

**Life Satisfaction in Late Life:
Markers and Predictors of Level and Change
Among 80+ Year Olds**

Anne Ingeborg Berg

Department of Psychology



UNIVERSITY OF GOTHENBURG

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Abstract

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Department of Psychology, University of Gothenburg, Sweden.

The overall aim of the thesis was to examine within-individual and between-individual changes in life satisfaction in the oldest-old using different time metrics and to study life satisfaction within the context of psychosocial and health-related variables. Data were obtained from the Swedish OCTO-Twin Study of individuals aged 80 and older who were able to complete the Life Satisfaction Index-Z (LSI-Z). In **Study I** the association between life satisfaction and scales and questions regarding demographics, self-rated overall health and medically based health, functional capacity (instrumental and personal activities of daily living), cognitive function, depression, locus of control, and social network was investigated. Analyses indicated that social network quality, self-rated overall health, sense of being in control of one's life, widowhood, and depressive symptoms were associated with life satisfaction. A gender-specific pattern was found; self-rated overall health and depressive symptoms were related to life satisfaction in women, whereas widowhood was significantly associated with lower satisfaction among men. In **Study II** the associates identified in Study I; perceived quality of social network, self-rated overall health, depressive symptoms, locus of control, and widowhood, in addition to financial satisfaction and the personality traits neuroticism and extraversion, were investigated as predictors of change in life satisfaction across four measurements over a 6-year period. Growth curve analysis showed a fairly consistent significant linear decline in life satisfaction. Certain markers predicted decrease in life satisfaction; the loss of spouse, particularly in men, and higher levels of depressive symptoms. Results suggest that life satisfaction is influenced by changes in psychosocial variables although there is an overall stability in level of life satisfaction in the oldest old. In **Study III** different time metrics were examined in the study of late life changes in life satisfaction. Findings of age-graded stability of life satisfaction, despite health-related losses distinctive of the oldest old, suggest that mortality-related processes could be more influential than chronological age. The study investigated changes in life satisfaction at 4 measurement occasions over a 6-year period using two competing parameterizations of time, chronological age and time-to-death. Growth curve analyses showed a linear decrease in both time-structures, but the time-to-death metric revealed a significantly better model fit. Notably, age, gender, SES, years to death, level or change in overall load of disease and self-rated health did not predict time-to-death related changes. Lower overall disease load was, however, related to higher levels of life satisfaction. In individuals with higher disease load, an external locus of control was related to lower satisfaction with life. Among those who rated their health as poor, a higher level of neuroticism was related to lower life satisfaction. The results suggest that a time-to-death metric was superior to chronological age to predict change in life satisfaction. In **Study IV** the relationships between life satisfaction and 25 specific chronic diagnoses were investigated. Problems with sleep, urinary incontinence and stroke were significantly related to life satisfaction in both men and women. Among men, angina pectoris and eczema were related to lower life satisfaction, whereas among women peptic ulcer was related to lower life satisfaction. The results confirm previous findings of a weak relationship between medically based measures of health and life satisfaction. However, health care and future studies of health and life satisfaction need to recognize and address that the meaning and consequences of various diseases may differ among individuals and that gender differences should be considered in this context.

Overall findings from the thesis demonstrate a homogenous decline in life satisfaction in the oldest-old. Despite health-related losses, social network and personal resources accounted for substantial inter-individual differences in life satisfaction. The thesis demonstrated the need to analyse associates of life satisfaction at the intra-individual level and within a broader context of psychosocial and health-related variables also in late life.

Keywords: Life satisfaction, oldest-old, longitudinal design, health, social network, locus of control, depressive symptoms, personality.

Preface

This thesis is based on the following studies, which will be referred to in the text by their Roman numerals:

I. Berg, A.I., Hassing, L.B., McClearn, G.E., & Johansson, B. (2006). What matters for life satisfaction in the oldest-old? *Aging and Mental Health* 10(3), 257-264.

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Introduction

Life satisfaction and the prospect of aging well are likely to be important for all of us. In the last decades extensive empirical research efforts have been directed at clarifying the degree of stability as well as to identify relevant predictors of level and change in life satisfaction across the lifespan. The vast majority of studies have, however, focused on younger age segments of the older population. The main finding is that life satisfaction is relatively stable across life (Costa, McCrae, & Zonderman, 1987). However, the results from the few studies conducted among people aged 80 and over, often referred to as the oldest-old, suggest a more ambiguous picture. Some studies indicate stability (Diener, Suh, Lucas, & Smith, 1999) or even an increase in satisfaction (Diener, 1984; Mercier, Peladeau, & Tempier, 1998), whereas other studies suggest a decrease (Mroczek & Spiro, 2005). Inconsistent research findings therefore prevent firm conclusions about life satisfaction in the oldest old age segment. Because the oldest-old are especially exposed to numerous potential threats to life satisfaction such as loss of spouse, changes in social network, and age related diseases and comorbidity, the study of life satisfaction is particularly motivated in this age group. In addition, the identification of life satisfaction as a predictor of survival in the oldest-old further motivates the exploration of satisfaction in old age (Lyyra, Törmäkangas, Read, Rantanen, & Berg, 2006). The oldest-old also constitute a continually increasing proportion of the population in western societies and will require considerable societal welfare resources in the near future. Taken together, the ambiguous research findings, unique exposure to multiple threats to life satisfaction, and demographic changes, provide strong arguments for more detailed investigations of various facets of life satisfaction in the oldest-old.

Life satisfaction

Life satisfaction is one among a range of concepts that is assumed to reflect the conditions of ‘a good life’. This section aims to clarify the relationship between life satisfaction and the two related concepts of quality of life and subjective well-being. Subjective well-being also provides the theoretical context for the definition of life satisfaction applied in the thesis. The distinction between a top-down and bottom-up theoretical framework for life satisfaction judgments is also addressed.

Quality of life

The concept of quality of life is frequently used to describe “the good life” within several disciplines such as economy, sociology, psychology, medicine, and health-care. The contents

and specific measures of quality of life, however, vary both between and within disciplines (Farquhar, 1995). The emphasis ranges from standards of living in economy to perceived health status in medicine. In fact, more than 1000 measures of various aspects of quality of life have been identified (Hughes & Hwang, 1996) and more than 100 definitions of quality of life have been proposed (Cummins, 1997). In spite of the lack of a widely accepted definition, most definitions of quality of life include a multidimensional functional status aspect and a subjectivity aspect (Muldoon, Barger, Flory, & Manuck, 1998). Multidimensional functional status incorporates physical well-being, functional ability, emotional well-being, and social well-being and subjectivity refers to the individual's own perception of his or her quality of life (Muldoon et al., 1998). Accordingly, whereas the subjectivity aspect of quality of life resembles life satisfaction, there is a multidimensional functional status dimension of the quality of life concept that life satisfaction clearly excludes.

