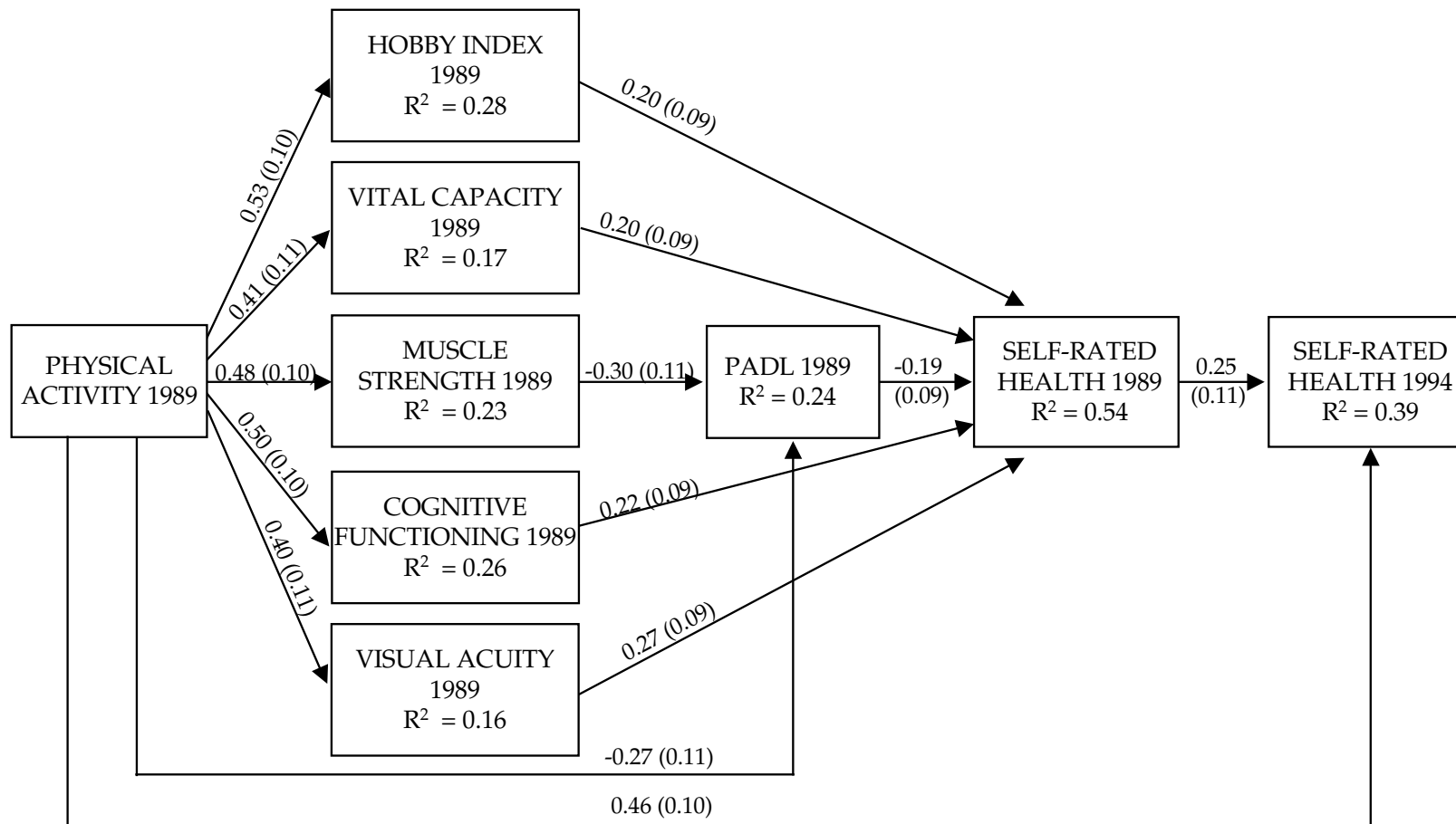
The path analysis model for the men seemed to be more unstable: for example, physical activity and number of chronic conditions did not fit the model together, but could only be substituted one for the other. Depending on which one of these two was included in the model, the pattern of the determinants of SRH changed somewhat. Figure 5 presents the model fitted with physical activity. A higher level of physical activity and better SRH at baseline were related to better SRH at follow-up. In addition, physical activity had a significant indirect effect on SRH at follow-up. Functional ability, muscle strength, vital capacity, visual acuity, cognitive functioning and hobby index also had indirect, but only almost significant effects on follow-up SRH. The explanatory power of this model for SRH at the 5-year follow-up was 39%.

The explanatory power of SRH at the 5-year follow-up was 31% in the alternative model for men, which included chronic conditions (not shown). The chi-square goodness-of-fit indices ($p = 0.24$), the Goodness-of-Fit Indices (GFI = 0.97), and the root mean square residuals (RMR = 0.043) showed a high level of fit for this model as well. Baseline SRH ($\beta = 0.28$, $t = 2.46$), functional ability ($\beta = -0.24$, $t = -2.22$) and number of chronic conditions had a direct effect ($\beta = -0.20$, $t = -1.88$) and visual acuity, number of chronic conditions and participation in social activities had an indirect effect on follow-up SRH.



$X^2(20) = 13.50, p = 0.86; GFI = 0.98; RMR = 0.042.$

FIGURE 4 The path analysis model of follow-up self-rated health for 75-year-old women. The numbers in the figure show the maximum likelihood of the path coefficients, standard errors given in parentheses. R², squared multiple correlations; GFI, Goodness-of-Fit Indices; RMR, root mean square residuals.



$\chi^2(12) = 12.35, p = 0.42; GFI = 0.96; RMR = 0.050$

FIGURE 5 The path analysis model of follow-up self-rated health for 75-year-old men. The numbers in the figure show the maximum likelihood of the path coefficients, standard errors given in parentheses. R², squared multiple correlations; GFI, Goodness-of-Fit Indices; RMR, root mean square residuals.

5.5 Factors related to decline in self-assessments of health

Logistic regression models were constructed to examine the relation between a substantial decrease in the indicators of health status, functional performance and physical activity and worsening of SRH and SACH over the first 5-year period (III). For the analysis, a sum score of maximal walking speed and climbing ability was calculated to describe functional performance as an entity. The odds ratios show that a decrease in physical activity and cognitive functioning (Digit Symbol) increased the probability of a decline in SRH. The baseline measurements were not significantly associated with a worsening of SRH (table 8). An increase in number of chronic diseases and decline in physical activity and functional performance increased the probability of a negative SACH. In addition, subjects who had a higher number of chronic conditions at baseline were more likely to report negative SACH (table 9). These results remained about the same when baseline SRH was included in the SACH model.