The indistinctness of the concept of quality of life has been acknowledged and efforts have consequently been made to propose a more specific measure. In 1991 the World Health Organization presented the WHOQOL; World Health Organization Quality of Life inventory that was developed for the purpose of providing a cross-cultural measure of quality of life related to global well-being (WHOQOL-GROUP, 1993). The WHOQOL-BREF is a shorter 28-item-version of the original WHOQOL-100 and captures responders' perceptions of physical, psychological, social relations, and environmental quality of life in addition to two global questions of overall health and quality of life. In 2005 the WHOQOL-OLD module was introduced as a complement to the WHOQOL-BREF or the original WHOQOL-100. The WHOQOL-OLD adds six facets of specific relevance for quality of life in an old population; Sensory abilities, Autonomy, Past, present, and future activities, Social participation, Death and dying, and Intimacy (Power, Quinn, Schmidt, & WHOQOL-OLD-GROUP, 2008; WHOQOL-OLD, 2005). The application of an instrument that generates a global measure of subjective quality of life on the basis of a broad spectrum of specific domains of satisfaction faces shortcomings in terms of lack of individual priority. Assuming that different areas are valued differently among people, the global measure will inevitably represent an unspecific measure of the real-life quality of life. Despite these shortcomings, the WHOQOL-OLD is an important contribution towards a more specific conceptual structure in the study of late life qualities and represents an instrument gerontology researchers might well consider useful.

Hedonism and subjective well-being

The majority of measures of well-being are developed from one of two distinct philosophical traditions; eudaimonism and hedonism. Eudaimonism represents a perspective that not only emphasizes pleasant or unpleasant experiences but that also maintains that aspects of human life such as self-actualization or realization of one's true potential are basic features of well-being. Ryff and Singer have proposed a multidimensional measure of psychological well-being (PWB) that incorporates six different areas of human actualisation; Autonomy, Personal growth, Self-acceptance, Life purpose, Mastery, and Positive relatedness (Ryff & Singer, 1998). Hedonism on the other side represents a narrower approach to well-being based on the idea that well-being is equal to maximizing pleasant and minimizing unpleasant experiences (Kahneman, Diener, & Schwarz, 1999). In this context happiness is the ultimate marker of well-being.

Subjective well-being represents a hedonic well-being concept with roots in the mid-seventies when Andrews and Whitey (1976) introduced a well-being structure consisting of three factors; cognitive evaluation, negative affect, and positive affect. Some years later Diener (1984) rephrased the concept using the narrower name subjective well-being, with the intention of accentuating the importance of assessing the subjective experience of life in contrast to an assessment of life conditions using an absolute, fixed standard as a reference. According to Diener, subjective well-being covers two main components; one affective including negative and positive emotions, and one cognitive; namely life satisfaction. Negative emotions and life satisfaction are however distinct measures and although positive emotions are related to life satisfaction, they are not fully overlapping constructs (Lucas, Diener, & Suh, 1996). In sum, subjective well-being can be defined in terms of high levels of positive emotion and life satisfaction and low levels of negative emotions.

Life satisfaction

Diener defined life satisfaction as “a cognitive judgmental global evaluation of one's life. It may be influenced by affect but is not itself a direct measure of emotion” (1984). The definition highlights the distinction between the sub-categories of subjective well-being; the evaluation of life satisfaction involves a judgmental process that differs from that involved when reporting affect as it requires a conscious, cognitive assessment of life circumstances and a comparison of these to a subjectively set standard (Pavot & Diener, 1993). A greater amount of discrepancy between the set standard and one's actual standing means less

happiness. However, there are different perspectives on the judgmental process of life satisfaction. Figure 1 (below) serves to place the concept of life satisfaction within the broader framework of various well-being concepts. Importantly, the well-being construct has been used in varying settings in which the subcategories may differ, thus, the proposed figure represents by no means a complete definition of the construct.

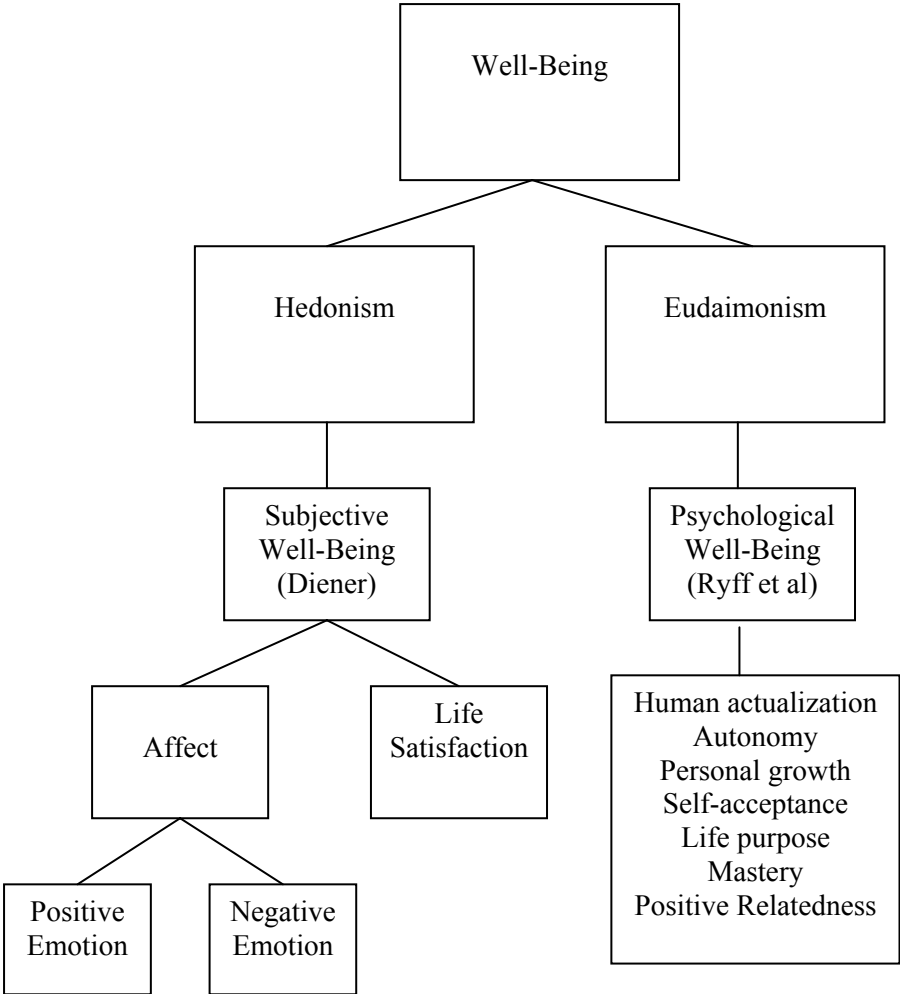


Figure 1. The Concept of Life Satisfaction in a Heuristic Well-Being Framework.

Life satisfaction evaluations: Top-down and bottom-up

Why are some people more satisfied with their lives whereas others are more dissatisfied? Are objective life circumstances such as health, socio-economic status, and material standards basic determinants of life satisfaction or are these conditions of little importance because people's own attitudes matter more? Theories that emphasize objective circumstances and shifting contextual sources as most influential for life satisfaction judgments are commonly labelled bottom-up theories whereas theories that focus on stable individual characteristics are commonly labelled top-down theories. These two perspectives have become organizing principles in the subjective well-being research (Diener, 1984).

Top-down theories state that global personality traits predispose level of life satisfaction (Eid & Diener, 2004; Heller, Watson, & Hies, 2004). Certain personality traits, in particular extraversion and neuroticism, determine to what degree people experience happiness (Costa & McCrae, 1980). Evidence of stability of life satisfaction (Diener et al., 1999) is assumed to support the top-down perspective, indicating a strong association with stable personality traits and a weak influence of current mood, situational factors or long-term influence of life events (Eid & Diener, 2004; Suh, Diener, & Fujita, 1996). Adaptation theory is one representative of the top-down perspective that provides a more complex elaboration of the finding that important life events such as changes in income, marital status, and health status only have short-term effects on life satisfaction. Brickman and Campbell (1971) described an adaptation process in terms of a hedonic treadmill; when exposed to an event that temporarily reduces or increases happiness; people have an innate, global tendency to adapt their aspirations to the new situation. The discrepancy between aspirations and actual life circumstances is reduced when the individual's personal set standard has adjusted to the changed conditions, and as a result, life satisfaction returns to a previously fixed level. The impact of a life event on life satisfaction has been found to decrease in strength and diminish after 3 months (Suh et al., 1996). This indicates that an adaptation has occurred and life satisfaction is no longer affected. However, Adaptation theory has not been left unchallenged. Recent findings of incomplete adaptation after certain life events such as marital transitions and disability (Easterlin, 2003), in addition to great individual differences in degree of adaptation (Fujita & Diener, 2005; Lucas, Clark, Georgellis, & Diener, 2003) question the notion of predestined life-long happiness. In sum, among top-down theories, Adaptation theory is still controversial and an object for empirical testing, whereas the relevance of global personality traits is generally accepted.

In contrast to researchers applying a top-down perspective, proponents of the bottom-up perspective build their approach on the assumption that happiness depends on the realization of certain basic and universal human needs. Consequently, contextual conditions are influential sources of life satisfaction. Some argue that life satisfaction depends on life circumstances and the individual judgment of these, whereas other bottom-up theories such as the social-cognition tradition (Strack, 1988) regard life satisfaction reports simply as expressions of what comes to mind in a given moment. Experimental studies within the social-cognition tradition have shown that level of life satisfaction depends on temporarily accessible information via mood influence (Schwarz & Strack, 1999, 1991; Schwarz, Strack, & Mai, 1991; Strack, Martin, & Schwarz, 1988). An event that comes to mind can influence reports of life satisfaction via mood in two different ways according to how the information is used; directly, as an assimilation effect, by forming the mental representation of “life today” or as a contrast effect by which current life situation can be compared. Low short-term test-retest reliability of life satisfaction (Andrews & Whithey, 1976) also confirms the influence of temporary and changing sources. Noteworthy, assumptions of fluctuating life satisfaction ratings partly rest on results from experimental studies using research designs where circumstances in personal interviews have been manipulated. Personal interviews, in contrast to completing a questionnaire, have a more pronounced unwanted side-effect of increased risk for socially desirable answers (Moum, 1998), which may have accentuated the identified poor test-retest validity of life satisfaction judgements.

The bottom-up perspective also has proponents among researchers exploring effects of more general contextual sources. The underlying assumption is that life satisfaction is equal to the summation of pleasant and unpleasant experiences and actual conditions related to different life circumstances (Campbell, Converse, & Rodgers, 1976). Researchers concerned with the influence of health, marital status, economy or social network on life satisfaction belong here. Taken together, the bottom-up perspective comprises both the view of life satisfaction as a direct expression of temporary information that comes to mind and research that investigates the importance of contextual sources such as life domains as the base of life satisfaction judgments.

Despite the apparent controversy between top-down and bottom-up theories, theoretical and empirical efforts have been made to incorporate the two. Brief et.al. (1993) developed a framework for integrating these perspectives of subjective well-being. In a study by Okun and

George (1984) self-rated health was related to subjective well-being, physician-rated health, and neuroticism. However, neuroticism seemed to modify the relationship between self-rated health and subjective well-being, indicating that the association between perception (self-rated health) of objective conditions (health) and subjective well-being is partly channelled by personality traits (neuroticism). Recognizing such findings, Brief and colleagues (1993) argued that both top-down and bottom-up perspectives contribute to the understanding of subjective well-being by proposing that both global personality traits and objective life circumstances influence people's interpretations of their lives, which in turn determine well-being judgments. Some years later, Schimmack and colleagues applied a similar model on life satisfaction judgments (2002). In support of bottom-up theories life satisfaction judgments seemed to depend on accessible and relevant sources of information (Schimmack, Diener, & Oishi, 2002). Furthermore, consistent with top-down theories, life satisfaction reports were stable over time, a finding assumed to be caused by the tendency to use the same sources as the basis of life satisfaction judgments over time. In addition, top-down theories that emphasize personality traits as predictors of life satisfaction receive some support as personality traits seemed to influence the perception and selection of chronically accessible sources of life satisfaction (Brief, Butcher, George, & Link, 1993; Schimmack et al., 2002).