5.6 Does self-rated health take the form of a continuum?

In order to examine whether self-rated health takes the form of a continuum the relation between different indicators of health status, functional performance, physical and social activity and the four change and stability groups in SRH: 'good-good', 'good-bad', 'bad-good' and 'bad-bad' was examined (V). The groups were constructed according to the difference in SRH at two consecutive time-points five years apart. The cross-sectional differences in the measured indicators between the four groups were systematic at baseline and at the 5-year follow-up but did not reach statistical significance among all the groups. All the subjects declined statistically significantly ($p < 0.05$) over the first 5-year period in all the determinants of SRH except depressive symptoms. The subjects in the 'good-bad' group declined more compared with those in the three other groups but a statistically significant interaction with the SRH groups was only found in maximal walking speed ($p = 0.001$), climbing ability ($p = 0.050$) and trunk extension ($p = 0.030$) over the five years.

At the 5-year follow-up the 'good-good' group also had better results, and the 'bad-bad' group worse results than the other three groups. Conversely, the subjects in the 'good-bad' group had worse results in all the determinants of SRH except depressive symptoms, compared with the 'bad-good' group, although at baseline those in the 'good-bad' group were superior in all the tests except muscle strength as well as in hobby index (table 10).

The number of participants who took part in the study centre examinations at the 10-year follow-up was low (103 persons). In addition, not all of them were able to perform all the examinations, e.g. trunk extension, maximal walking speed. The magnitude of the decline in the determinants of SRH did not differ statistically significantly between the four SRH groups over the second 5-

year period. As in the first two waves, the subjects in the 'good-good' group had the best results in all the measurements, and the subjects in 'bad-bad' group had the worst results in all the measurements except maximal hand grip strength. The results of the 'good-bad' and 'bad-good' group were less systematic (appendix 5).

TABLE 8 Logistic regression model for decline in self-rated health (SRH, n=178) (III).

Variable	Odds Ratio	95% Confidence Interval
Change in physical activity (substantial decrease vs slight or no decrease)	3.81	1.20 - 12.07
Change in cognitive functioning (substantial decrease vs slight or no decrease)	2.70	1.17 - 6.22
Change in number of chronic conditions (substantial increase vs slight or no increase)	1.26	0.49 - 3.23
Change in functional performance (substantial decrease vs slight or no decrease)	1.62	0.70 - 3.77
Physical activity at baseline heavy vs light	1.77	0.54 - 5.78
heavy vs moderate	0.75	0.19 - 2.99
Cognitive functioning at baseline	0.99	0.95 - 1.05
Number of chronic conditions at baseline	0.93	0.68 - 1.27
Functional performance at baseline	1.09	0.69 - 1.23
Sex female vs male	0.83	0.33 - 2.11

TABLE 9 Logistic regression model for self-assessed deterioration in health over five years, (SACH, n=180) (III).

Variable	Odds Ratio	95% Confidence Interval
Change in physical activity (substantial decrease vs slight or no decrease)	4.22	1.42 - 12.51
Change in cognitive functioning (substantial decrease vs slight or no decrease)	1.13	0.55 - 2.33
Change in number of chronic conditions (substantial increase vs slight or no increase)	2.81	1.21 - 6.52
Change in functional performance (substantial decrease vs slight or no decrease)	1.89	0.96 - 3.74
Physical activity at baseline heavy vs light	1.06	0.20 - 1.56
heavy vs moderate	0.56	0.73 - 1.14
Cognitive functioning at baseline	0.99	0.95 - 1.03
Number of the chronic conditions at baseline	1.47	1.13 - 1.91
Functional performance at baseline	0.91	0.73 - 1.14
Sex female vs male	1.30	0.61 - 2.76

TABLE 10 Indicators of health and functional capacity at baseline and at the 5-year follow-up by change in self-rated health. Means, standard deviations, percentage distributions, and statistical significance of differences between groups (one-way analysis of variance for continuous variables and χ^2 test for discrete variables). ***p < 0.001, **p < 0.01, *p < 0.05 (V).

Variables	Self-rated health 1989 – 1994										Difference between groups		
	Good-Good (1) (n=63-74)		Good-Bad (2) (n=24-33)		Bad-Good (3) (n=22-31)		Bad-Bad (4) (n=25-49)		F				
	Mean	SD	Mean	SD	Mean	SD	Mean	SD					
Number of chronic conditions	1989	1.5	1.1	2.1	1.5	2.5	1.8	3.0	1.5	12.0***	1,3	1,4	1,4
	1994	2.0	1.1	3.1	1.3	3.0	1.7	3.5	1.7	12.4***	1,2	1,3	
CESD score	1989	11.6	6.4	12.7	6.9	14.1	7.2	16.1	8.7	3.9*	1,4	2,4	
	1994	11.1	5.7	13.0	7.0	13.4	8.3	15.8	9.3	4.0**	1,4		
PADL difficulties	1989	1.6	2.1	3.3	3.2	3.7	3.1	4.8	3.0	12.9***	1,3	1,4	3,4
	1994	2.0	2.1	4.5	3.2	2.8	2.8	5.4	3.1	18.1***	1,2	1,4	
Walking speed, m/s	1989	1.76	0.39	1.69	0.33	1.65	0.40	1.51	0.36	4.9**	1,4	2,4	3,4
	1994	1.55	0.43	1.24	0.42	1.40	0.36	1.19	0.39	8.6***	1,2	1,4	
Climbing ability, cm/m	1989	26.3	7.3	25.9	5.5	24.0	9.0	21.0	9.4	4.7**	1,4	2,4	3,4
	1994	26.5	8.7	21.6	9.0	24.0	9.3	19.1	8.5	6.4***	1,2	1,4	
Hand grip, N/kg	1989	4.4	1.4	4.1	1.1	4.5	1.5	3.6	1.2	4.1**	1,4	3,4	
	1994	4.0	1.5	3.6	1.2	3.8	1.6	3.2	1.2	3.3*	1,4		
Trunk extension, N/kg	1989	7.3	2.7	6.9	2.9	6.9	2.5	5.2	2.5	5.7***	1,4	2,4	3,4
	1994	6.5	2.7	5.7	2.7	6.6	2.8	5.2	2.2	1.8			
Vital capacity, litre	1989	2.9	0.8	2.7	0.7	2.6	0.6	2.5	0.6	3.7*	1,4		
	1994	2.5	0.7	2.2	0.7	2.4	0.6	2.2	0.6	2.9*	1,2	1,4	
Cognitive functioning (Digit Symbol)	1989	25.8	9.0	23.5	8.9	21.4	8.7	19.3	9.0	5.5**	1,3	1,4	2,4
	1994	22.6	8.7	19.0	8.0	19.6	6.9	16.7	7.3	5.1**	1,4		
Hobby index	1989	52.5	7.8	47.9	9.4	47.9	9.6	46.3	8.8	5.9***	1,2	1,3	1,4
	1994	44.1	7.2	37.9	10.0	40.0	7.9	37.4	7.5	8.7***	1,2	1,3	
Physical activity, %		1989 (n=74)	1994 (n=74)	1989 (n=33)	1994 (n=33)	1989 (n=31)	1994 (n=31)	1989 (n=48)	1994 (n=49)	p(1989)	p(1994)		
Light		18	27	9	52	16	48	31	55	0.197	0.036		
Moderate		39	39	52	33	42	29	42	29				
Strenuous		43	34	39	15	42	23	27	16				