In sum, objective life circumstances are related to level of well-being, but individuals' perceptions act as filters of the impact and personality traits seem to have some influence on how circumstances are filtered (Brief et al., 1993). What circumstances are considered is also partly an expression of certain personality traits as people have been found to consistently choose the same accessible sources (Schimmack et al., 2002). According to these findings an integration of bottom-up and top-down perspectives might provide a theoretical framework that comprises the complexity of life satisfaction judgments in a better way than the perspectives do separately.

Life satisfaction in an aging context

Theoretical approaches

According to the advocates of an integration of bottom-up and top-down perspectives, life satisfaction reflects both objective life circumstances and the perception of these. Stability in what circumstances people consider provides corresponding stability of level of life satisfaction (Brief et al., 1993; Schimmack et al., 2002). Consequently life satisfaction in the

oldest-old is presumably related to objective measures and subjective evaluations of significant domains, in addition to psychological characteristics of the individual.

The premises of life satisfaction in light of the specific conditions of later life have been explored within various theoretical approaches. Firstly, life satisfaction is sometimes considered as a component of a broad construct, such as successful aging. Conclusions from successful aging research indicate that both contextual objective measures as well as subjective perceptions of significant areas, such as health and social network, are necessary. Secondly, the association between perceived personal control and life satisfaction represents a field of great interest within gerontology. Control beliefs, which have variously been described as personality traits or context dependent behaviours are increasingly important to life satisfaction in old age and should be taken into consideration. Thirdly, life satisfaction is relevant in the context of aging and personal resources such as coping. The Selectivity Optimization Compensation theory of how to cope with age related changes has focused on how life satisfaction is related to successful coping. Finally, social network is an important part of life circumstances in late life. The Socioemotional selectivity theory may serve to integrate the concept of life satisfaction within a psychosocial context, which emphasizes perceived quality of social contacts in old age. These approaches are presented below.

Successful aging

The issue of life satisfaction in old age is closely related to successful aging. Both concepts emerged in gerontology literature almost half a century ago, representing the need for a counterbalance to the existing focus on negative consequences of aging (e.g. illness, depression, disability, social withdrawal etc.). In contrast to the state of the life satisfaction concept, there is still no consensus definition of successful aging (Phelan & Larson, 2002). Besides the problem of defining what “success” means in the context, there are conflicting opinions concerning the characteristics of a successfully aged individual. Some emphasize absolute measures of certain significant domains. For example, Rowe and Kahn (1997) identified three important criteria for successful aging; absence of disease and disease related incapacity, high cognitive and physical functional capacity, and active engagement with life. In contrast to proponents of absolute measures, others have argued that whether or not an individual has aged successfully should be determined by a relative standard originating from the potential of each individual. Baltes and Carstensen (1996) defined successful aging as “doing the best with what one has”, suggesting that low health status does not necessarily

mean that an individual has aged unsuccessfully. Findings of low concurrence between Rowe and Kahn's three objective criteria and the individual's own perception of aging successfully (Strawbridge, Wallhagen, & Cohen, 2002) clearly illustrate the intricate contradiction between objective, absolute measures and subjective perceptions. The different and partly conflicting answers provided as a consequence of selected measures needs to be recognized. Successful aging within a psychological perspective should preferably include both self-reports and absolute measures of for example health, functioning, social network as well as information on psychological measures such as subjective well-being, cognitive functioning or sense of control.

Personal control and well-being

The concept of locus of control was introduced four decades ago by Rotter, one of the founders of social learning theory (Rotter, 1966). Locus of control reflects individuals' beliefs about their own influence on what happens to them in contrast to beliefs that outcomes depend on chance or on other people. Rotter developed an inventory that measured degree of internal and external locus of control, and maintained that the perception of control remains stable across life and should consequently be regarded as a personality trait. However, Schulz and Heckhausen (1995), representing an alternative perspective of the control concept, presented a life span theory of control, suggesting that the perception of control is altered across life as a result of aging-related psychosocial and biological changes. In their view, the control concept consists of primary control, which refers to influence of external environment, and secondary control, which refers to internal processes with the aim of handling changes in primary control (Heckhausen & Schulz, 1995). Primary control has been found to follow an inverted-u curvilinear development across the life course with a decrease from midlife to old age, whereas secondary control increases linearly with age. Increased secondary control with age possibly reflects individual adaptation to aging-related losses. Empirical studies of experiences of losing control show that the sense of control seems to be particularly important for coping in situations when people become aware of restrictions in their own capability to influence outcomes (Skinner, 1995). Accordingly, in advanced ages people often experience personal limitations associated with health-related, psychological, and social losses, the perception of control is therefore expected to be influential in the oldest-old. The sense of being in control of the immediate environment has also repeatedly been found to be of importance to psychological well-being in old age (Femia, Zarit, & Johansson, 1997; Hickson, Housley, & Boyle, 1988; Langer & Rodin, 1976; Smith et al., 2000). Regardless of

whether or not the sense of control is an expression of personality or if it is context-related, the aging process alters the conditions of control, which in turn might influence psychological well-being.

Selective Optimization with Compensation-theory

Recognizing the importance of individual attitudes and control beliefs, Baltes and Baltes developed a theory of successful aging, describing an adaptive process of how to manage age related losses; Selective Optimization with Compensation; SOC (Baltes & Baltes, 1990). Individuals aging successfully *select* life domains of significance, *compensate* for shortcomings by utilizing intact functions and, if necessary, relevant aids, and keep *optimizing* performance in selected domains. The use of SOC-strategies have been found to correlate positively with the experience of subjective well-being, but when the components of subjective well-being were studied separately, no relationship was found between SOC-strategies and life satisfaction (Freund & Baltes, 1998). This indicates that the use of SOC-strategies is weakly related to life satisfaction in old age. However, the SOC theory has contributed by explaining other empirical findings of well-being in old age, and thereby guided the development of new theories, such as the Socioemotional selectivity theory.

Socioemotional selectivity theory

In an attempt to explore conditions related to a decrease in size of social network with age, Carstensen developed a socioemotional selectivity theory that is related to the core ideas of adaptation in the SOC theory (Carstensen, 1995; Carstensen, Isaacowitz, & Charles, 1999). As people age and future time perception changes they tend to select fewer, but more emotionally rewarding contacts at the expense of investing their time in maintaining a large network (Carstensen, 1992; Lansford, Sherman, & Antonucci, 1998). Seemingly, the adequacy of age related changes in psychosocial preferences is confirmed in a recent meta-analysis finding subjective well-being to be more strongly related to quality of social network than to frequency of social contacts (Pinquart & Sorensen, 2000). Moreover, in a longitudinal study by Charles and colleagues, negative emotions were found to decrease over a 23-year period (Charles, Reynolds, & Gatz, 2001). This adds support to the notion of a more general tendency of age-related improvements in emotional regulation by the selection of emotionally rewarding situations and avoidance of experiences that generate negative emotions. Altogether, because certain psychosocial aspects of life are unique to old age there is a risk

associated with generalizing findings from research conducted on younger samples to older populations.

To conclude, objective conditions and the perception of these are assumed to be relevant aspects of life satisfaction in later life and include domains such as, physical and mental health, marital status, and social networks. Individual characteristics and personal resources should also be considered (Malmberg, 1990).

Design and methodological considerations

Using the above theoretical suggestions in the study of late life development differs from a corresponding investigation of younger individuals. The age-graded processes that are supposedly related to change across the lifespan are accompanied by substantial influence from mortality and pathology related processes in late life (Baltes & Smith, 1997; Berg, 1996). The contribution to change from these processes and the balance between them may change and is related to the substantial age-related heterogeneity in health and functioning and the capacity of coping with health deteriorations that are also observed in old age (Prohaska, Keller, Leventhal, & Leventhal, 1987). The exploration of the influence of these processes on changes in life satisfaction necessitates a longitudinal design, preferably with more than three measurement points, and analytic approaches and time metrics that may account for different sources of variance.

Growth curves within a mixed, or multilevel, modelling (MLM) framework is a novel methodology that allows identification of random effects of the covariance structures of the data, in addition to tracking mean trends in the population. The application of MLM-analyses provides knowledge about polynomial changes of the population mean and also individuals' deviation from the sample mean trajectory, that is, inter-individual differences in intra-individual changes (Baltes, Reese, & Nesselrode, 1988).

Time metrics or the operationalization of time, is important to consider for research questions related to processes of change. For example, as long as individuals are recruited at different ages, an age-based time metric of change in life satisfaction will not properly separate cohort-effects from individual development. Hence, firm conclusions can not be drawn concerning developmental age-graded influences. A time-in-study metric on the other hand, provides an estimation of change across a limited time period, and reflects intra-individual development

within a cohort. Investigating the influence of mortality on life satisfaction changes entails a time-to-death time metric, and although it may be problematic as it only includes individuals on the condition that they are deceased, it provides important information on change processes in late life.

In sum, the study of life satisfaction changes in old age necessitates methods that are able to deal with the great heterogeneity of the oldest-old population and the influence of age, morbidity, and mortality related processes that may underlie change.

The measurement of life satisfaction in old populations: The Life Satisfaction Index-Z.

A valid picture of life satisfaction in a given population requires instruments that are adjusted to the characteristics of the population in question. One of the few scales developed for the purpose of capturing life satisfaction in old age is the Life Satisfaction Rating (Neugarten, Havighurst, & Tobin, 1961), and modified versions are frequently used in studies of older populations. Neugarten et al. carried out interviews with 177 individuals aged 50 to 90 with the aim of portraying older people's own evaluations of their lives. The result of the analysis of the interviews was the derivation of five dimensions of life satisfaction: 1) Zest versus apathy; referring to degree of enthusiasm and ego-involvement in various activities, 2) resolution and fortitude; referring to feeling of one's own influence and responsibility for one's life, 3) congruence between desired and achieved goals; referring to perception of accomplishing desired goals, 4) self-concept; referring to perception of one's own physical, psychological, and social attributes, and 5) mood tone; high ratings referring to optimistic attitudes and mood in relation to one's own life. These dimensions provided a base for the construction of the Life Satisfaction Rating, which in turn resulted in the shorter indexes LSI-A and B. The Life Satisfaction Index-Z (LSI-Z), is a further modification of these scales and consists of 13 items (Wood, Wylie, & Sheafor, 1969). The proposed five factor solution the LSI-Z was recently questioned in a study using OCTO Twin data (the same sample as used in this thesis) (Lyyra et al., 2006). Instead, evidence was found for a three factor solution: 1) Zest; representing positively worded satisfaction with present life and zest ("As I grow older, things seem better than I thought they would.", "I'm just as happy as when I was younger.", "These are the best years of my life.", "The things I do are as interesting to me as they ever were.", and "I have made plans for things I'll be doing a month or a year from now,"), 2) Mood; represented by negatively worded present life satisfaction and mood tone ("This is the dreariest time of my life.", "Most of the things I do are boring or monotonous." "Compared

with other people I get down in the dumps too often.”, and “In spite of what people say, the lot of the average person is getting worse, not better.”), and Congruence; representing past life satisfaction and congruence (“I have got more breaks in life than most of the people I know.”, “As I look back on my life, I am fairly well satisfied.”, When I think back over my life, I didn’t get most of the important things I wanted.”, and “I’ve got pretty much what I expected out of life”). The three factor structure of Zest, Mood tone, and Congruence is previously confirmed in the LSI-A version (Adams, 1969; Hoyt & Creech, 1983). Even though the scale consists of separate dimensions, the LSI-Z is typically analyzed at the level of total sum of scores (Bowling, Farquhar, & Browne, 1991; Dennerstein, Dudley, Guthrie, & Barrett-Connor, 2000; Hillerås, Jorm, Herlitz, & Winblad, 2001; Kritz-Silverstein, Wingard, & Barrett-Connor, 2002)

It may be argued that the LSI-Z includes items that border on dimensions other than the cognitive component of subjective well-being as illustrated in Figure.1. First, the item “Compared with other people I get down in the dumps too often” bear a resemblance to the affective component of subjective well-being. However, in contrast to measures of negative affect such as the CES-D (Radloff, 1977), in which items are clearly focused on negatively loaded emotions, the LSI-Z predominantly consists of items that verge on the cognitive component. Second, the item “I have made plans for things I’ll be doing a month or a year from now,” verge on the self actualization dimension that is characteristic of the Psychological Well-Being construct, and in particular the subcategories Mastery or Life Purpose (Ryff, 1989). However, as the majority of the items enquire cognitively loaded statements of the respondent’s life, the LSI-Z is above all a representative of the cognitive component of subjective well-being.