6 DISCUSSION

The purpose of the present study was to examine how older men and women rate their health and how they assess change in their health with increasing age. Further, the aim was to examine the individual-related factors underlying self-rated health, as well as to explore whether self-rated health takes the form of a continuum in relation to different indicators of health status, functional performance, and physical and social activity.

Self-assessments of health over the follow-up

Consistently with most of the prior studies among older people (Maddox & Douglas 1973, Minkler & Langhauser 1988, Jylhä et al. 1992, Rodin and McAvay 1992) stability in self-rated health was more common than change when the same question was asked at two different time points, five years apart. However, when the respondents were directly asked about change in their health status in the past five years, nearly half of them said their health had become worse.

Despite the fact that objectively measured health status and functional performance declined with increasing age and that about half of the respondents said their health had become worse over the 5-year period, the majority of them rated their health the same or better than before. Stability in self-rated health does not mean that older people are unrealistic about their health but that self-rated health seems to be age-adjusted: stability may indicate a decreased level of aspiration as well as comparison of oneself with age peers. However, when assessing change in health over time the comparison is intra-individual and is made on the basis of the subject's own past health, and thus, if the subject's health status has deteriorated, s(he) accordingly reports worsening of health over time (Suls et al. 1991). This difference in the basis of comparison may partly explain the inconsistency between the two measurements of change in health found in the present study. In addition, the inconsistent findings may indicate a difference in the sensitivity of these two self-reported health measures. Self-assessed change in health seems to be a more sensitive measure of

change in health. The categories of the questions were also different, which may have had an impact on the results.

Hoeymans and colleagues (1999) proposed that because people adjust their self-ratings of health on the basis of comparisons and expectations, the sensitivity of self-rated health may be too low to monitor trends in the health status of older people. Thus, they suggested that studies evaluating health changes in old age need also to include objective measures of health status. In my opinion objective health measures (biomedical health) and self-rated health are two different perspectives on health and their relative superiority should not be an issue. Although the stability of self-rated health indicates that it may not be a sensitive or specific measure of change in health, it is an important part of the evaluation of older people's health status and above all quality of life.

Gender differences in self-assessments of health

The results of the baseline and 5-year follow-up studies concur with those of previous cross-sectional studies that report no gender differences in self-rated health in Finnish populations (Aromaa et al. 1989, KozareviĀ et al. 1989). However, an interesting finding was that at the 10-year follow-up the proportion of men assessing their health as good increased to 75%, whereas the women's ratings remained at the same level as at baseline and at the 5-year follow-up (unpublished data). Thus the men who survive, despite worsening health status and functional performance, have a particularly positive view of their health status.

Gender differences in self-rated health among elderly people have not been found in other Nordic populations, either in the NORA study in Gothenburg, Sweden and Glostrup, Denmark (Heikkinen et al. 1997) or in the Swedish twin study (Gold 1997). The studies performed in other countries have suggested that women evaluate their health as worse than men evaluate theirs (Fillenbaum 1979, Schroll et al. 1991, Anson et al. 1993, Spiers et al. 1996) or no significant gender differences have been found (Pilpel et al. 1988, Lindgren et al. 1994, Schulz et al. 1994).

At the 5-year follow-up the women more often than the men assessed their health as having become worse and some of the men assessed their health as having improved over the follow-up period. The results reported by Jylhā and colleagues (1992) were in the same direction, although the gender difference in their study was not statistically significant. One explanation for the gender differences found in the present study could be that the number of musculoskeletal disorders, which are usually painful and well noticed, increased much more among the women but decreased among the men during the follow-up period. In addition, difficulties in performing daily physical activities (PADL) increased more among the women than men (Laukkanen et al. 1997).

A continuum of self-rated health

The association between self-ratings of health grouped according to stability and change and the selected indicators of health status, functional performance

and physical and social activity was systematic over time. In my view, these results support those of previous studies, which have suggested that self-rated health is a continuum (Mackenbach et al. 1994, Manderbacka et al. 1998). At baseline and at the 5-year follow-up, in particular, self-rated health seemed systematically to follow the level of the selected indicators. The results over the second 5-year follow-up were in line with those of the first 5-year period but this relation was systematic only for the 'good-good' and the 'bad-bad' groups. This may, at least in part, be due to the low number of survivors (especially in 'good-bad' and 'bad-good' groups) who participated in the examinations at both the 5- and 10-year follow-ups. This is the first study to have looked at the question of self-rated health as a continuum in relation to objective measures of health status and functional performance.

Determinants of self-rated health and factors related to decline in self-assessments of health

The findings of the present study suggest that the concept of self-rated health among older people is multidimensional and includes such dimensions as chronic conditions, cognitive and sensory-motor performance, psychosocial well-being and health behaviours. The factors underlying self-rated health and the paths from the examined variables to self-rated health showed some gender differences and some variation between cross-sectional and longitudinal models. However, these factors represented dimensions which were included in the hypothetical model. The present quantitative study gave much the same view of the factors related to health assessments as that reported by the qualitative studies of lay perspectives on the concept of health have reported, e.g. by Blaxter and Paterson (1982) and Herzlich (1973).

In the cross-sectional analyses the empirical data supported the theoretical path analysis model well among both sexes and indicated that the variables examined had direct and indirect effects on self-rated health, whereas in the longitudinal analyses among the men the path analysis model was more unstable. The variance for self-rated health explained in the present study was about the same as reported earlier (Farmer & Ferraro 1997, Ferraro et al. 1997, Stump et al. 1997), although also higher figures for explained variance have been reported (Jylhä et al. 1986, Ferraro et al. 1997). However, it is somewhat difficult to compare these earlier results to those of the present study due to differences among the cohorts studied, the length of the follow-up periods, the form of the question concerning self-rated health and the independent variables included.