Associates of life satisfaction

The question of what may be related to life satisfaction late in life has frequently been investigated in empirical research, and numerous correlates have been identified in studies applying cross-sectional designs. Cross-sectional findings provide valuable knowledge of mean trends on population-level, however, the question of aging-related changes and the relation to important predictors within individuals must also be addressed (Hofer & Sliwinski, 2001). The study of changes in life satisfaction and the related predictors requires analysis of longitudinal data which enable the possibility of reducing the influence of unwanted cohort-effects. Unfortunately, these studies are uncommon at present. A selection of previously

found associates or markers as well as predictors identified in longitudinal studies of life satisfaction in old age is presented below.

Age: Distance from birth and distance from death

Even if life satisfaction has been found to be stable across life (Costa et al., 1987), findings from studies of later life are contradictory. Cross-sectional studies have presented results ranging from finding no relationship at all between age and life satisfaction (Diener et al., 1999; Hamarat et al., 2002) to finding a positive relationship (Diener, 1984; Mercier et al., 1998; Prenda & Lachman, 2001) and even negative relationships (Chen, 2001; Freund & Baltes, 1998). In one of the few studies applying a longitudinal design, Mroczek & Spiro (2005) found a decrease in life satisfaction in very old age. However, also investigating inter-individual differences in intra-individual change, they found large individual differences in rate of change and amount of curvature. Even if there seems to be a general tendency of decline in life satisfaction, there is also great heterogeneity in these trajectories that needs to be recognized.

Distance from death represents an alternative measure of age to consider in late life psychological changes. In contrast to studies of younger populations, mortality and pathology related processes accompany and influence the age-graded processes in the study of various psychological measures in the population of very old individuals (Baltes & Smith, 1997; Berg, 1996). Consequently, chronological-age-related changes in life satisfaction also incorporate effects of mortality-related processes given that individuals aged 80 and older are close to the average life expectancy. In Mroczek and Spiro's study (2005), individuals that died within one year showed a steeper decline in life satisfaction. The relevance of life satisfaction changes related to distance from death has been further confirmed by Gerstorf and colleagues (2008) who applied a time-to-death time metric in the study of life satisfaction changes in late life. They also identified a terminal decline at 4 years prior to death. Level and changes in satisfaction in the oldest-old are probably related to mortality and morbidity but the nature of the relationship needs to be further explored.

Gender

Gender differences in level of life satisfaction might be expected because women experience more health-related problems than men (Gold, Malmberg, McClearn, Pedersen, & Berg, 2002; Murtagh & Hubert, 2004), are more exposed to functional disability (Arber & Cooper,

1999; Gold et al., 2002; Katz et al., 1983), report lower internal control (Perrig-Chiello, 1999), more often report loneliness (Pinquart & Sorensen, 2001), are more likely to become widowed (Hobbs, Damon, & Taeuber, 1996), and, especially in older cohorts, are exposed to unequal opportunities. Despite this gender-specific picture, a majority of studies examined in a recent meta-analysis reported only small gender differences in psychological well-being (Pinquart & Sorensen, 2001). Interestingly, more recent studies in the meta-analysis indicated a tendency towards increasing gender differences in subsequent cohorts; a finding assumed to reflect a change in attitudes and expectations in younger cohorts. Higher aspirations within significant domains enlarge the discrepancy between aspirations and actual standings, which thereby may reduce life satisfaction. Hence, a gender perspective needs to be continuously investigated in new cohorts given that the presumed absence of gender differences might be cohort-specific. Another aspect of gender differences in life satisfaction is related to the selection of correlates of life satisfaction. Nagata (1999) found subjective well-being, health, and activities of daily living to be associates among women, whereas in men well-being was related to more narrow factors such as grip strength, hobbies, and social opportunities. Also, social support was more strongly related to life satisfaction in men than in women in a study of old-old (70-80 years old) people (Wang et al., 2002). Few studies have investigated gender differences in the pattern of life satisfaction associates.

Financial satisfaction

Winning a lottery has been found to have a positive effect on life satisfaction, but unfortunately the effect seems to be of a short-term character as lottery winners have been found to readjust to the satisfaction level preceding the lottery win (Brickman, Coates, & Janoff-Bulman, 1978). The results from Brickman's study add support to the Adaptation theory and set-point model approaches to subjective well-being as a framework (Headey & Wearing, 1989). The conclusion is; you will not be happier the more money you get. In line with this conclusion, Pinquart and Sorensen investigated 286 empirical studies of the influence of socioeconomic status on subjective well-being in later life (Pinquart & Sorensen, 2000). They found the association between income and well-being to be relatively small. Their interpretation was that quality of life in old people is not endangered by reduced income due to the actual ability to adjust needs and desires to the financial situation. However, Hsieh and colleagues found objective measures of income to be a too imprecise predictor of financial status given that equal level of income covers unequal household costs (Hsieh, 2003). Thus, it is a challenge for researchers to employ a valid measure of income that also

takes household costs into account. Financial satisfaction represents an alternative measure of financial situation. Financial satisfaction measured as the perception of economic deprivation has been found to be related to lower satisfaction with life (Revicki & Mitchell, 1990), therefore, financial security seems to constitute an important component of life satisfaction in old age. Although well-being does not increase with more money to spend, the experience of financial insecurity probably represents a basic menace to life satisfaction even in old age.

Marital status

Marital status is related to life satisfaction across all ages, also in old age (Diener, Gohm, Suh, & Oishi, 2000). In a cross sectional study the positive association between marriage and psychological well-being was found to reflect certain personality traits of people living in long lasting relationships; traits that per se are strongly related to well-being (Mastekaasa, 1992). Yet, longitudinal investigations of a selection effect of married people indicate that personality traits do not account for the entire association (Johnson & Wu, 2002). Among a range of life events, the effects of marriage and bereavement are the only events that have been found to influence level of life satisfaction positively respectively negatively over longer periods of time (Winter, Lawton, Casten, & Sando, 2000). Bereavement is one isolated event that has shown to have long-term negative impact on life satisfaction in old age, especially in men (Barer, 1994; Nagata, Yamagata, Nakamura, Miyamura, & Asaka, 1999; Padoani et al., 1998). The gender difference might be an expression of different marital roles. People born in the first part of the 20th century were generally raised to take different roles in marriage concerning housework and social activities, and consequently widowers might be less prepared to manage in these areas. As men and women tend to have more similar marital roles today, a part of the gender difference is likely to represent a cohort effect.

Social network

There is reason to believe that social networks play an essential role for life satisfaction in the oldest-old. Social networks are usually described either in terms of structural measures such as frequency of social contacts or as functional indicators such as quality of social network and social support (Cohen, Gottlieb, & Underwood, 2001). Paradoxically, although frequency of social contacts has been found to decrease with age (Due, Holstein, Lund, Modvig, & Avlund, 1999; Lang & Carstensen, 1994) satisfaction with the social network tends to increase (Lansford et al., 1998). Furthermore, the quality of the social network has repeatedly been found to be important to life satisfaction (Pinquart & Sorensen, 2000). On the other

hand, there is also evidence that frequency of social contacts are more important than quality (Bowling, 1990). The conflicting results may be an expression of individual differences in what is gained through network involvement. For example, in people with low health status in need of assistance, low frequency of contacts may have more negative consequences as compared to effects of low quality of contacts. Findings of negative impact of low social support on level of life satisfaction in old people (Newsom & Schulz, 1996), probably reflect increased dependency with old age and supports the assumption that networks differ in functions according to different needs. The conclusion is that life satisfaction and different measures of social network seem to form a complex pattern of associations in late life.

Physical health

With old age comes decline in functional capacity and health status; a deterioration likely to affect quality of life negatively. In a study of functional capacity in people aged 60 and older, activities of daily living were associated with life satisfaction (Markides & Martin, 1979). The findings apply even to the oldest-old; functional capacity and life satisfaction are positively related (Blazer, Hughes, & George, 1992; Menec, 2003). Health is also closely related to life satisfaction (Hamashima, 1994; Stolar, MacEntee, & Hill, 1992; von Heideken Wagert et al., 2005; Xavier, Ferraz, Marc, Escosteguy, & Moriguchi, 2003). It should be noted that the association appears in studies including health measures based on self-reports of health. Medically based health measures in terms of diagnoses and prescribed medications have not been investigated as frequently as self-reports in life satisfaction studies of the oldest-old, and the relationship is not yet clearly stated. In studies including the age groups of young-old (60-70) and old-old (70-80) healthier people were more satisfied with life (Okun & George, 1984). In the oldest-old, however, it seems as if the relation between medically based health and well-being becomes weaker (Hillerås et al., 2001; Myers & Diener, 1995). This tendency, of objective measures of health becoming less important to life satisfaction with increasing age, is confirmed in other studies (Okun & George, 1984; Smith, Fleeson, Geiselman, Settersten, & Kunzmann, 1999). Apparently, the experiential dimensions of health seem to be more strongly related to life satisfaction and well-being compared to quantitative and medically based measures of health. In late life an impaired health condition does not inevitably bring about dissatisfaction with life, it is rather the mindset related to health status that matters.

Even though there is strong evidence for the relevance of self-rated health for life satisfaction, there are methodological issues that question the rapid conclusion that medically based health measures are only weakly related to life satisfaction in elderly populations. First, findings that objective health measures are weakly related to life satisfaction are commonly based on analyses including an overall quantitative measure of health such as number of diseases. An examination of the association between health and life satisfaction necessitates health measures that go beyond the global level; the number of diagnoses may be less relevant than the actual diagnoses in question. As a consequence, in order to draw a fully adequate picture of the links between life satisfaction and medically based measures of health it is vital to consider the impact of specific diagnoses frequently afflicting the old population. Previous research also supports this proposal, given findings indicating the relevance of diseases such as hypertension, stroke, diabetes mellitus, arthritis for subjective well-being and depressive symptoms in clinical samples (Butler, Cohen, Lewis, Simmons-Clemmons, & Sunderland, 1997; Murphy, Dickens, Creed, & Bernstein, 1999). Furthermore, in two studies based on a sample of 70 year old individuals representative of the general population, dizziness (Grimby & Rosenhall, 1995), anginal pain, and urinary incontinence (Grimby & Svanborg, 1997) were associated with lower levels of life satisfaction. Also, Waern et al concluded that, even when controlling for depression, serious physical illness brought a threefold risk of suicide among elderly, and stroke itself was associated with an increased risk of suicide (Waern et al., 2002). In light of these findings, the use of specific diagnoses offers a more accurate measure of health in the study of health and life satisfaction. Moreover, men and women are differently afflicted concerning number of diseases, functional capacity, reported symptoms, and mortality (Oksuzyan, Juel, Vaupel, & Christensen, 2008). In general, women live longer than men, but endure higher levels of comorbidity and functional impairments (Arber & Cooper, 1999; Gold et al., 2002) and rate their health as poorer (Case & Paxson, 2005). This pattern is often referred to as the gender-health paradox (Nathanson, 1975). Gender specific patterns of morbidity and mortality suggest that gender needs to be considered in the study of life satisfaction and its relation to medically based health measures in old age.

The conflicting, yet interesting, picture of life satisfaction and different ways of assessing health highlights the importance of including both self-reports (subjective) and absolute measures (objective). Finally and importantly, the positive relationship between self-rated health and life satisfaction identified in cross-sectional studies has not been confirmed in longitudinal studies (Mroczek & Spiro, 2005).

Depressive symptoms

An association between depressive symptoms and less satisfaction with life in old age has been found in cross-sectional studies (Demura & Sato, 2003; Fiske, Gatz, & Pedersen, 2003) and in a follow-up-study, level of depressive symptoms at baseline was found to correlate highly with life satisfaction 3 years later in women (Chou & Chi, 1999). However, the increase of depressive symptoms with age, found in cross-sectional studies (Kessler, Foster, Webster, & House, 1992; Roberts, Kaplan, Shema, & Strawbridge, 1997), has not been confirmed in longitudinal studies (Dent et al., 1999; Haynie, Berg, Johansson, Gatz, & Zarit, 2001), although an increase was identified in a 6-year follow-up study (Wallace & O'Hara, 1992). The inconclusive results so far, show that depressive symptoms seem to be related to life satisfaction, but the pattern of associations and the direction over time is still uncertain.