The most important determinants of self-rated health among both sexes in the different models were the ability to perform the physical activities of daily living (PADL), number of chronic conditions and maximal working capacity. In addition, the number of depressive symptoms and social contacts among the women and cognitive functioning and physical activity among the men had a powerful effect on self-rated health. In the longitudinal analyses baseline self-rated health was strongly related to its follow-up level among both sexes. In the longitudinal analyses the gender differences may in part be due to the small,

and compared to the women, more homogeneous group of surviving men, and the strong multicollinearity among the latter between the variables of physical performance, cognitive functioning and physical activity.

Both in the cross-sectional and longitudinal analyses the ability to perform daily activities (PADL) was an important mediator of the indirect effects of other variables, as also has been found in previous cross-sectional (Johnson & Wolinsky 1993) and longitudinal studies (Ferraro et al. 1997). In the longitudinal analyses another important mediator of the effect of other factors on follow-up self-rated health was baseline self-rated health.

The results concerning the factors related to decline in self-rated health and the association between the four change-stability groups in self-rated health and the different indicators of health status, functional performance and physical and social activity support the suggestion of age-adjusted self-rated health. Although the ability to perform daily activities (PADL), number of chronic conditions and physical performance were important determinants of self-rated health, their decline was not followed by a worsening in self-rated health. Elderly people may adapt to a certain amount of decline in their health and functional performance, but when this decline exceeds a certain limit, it is also registered as a decline in their self-assessed health.

The important role of physical activity in the multivariate models of self-rated health in the present study supports the report by Borawski and colleagues (1996), who concluded that older people are more likely to emphasize attitudinal and behavioural factors such as psychological outlook ('I think positive') and lifestyle ('I exercise'), in assessing their own health, rather than medical conditions, symptoms, or functioning. Older people's cognitive interpretation of being physically active may impart a sense of the vigour which is considered an important aspect of health. The importance of decreased cognitive functioning as a predictor of decline in self-rated health may be a consequence of the fact that changes in cognitive functioning are easily noticed in everyday life, and any loss in these abilities are considered to represent a decline in health.

In contrast to the results for self-rated health, a decrease in health status and functional performance was related to a negative self-assessed change in health. It seems, as expressed by Hoeymans and coworkers (1997), that when self-assessing change in their health, older people comprehend and report deterioration in the different components usually related to health as a decline in health, whereas when assessing their current health, they are more likely to take into account the present situation, and not changes which have developed over time. In addition, it seems that among older people, those who already have worse health and functional performance also have a higher risk of deterioration during the next few years.

When older people select a single alternative from the response scale in answer to the question about their health they make interpretations regarding the meanings and importance of the different elements related to their health and daily life. In the present study it was not, however, possible to explore the process of interpretation involved and therefore this issue could not be approached directly. The basic aim of this study was to find out what individual-

related factors underlying self-ratings of health in older people. The data and methods used enabled these factors, defined as determinants of self-rated health, to be to some extent identified. The path analysis model using LISREL is an appropriate and interesting method with which to examine the multidimensional concept of self-rated health. An important advantage is that it provides an opportunity to examine both direct and indirect effects of the determinants of self-rated health. The LISREL program presumes the causal ordering of the factors included in the model. The causality assumption should not be, however, considered too categorically; preferably, the variables examined should be seen as determinants of self-rated health which may also have simultaneous effects. However, some of the paths, e.g. from chronic conditions to self-rated health are probably more recursive than simultaneous. On the other hand, some of the paths, e.g. from social relations to self-rated health may not be so direct as the path analysis model indicates but are mediated through a factor which was not measured. Social relations, for example, may influence health and well-being by providing positive affect, a sense of predictability and stability in one's life situation, a recognition of self-worth or by protecting people from the influence of stressful events (Cohen & Willis 1985). It is also implausible that lay people think in terms of causality when are making a self-assessment.

It may be that the determinants of self-rated health that older people take into account differ on the level of consciousness. Presumably, older people are conscious of some of the determinants e.g., chronic conditions and the ability to perform daily activities and think of these factors when they assess their health, whereas others e.g. vital capacity, balance and social contacts they do not think of consciously when selecting the alternative from the scale. However, these unconscious factors may also affect one's perceptions of one's health status.

Methodological issues

This study presented a good opportunity to improve the understanding of the concept of self-rated health among older people and has important strengths. First, the use of a longitudinal design, which enabled the long-term effects of the baseline determinants on later self-rated health to be examined, and second, the wide range of physical, psychological and social variables which were investigated, including objectively measured data on physical and cognitive performance. Third, the participation rate of a sample that consisted of the entire 75-year-old population in Jyväskylä was high, in particular at baseline and at the 5-year follow-up. Focusing on a one-year age cohort also minimizes the effects of age in that cohort. Subjects living in institutions were also included in the study population, although only a few of them participated in the study centre examinations.

In some parts of the present study, only those subjects who survived over the follow-up period were included in the analyses. This resulted in a selection bias, as is usual in follow-up studies among older people: subjects with better objectively measured health and functional performance and a higher level of physical and social activity were more likely to survive and thus be able to participate in the examinations at the later measurement points. However, a statis-

tically significant difference in baseline self-rated health was not found between the survivors and those subjects who died before 5-year follow-up. In spite of the element of selection bias at the follow-up measurements I believe that examining survivors and predicting the factors related to their maintaining good health is valuable and has implications for preventive interventions.

Although the participation rate was good in our study it decreased with increasing age among the eligible subjects, as is usual among older people (DeMaio 1980). A large proportion of older people are fairly healthy and mentally active but there are also others who suffer from chronic conditions and cognitive disorders which prevent them from taking part in examinations or lead them to make mistakes in the answers they give. We did not include subjects with proxy interview data because the answers do not represent the subjects' own opinion of their health and proxy respondents tend to underestimate the health and functional performance of older people compared to assessments made by the subjects themselves (Magaziner 1992).

The interviews and examinations held at the study centre were carried out by students from the University of Jyväskylä who received special training for the purpose. In addition, some of the personnel were health care professionals. The measurements used in this study have been used in previous studies. The question designed to elicit subjects' own ratings of their health used in here is not the most frequently used formulation. The wording of the question can have an impact on the results and thus, comparison with other studies is difficult. Nonetheless, I believe that this question represents the same dimension and covers the same variation in self-rated health than other, more frequently used wordings. Omission of the middle category in the response scale, usually defined as 'average' or 'satisfactory', forces the respondent to consider whether his/her health status is more good than bad or vice versa. The middle category may be tempting, particularly if the respondent does not have a distinct opinion of his/her health status e.g., (s)he feels differently about the distinct respects of health or is not willing to think it through. According to Manderbacka (1998) different forms of the questions of self-rated health are unlikely to effect the way they function as a scale or the relations between self-rated health and other indicators. There is no agreement on one standardized question for use in studies of self-rated health; rather, self-rated health is a "generic" term referring to an individual's own general assessment concerning the level of his or health status. The exact wordings of these subjective assessments of health vary from one study to another.

Measuring change in health by the difference between self-ratings conducted at two different time points is complex. The transition tables were based on dichotomised question of self-rated health with the result that some information about change was lost. The extreme categories had a low number of cases and using the question in its original form would have led to problems in performing the statistical analyses. Because of the low number of participants who reported a decline in their health, it was impossible to test for differences in the magnitude of the decline required to move from one level of self-rated health to another, e.g. from 'unusually good' to 'good' or from 'good' to 'not so good, rather bad'. In addition, it was impossible to examine whether the specific fac-

tors that influence the decline in self-rated health are the same or different when subjects move from one level of self-rated health to another. In the present study, almost 75% of those whose self-rated health declined over the first 5-year period moved from 'good' to 'not so good, rather bad'. Kempen and colleagues (1998) found in a cross-sectional study that differences between good, fair, and poor health were strongly reflected in nine domain-specific measures of health, whereas differences between very good and good perceived health were not.

In the present study, the calculation of change in self-rated health was based on the continuum model of self-rated health, which allows for the use of quantitative methods (Segovia et al. 1989, Fylkesnes & Førde 1992, Moum 1992). This model has been used previously by Goldstein and coworkers (1984) in the Los Angeles Health Survey and Markides and Ray (1988) in a longitudinal study of older Mexican Americans and Anglos. Another, the discontinuity model, examines the content of different states of self-rated health and suggests that different factors are associated with these different states (Smith et al. 1994), indicating that the calculation of the difference between self-assessments of health at two different time-points is impossible. This model has also been used to predict survival (Kaplan et al. 1988, Idler et al. 1990).

The study also has limitations which deserve mention and need to be taken into account in future research. Despite its advantages the use of a one-year age cohort can be also seen as a limiting factor, in-so-far as the results concern only this specific age group and cannot be generalized to other age groups. It would have been advantageous to have been able to include more men in the baseline examinations to ensure a sufficient number of survivors for the follow-up analysis. The relatively long follow-up period (5 years) between the baseline and follow-up measurements can also be seen as a limitation because the health status of older people can undergo considerable fluctuation over five years.

Certain measures of health and functioning used at baseline would have required further development. In particular, measures of the severity of disease were only done at the 5- and 10-year follow-ups but not at baseline: this would have been a more powerful variable with which to describe morbidity in the path analyses and logistic regression models than simply the number of chronic conditions. Type of disease and its severity are likely to have different effects on health perceptions and the ability to perform daily activities (Rakowski & Cryan 1990, Johnson & Wolinsky 1993). The models of the determinants of self-rated health did not take into account the possibility that the constructs measured at baseline may be influenced by feedback mechanisms. For instance, low physical activity leads to diminished physical capacity and an increase in disability which, in turn, may result in even lower physical activity.

Importance of the study and future research

The aim of this thesis was to improve our understanding of the concept of self-rated health among older people, i.e. to throw light on the individual-related factors underlying self-rated health and how self-assessments of health change with increasing age. Self-rated health is an important concept in measuring health, psychological well-being and quality of life in elderly people (Bjorner et

al. 1996). Self-assessments of health can be used to screen populations and to predict morbidity, the use of services (Heikkinen 1989, Segovia et al. 1989) and survival (e.g. Kaplan & Camacho 1983, Idler et al. 1990, Jylhä et al. 1992). It can also be used as an endpoint of interventions in evaluating the benefits of programmes designed to enhance the quality of life (Bjorner et al. 1996).

This research gives empirical support to the assumption that older people adapt to decline in their objectively measured health status and functional performance. In addition, the results show that self-rated health measures multiple health-related aspects and that objectively measured physical and cognitive performance have an important effect on self-rated health. This finding is important because most studies of the determinants of self-rated health have only been based on self-reports, and it is possible that such determinants are influenced by the same confounders or reporting bias as in self-assessments of health. This is likely to increase the relation between self-rated health and self-reported functional ability.

This study identified those domains of health status which should be included in examinations of older people. The effect of these domains on self-rated health may vary between individuals because the models are based on group level analyses. A better understanding of the factors underlying self-rated health would enable the development of preventive interventions to maintain and improve the health and quality of life of elderly people and even ultimately lead to a decrease in the use of services. The focus of such interventions would be the prevention of negative and the promotion of positive indicators of self-rated health, e.g. the prevention of depressiveness, increasing the number of social contacts and amount of social activity as well as enhancing physical activity, all of which may consequently improve the physical performance and functional ability of older people. It is important that people working in the field of the health and social care of older people understand the variety of factors that older people take into account when they assess their health. In addition, the knowledge could also be utilized in planning health counseling, which is an area needing further development.

Self-rated health is a complex and dynamic concept and more research is needed to clarify its meaning and the properties contained in it. The question of whether self-rated health takes the form of a continuum needs further examination with a higher number of subjects so that this apparent continuum running from very bad through average to very good health can be studied more closely. In addition, the factors related to self-rated decline in health merit closer examination more exactly: do the same factors affect this decline or does the magnitude of change in these factors differ when moving between different levels of self-rated health, e.g. from very good to good health and from good to bad health? The explanatory power of the path analyses models for self-rated health varied between 31% and 44%. Although the explained variance of self-rated health was fairly good compared to that usually found in models of this kind, more research is nonetheless needed, e.g. combinations of quantitative and qualitative methods to better understand the determinants people use when they assess their health. The inclusion of more positive indicators, e.g. feelings of energy and positive affect may also increase the explained variance of self-

rated health. Models of self-rated health also need to be more dynamic, taking into account possible feedback loops between the determinants. The use of time-dependent covariates in examining the determinants of self-rated health in longitudinal studies would also make such models more dynamic by including the timing of changes in the determinants. In addition, the age-dependency of the factors underlying self-rated health should be examined in order to find out whether the same determinants are important, e.g. at the age of 65 and 85. Further, exploration of the different adaptive systems people use when they assess their health and the possible age-dependency of these systems would be important. Finally, contextuality in self-rated health is a neglected area which needs further research.

YHTEENVETO

Tutkimuksen tarkoituksena oli kuvata, millaiseksi iäkkäät henkilöt arvioivat terveytensä 75-vuotiaina ja viisi vuotta myöhemmin seurantamittauksissa sekä kuinka he arvioivat terveytensä muuttuneen viiden vuoden aikana. Lisäksi tutkittiin itsearvioitun terveyden determinantteja sekä sitä, muodostaako itsearvioitu terveys jatkumon erilaisten terveyttä ja toimintakykyä kuvaavien muutusten sekä fyysisen ja sosiaalisen aktiivisuuden suhteen.

Tutkimuksen viitekehystenä oli malli, jossa elämäntavat, pitkäaikais-sairaudet, fyysinen ja kognitiivinen suorituskyky, psykososiaalinen hyvinvointi ja päivittäisistä toiminnoista selviytyminen vaikuttavat terveyden itsearvioon iäkkäillä henkilöillä. Itsearvioon vaikuttavat lisäksi erilaiset sopeutumismenetelmät sekä sosiodemografiset ja -ekonomiset tekijät.

Tutkimus on osa Ikivihreät-projektia ja tässä osatutkimuksessa tutkimusjoukko koostui vuonna 1914 syntyneistä henkilöistä. Alkumittaukset tehtiin vuonna 1989, 5-vuotisseuruu vuonna 1994 ja 10-vuotisseuruu vuonna 1999. Tutkimuksessa käytettiin monipuolisia menetelmiä, jotka perustuivat haastatteluihin, kyselomakkeisiin sekä laajoihin terveyden ja toimintakyvyn mittauksiin tutkimuskeskuksessa.

Noin puolet tutkituista arvioivat terveytensä hyväksi sekä alkumittauksessa että 5-vuotisseuruussa. Terveydentilan muutosta viiden vuoden aikana mitattiin kahdella eri tavalla: 1) erotusmuuttujalla, joka kuvasi itsearvioissa tapahtunutta muutosta seuranta-aikana (1994 itsearvio - 1989 itsearvio) ja 2) suoralla terveydentilan muutosta mittaavalla kysymyksellä. Noin kaksi kolmas-osaa tutkituista arvioi terveytensä samanlaiseksi molemmilla mittauskerroilla, vaikka suoralla muutuskysymyksellä arvioituna noin puolet tutkituista ilmoitti terveytensä heikentyneen viiden vuoden aikana. Fyysisen aktiivisuuden vähentyminen ja kognitiivisen kyvykkyyden heikkeneminen olivat yhteydessä itsearvioitun terveyden huononemiseen viiden vuoden aikana. Fyysisen suorituskyvyn heikkeneminen, fyysisen aktiivisuuden väheneminen, pitkäaikaisraukosten lisääntyminen ja pitkäaikaisraukosten määrä alkumittauksessa olivat yhteydessä arvioon, että terveys on heikentynyt viiden vuoden aikana.

Erilainen kuva terveydentilan muutoksesta, joka saatiin näillä kahdella itsearviointeihin perustuvalla mittaustavalla, näyttää perustuvan siihen, mihin tutkittavat vertaavat terveyttään. Vaikka tämän tutkimuksen aineisto ei antanut mahdollisuutta tutkia tarkemmin näiden kahden mittaustavan perusteita, oletan, että iäkkäät henkilöt vertaavat omaa tilaansa suhteessa ikätovereihin arvioidessaan terveyttään tutkimushetkellä. Lisäksi he ilmeisesti sopeutuessaan iän mukana tapahtuvaan terveyden ja toimintakyvyn heikkenemiseen laskevat hyvän terveyden vaatimustasoa. Vastatessaan suoraan terveydentilan muutuskysymykseen tutkittavat vertaavat terveyttään omaan aikaisempaan terveyteensä, jolloin heikentyminen huomioidaan ja arvio muutoksesta tehdään yleensä realistisesti.

Neljä itsearvioitun terveyden muutosryhmää seurasi systemaattisesti terveydentilan ja toimintakyvyn sekä fyysisen ja sosiaalisen aktiivisuuden tasoa. Itsearvioitu terveys näyttää muodostavan jatkumon suhteessa tutkittuihin

muuttujiin.

Itsearvioitua terveyttä määrittävät tekijät erosivat jonkin verran sukupuolen mukaan samoin kuin poikittais- ja pitkittäistutkimuksen malleissa. Itsearvioitua terveyttä määrittivät voimakkaimmin selvityminen päivittäisistä toiminnoista, pitkäaikaissairauksien ja depressiivisten oireiden lukumäärä, fyysinen suorituskyky, kognitiivinen kyvykkyys sekä fyysinen ja sosiaalinen aktiivisuus. Lisäksi alkumittauksen itsearvio terveydestä oli voimakkaasti yhteydessä 5-vuotisseuruun itsearvioituun terveyteen.

Tulokset viittaavat siihen, että yksittäinen itsearvioitua terveydentilaa mittaava kysymys kuvastaa monipuolisesti terveyttä ja toimintakykyä. Tulos tukee oletusta, että arvioidessaan terveydentilaansa iäkkäät henkilöt ottavat laajasti huomioon kaikkea sitä tietoa, jonka he olettavat liittyvän terveyteen. Itsearvioitun terveyden determinanteilla on suorien vaikutusten lisäksi epäsuoria vaikutuksia, jotka kulkevat sekventaalisesti elämäntapoihin liittyvistä tekijöistä suorituskyvyn ja päivittäisten toimintojen kautta itsearvioituun terveyteen.

Tämä tutkimus osoitti niitä terveyden osa-alueita, joita tulisi sisällyttää iäkkäiden henkilöiden terveystarkastuksiin. Tietoa itsearvioitua terveyttä määrittävistä tekijöistä voidaan hyödyntää suunniteltaessa esim. ennaltaehkäiseviä interventioita, joiden tavoitteena on iäkkäiden henkilöiden terveyden, toimintakyvyn ja elämänlaadun ylläpito ja parantaminen. Interventioiden kohteena tulisi olla terveydentilaa ennustavien negatiivisten tekijöiden ehkäiseminen ja positiivisten tekijöiden edistäminen. Itsearvioitua terveyttä koskeva tieto on tärkeää myös iäkkäiden henkilöiden parissa työskentelevälle terveys- ja sosiaalitoimen henkilöstölle, jotta he ymmärtävät kuinka monipuolisesti iäkkäät henkilöt huomioivat eri tekijöitä arvioidessaan terveyttään. Saatua tietoa voidaan käyttää suunniteltaessa iäkkäiden henkilöiden terveysneuvontaa, joka vaatii vielä paljon kehittämistä.

Itsearvioitu terveys on monimuotoinen ja dynaaminen käsite, jonka ymmärtäminen edellyttää vielä lisätutkimusta esim. kvalitatiivisten ja kvantitatiivisten menetelmien yhdistämistä ja itsearvioitun terveyden determinanttien ikäriippuvuuden tutkimusta. Lisätietoa tarvitaan myös siitä, vaikuttavatko samat tekijät tai onko muutos determinanteissa yhtä suurta, kun siirryttään eri itsearvioitun terveyden tasojen välillä. Lisäksi tulisi selvittää, mitä sopeutumismenetelmiä iäkkäät henkilöt käyttävät terveysarvioissaan ja ovatko käytetyt menetelmät iästä riippuvia. Itsearvioitun terveyden malleja tulisi kehittää dynaamisemmiksi ja pitkittäistutkimuksissa tulisi jatkossa hyödyntää aikariippuvien muuttujien käyttöä tutkittaessa itsearvioitua terveyttä ennustavia tekijöitä. Itsearvioitun terveyden kontekstisidonnaisuus on vähän tutkittu alue, jota tulisi selvittää.

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APPENDIX 1 Correlation coefficients between selected variables at baseline in 1989, men (n=78-104). ***p < 0.001, **p < 0.01, *p < 0.05 (II).

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Self-rated health	1.00													
2. PADL	-.508 ***	1.00												
3. Chronic diseases	-.400 ***	.322 ***	1.00											
4. Depression (CESD score)	-.201 *	.206 *	.120	1.00										
5. Vital capacity, litre	.374 ***	-.332 ***	-.257 **	-.052	1.00									
6. Max working capacity, W	.450 ***	-.329 ***	-.312 **	-.083	.539 ***	1.00								
7. Max isometric strength	.336 ***	-.451 ***	-.285 **	-.122	.465 ***	.451 ***	1.00							
8. Balance, mm ² /s	-.276 *	.200	.186	.199	-.178	-.217	-.131	1.00						
9. Cognitive functioning	.518 ***	-.398 ***	-.185	-.158	.398 ***	.358 ***	.510 ***	-.290 **	1.00					
10. Visual acuity	.417 ***	-.429 ***	-.081	.042	.364 ***	.285 **	.356 ***	-.158	.475 ***	1.00				
11. Hearing, dB	-.105	.161	.082	.036	-.092	-.060	.040	-.063	-.095	-.015	1.00			
12. Physical activity	.468 ***	-.392 ***	-.243 *	-.013	.413 ***	.426 ***	.546 ***	-.061	.527 ***	.363 ***	-.082	1.00		
13. Use of alcohol	.265 **	-.094	-.059	-.120	.056	.111	.013	-.098	.256 **	.156	.010	.389 ***	1.00	
14. Smoking	-.281 **	.113	.291 **	.173	-.060	-.252 *	-.168	.193	-.162	-.048	.254 *	-.096	.091	1.00

APPENDIX 2 Correlation coefficients between selected variables at baseline in 1989, women (n=140-190). ***p < 0.001, **p < 0.01, *p < 0.05 (II).

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Self-rated health	1.00													
2. PADL	-.508 ***	1.00												
3. Chronic diseases	-.450 ***	.339 ***	1.00											
4. Depression (CESD score)	-.404 ***	.140	.212 **	1.00										
5. Vital capacity, litre	.289 ***	-.246 ***	-.192 **	-.170 *	1.00									
6. Max working capacity, W	.289 ***	-.341 ***	-.175 *	-.129	.451 ***	1.00								
7. Max isometric strength	.195 **	-.352 ***	-.093	-.019	.360 ***	.299 ***	1.00							
8. Balance, mm ² /s	.036	.117	.100	-.167 *	-.138	-.051	-.119	1.00						
9. Cognitive functioning	.199 **	-.204 **	-.139	-.070	.304 ***	.355 ***	.248 ***	-.187 *	1.00					
10. Visual acuity	-.095	-.049	-.173 *	-.002	.073	.009	.043	-.244 **	.341 ***	1.00				
11. Hearing, dB	-.188 **	.113	.122	.156 *	-.194 **	-.125	-.108	-.002	-.151 *	-.066	1.00			
12. Physical activity	.153 *	-.336 ***	-.136	.018	.201 **	.117	.364 ***	-.041	.222 **	.137	-.087	1.00		
13. Use of alcohol	.361 ***	-.231 **	-.078	-.110	.223 **	.238 **	.240 **	-.097	.352 ***	.008	.036	.206 **	1.00	
14. Smoking	-.023	.137	.015	.000	-.038	-.025	-.121	.180 *	.031	-.177 *	.033	.025	.126	1.00

APPENDIX 3 Correlation coefficients between self-rated health measured at the 5-year follow-up and selected variables measured at baseline, men (n=66-75). ***p < 0.001, **p < 0.01, *p < 0.05 (IV).

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Self-rated health 1994	1.00														
2. Self-rated health 1989	.48 ***	1.00													
3. PADL 1989	-.44 ***	-.49 ***	1.00												
4. Chronic conditions 1989	-.39 ***	-.43 ***	.30 **	1.00											
5. Depression (CESD score) 1989	-.06	-.11	.04	.19	1.00										
6. Vital capacity, litre 1989	.29 *	.46 ***	-.28 *	-.22	.05	1.00									
7. Max working capacity, W, 1989	.41 ***	.36 **	-.26	-.29 *	.04	.50 ***	1.00								
8. Max isometric strength 1989	.38 ***	.42 ***	-.45 ***	-.29 *	-.06	.50 ***	.53 ***	1.00							
9. Balance, mm ² /s 1989	-.20	-.20	.14	.28 *	-.11	-.26 *	-.42 ***	-.05	1.00						
10. Cognitive functioning 1989	.55 ***	.54 ***	-.37 **	-.22	-.09	.31 **	.39 ***	.46 ***	-.14	1.00					
11. Visual acuity 1989	.31 **	.57 ***	-.35 **	-.09	.20	.36 **	.25 *	.30 *	-.22	.39 ***	1.00				
12. Hearing, dB 1989	-.19	-.18	.21	.09	.07	.03	-.08	.00	.20	-.11	.02	1.00			
13. Physical activity 1989	.59 ***	.49 ***	-.41 ***	-.19	.12	.41 ***	.53 ***	.48 ***	-.08	.50 ***	.40 ***	-.12	1.00		
14. Hobby index 1989	.40 ***	.52 ***	-.39 ***	.07	.01	.25 *	.33 **	.35 **	-.18	.40 ***	.41 ***	-.21	.53 ***	1.00	
15. Social contacts 1989	.21	.12	-.07	.05	.04	-.02	.03	.30 **	.16	.02	.10	.12	.05	.12	1.00

APPENDIX 4 Correlation coefficients between self-rated health measured at the 5-year follow-up and selected variables measured at baseline, women (n=135-149). ***p < 0.001, **p < 0.01, *p < 0.05 (IV).

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Self-rated health 1994	1.00														
2. Self-rated health 1989	.43 ***	1.00													
3. PADL 1989	-.40 ***	-.42 ***	1.00												
4. Chronic conditions 1989	-.28 ***	-.48 ***	.36 ***	1.00											
5. Depression (CESD score) 1989	-.21 **	-.39 ***	.15	.29 ***	1.00										
6. Vital capacity, litre 1989	.24 **	.16	-.27 ***	-.23 **	-.14	1.00									
7. Max working capacity, W, 1989	.32 ***	.14	-.42 ***	-.22 **	-.11	.41 ***	1.00								
8. Max isometric strength 1989	.15	.09	-.34 ***	-.10	.00	.34 ***	.24 **	1.00							
9. Balance, mm ² /s 1989	-.16	-.02	.05	.03	-.15	-.27 ***	-.00	-.07	1.00						
10. Cognitive functioning 1989	.19 *	.10	-.19 *	-.16	-.07	.26 **	.30 ***	.21 *	-.11	1.00					
11. Visual acuity 1989	.13	-.06	-.01	-.18 *	-.07	.10	.10	-.02	-.33 ***	.35 ***	1.00				
12. Hearing, dB 1989	-.02	-.22 *	.05	.19 *	.13	-.17 *	-.09	-.06	.03	-.12	-.13	1.00			
13. Physical activity 1989	.08	.11	-.23 **	-.09	.02	.13	.20 *	.30 ***	.10	.14	.10	.06	1.00		
14. Hobby index 1989	.26 **	.20 *	-.24 **	-.24 **	-.12	.24 **	.21 *	.28 **	-.09	.36 ***	.11	-.21 *	.27 **	1.00	
15. Social contacts 1989	.23 **	-.04	-.08	.06	.14	.03	.03	.09	-.05	-.07	-.22 **	.21 **	.11	.15	1.00

APPENDIX 5 Indicators of health and functional capacity at the 5-year and 10-year follow-up by change in self-rated health. Means, standard deviations, percentage distributions, and statistical significance of differences between groups (one-way analysis of variance for continuous variables and χ^2 test for discrete variables). ***p < 0.001, **p < 0.01, *p < 0.05 (V).

Variables	Self-rated health 1994 - 1999										Difference between groups		
	Good-Good (1) (n=41-48)		Good-Bad (2) (n=9-14)		Bad-Good (3) (n=5-10)		Bad-Bad (4) (n=8-23)		F				
	Mean	SD	Mean	SD	Mean	SD	Mean	SD					
Number of chronic conditions	1994	1.8	1.2	2.1	1.0	2.7	0.5	3.3	1.3	9.4***	1,3	1,4	2,4
	1999	2.6	1.4	3.1	1.4	4.1	2.1	4.7	4.7	10.3***	1,3	1,4	2,4
CESD score	1994	10.9	6.2	13.4	7.7	12.8	6.1	15.0	7.7	1.9	1,4		
	1999	10.7	5.7	15.1	8.7	15.8	3.6	18.4	6.2	8.9***	1,2	1,3	1,4
PADL difficulties	1994	1.5	2.0	3.1	2.5	4.5	3.2	4.7	2.9	10.3***	1,2	1,3	1,4
	1999	2.0	2.0	3.9	2.3	3.6	2.3	5.6	2.2	16.5***	1,2	1,3	1,4 2,4 3,4
Walking speed, m/s	1994	1.69	0.39	1.46	0.24	1.41	0.45	1.28	0.34	7.3***	1,2	1,3	1,4
	1999	1.41	0.39	1.15	0.22	1.05	0.74	0.79	0.42	9.3***	1,2	1,4	2,4
Climbing ability, cm/m	1994	28.7	6.9	24.0	6.4	24.2	7.8	21.5	7.4	5.4**	1,2	1,4	
	1999	22.5	7.9	17.6	8.1	15.7	9.1	13.3	6.3	5.7*	1,3	1,4	
Hand grip, N/kg	1994	4.2	1.6	3.6	1.3	3.3	1.1	3.5	1.2	2.1			
	1999	3.9	1.3	3.0	1.1	2.6	1.2	2.9	0.8	5.4**	1,4		
Trunk extension, N/kg	1994	7.4	2.7	5.2	2.5	4.9	2.4	5.5	2.6	4.2**	1,2	1,3	1,4
	1999	5.3	2.2	3.9	2.7	4.7	2.6	3.8	1.2	2.0			
Vital capacity, litre	1994	2.8	0.6	2.2	0.6	2.4	0.7	2.3	0.4	5.1**	1,2	1,4	
	1999	2.5	0.6	2.1	0.6	2.3	0.7	1.8	0.4	6.6***	1,2	1,4	3,4
Cognitive functioning (Digit Symbol)	1994	24.6	8.0	20.8	7.8	20.4	8.4	19.2	6.6	2.9*	1,4		
	1999	20.1	7.7	14.8	5.8	16.1	8.3	13.3	7.0	4.1**	1,2	1,4	
Hobby index	1994	45.4	7.9	41.1	5.2	41.8	11.1	41.0	6.8	2.4	1,4		
	1999	41.1	9.1	38.1	6.5	37.9	8.3	32.5	8.0	5.4**	1,4		
Physical activity, %		1994 (n=48)	1999 (n=48)	1994 (n=14)	1999 (n=14)	1994 (n=10)	1999 (n=10)	1994 (n=23)	1999 (n=23)	p(1994)	p(1999)		
	Light	23	42	29	64	40	70	44	74				
	Moderate	35	25	57	29	50	20	30	13	0.159	0.101		
Strenuous	42	33	14	7	10	10	26	13					

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