Cognitive functioning

Preserved cognitive functioning is commonly considered an important part of aging well, and found to be related to life satisfaction in old age (Jones, Rapport, Hanks, Lichtenberg, & Telmet, 2003). People who are cognitively healthy are more likely to experience a better quality of life. Padoani and colleagues (1998) also found the association to be stronger in men than in women. They suggest that the gender difference is attributable to different resources available in coping with aging-related losses. Whereas women employ a broader spectrum of resources, including both cognitive and socioemotional strategies, men are more likely to rely solely on cognitive strategies (Padoani et al., 1998). Whether or not this tendency applies to the oldest-old needs to be further studied.

Personal control

The feeling of being in control of one's life is important to psychological well-being in a period of life when primary control has been found to decrease (Heckhausen & Schultz, 1995). In their experimental study, Langer and Rodin (1976) stated that by enhancing personal responsibility and choice in a group of nursing home residents, well-being was improved. The finding illustrates the importance of one's own influence in a typical dependency situation. Locus of control not only influences well-being, but also health, functional capacity as well as the ability to use social support in both old and oldest-old people (Bisconti & Bergeman, 1999; Femia et al., 1997; Hickson et al., 1988; Newsom & Schultz, 1996; Smith et al., 2000). In fact, in a study including individuals aged 80 and older, locus of control was more important to well-being than social resources (Landau & Litwin,

2001). Taken together, there is strong empirical evidence of a relationship between the experience of high influence over one's life and the perception of life circumstances.

Personality

Personality in terms of the personality traits extraversion (extraversion-introversion) and neuroticism (neuroticism-emotionally stability) has repeatedly been identified as strongly related to life satisfaction (Costa & McCrae, 1980; Headey & Wearing, 1989; Hillerås et al., 2001). Eysenck defined personality as “a more or less stable and enduring organization of a person's character, temperament, intellect, and physique which determines his unique adjustment to the environment” (Eysenck, 1970) and proposed a hierarchical model of personality. Extraversion includes characteristics such as sociability, impulsiveness, activity, liveliness, and excitability. Essentially, the extraversion trait reflects to what degree an individual is sociably outgoing. Neuroticism refers to characteristics such as moody, touchy, anxious, and restless. Those higher in extraversion show higher levels of life satisfaction whereas those higher in neuroticism show lower levels of life satisfaction (Costa & McCrae, 1980; Hillerås et al., 2001). In a recent meta-analysis Steel et.al. found support for two plausible explanations for the strong links between subjective well-being measures and personality (Steel, Schmidt, & Shultz, 2008). First, common biological mechanisms are possible determinants of the strong relationship between personality and well-being, that is, parts of the variance in both constructs are biologically determined. Furthermore, there is also a possible intersection in the operationalization of the constructs, that is, inventories for the traits of neuroticism and extraversion resemble the formulations used in questionnaires about well-being. Findings that personality traits and well-being measures show sustained stability across the life-span provide support for an interrelation of the constructs (Costa et al., 1987). However, although few studies have investigated the longitudinal relationship between personality and well-being measures such as life satisfaction into late life, there are findings that suggest that well-being and life satisfaction in fact decreases in late life (Mroczek & Spiro, 2005). Findings of separate lifespan trajectories of personality and life satisfaction contradict the notion that the constructs are expressions of identical psychological dimensions. Studies including samples of very old people could shed light on the personality and well-being association.

The need for multiple indicators of life satisfaction

Previous research has identified a range of associates of life satisfaction in the oldest-old. In contrast to most studies that have examined the relevance of one or a few factors at a time the application of a multivariate design enables a simultaneous examination of the relative importance of variables assumed to be related to life satisfaction. Furthermore, most studies have explored these relationships cross-sectionally, thereby excluding the possibilities of drawing conclusions about long-term relationships. Therefore, aging-related changes and relevant associates and predictors of life satisfaction should preferably be studied within multivariate and longitudinal designs.

Summary of the empirical studies

The description of sample, instruments, and procedure is largely similar in Study I - IV and is therefore presented here, prior to the presentation of each study.

Overall aim

The overall aim of the thesis was to identify the most relevant covariates of life satisfaction in a sample of non-demented people aged 80 and over (Study I), to investigate if these also were predictors of possible changes in life satisfaction across four time points over a six-year period (Study II), and also track changes in life satisfaction related to distance from death and the related predictors of change (Study III). Another aim was to investigate the cross-sectional relationships between diseases represented in more than 5 % of the sample and level of life satisfaction (Study IV). The identification of possible gender-specific patterns of associates was of particular interest in the cross-sectional studies I and IV.

Sample

The sample was drawn from the Swedish population based study, Origins of Variance in the Old-Old or the OCTO-Twin Study (McClearn et al., 1997). The study included individuals recruited from the Swedish Twin Registry aged 80 and over with a mean age of 84 at entry. Initially, 549 pairs of twins were invited to participate. Out of 1098 individuals, 198 (549 pairs) refused to take part giving a refusal rate of 18%. However, as a consequence of the inclusion criterion of intact pairs of twins, refusal to participate by one twin automatically excluded the other, therefore 702 individuals (in 351 pairs of twins) participated at the first occasion yielding an overall pairwise participant rate of 64%. At occasion 2, 3, and 4 the sample size was reduced to 568, 430, and 315 respectively. The reduced sample size across

the measurement points was predominantly due to the high mortality rates at these ages. Demographic characteristics of the selected sample concerning gender, education, socioeconomic status, and housing correspond to the overall population of this age group in Sweden (Simmons et al., 1997).

The present studies include participants who did not have a dementia diagnosis and who were able to complete Life-Satisfaction-Index-Z and return it by mail; as a consequence sample sizes were markedly reduced. Furthermore, although the LSI-Z was the outcome variable in all studies the sample size varied because of the inclusion of different independent variables. The sample sizes of studies I - IV is presented in Table 1. The proportion of women was 64% in Study I and 62% in study IV. In Study II the proportion of women was 61% at time point 1 and 2, and 63% and 69% at time point 3 and 4 respectively. In Study III, the proportion of women was 55%, 53%, 53%, and 56% at time points 1, 2, 3, and 4. In Study I, 51% of the sample consisted of intact pairs of twins. In Study II, 71% intact pairs of twins were included at the first occasion whereas the proportion was reduced to 57%, 44%, and 33% at time points 2, 3, and 4 respectively. At the first occasion in Study III, the sample consisted of 58% intact pairs of twins whereas at time point 2, 3, and 4 the proportion was reduced to 46%, 32%, and 21% respectively. In Study IV, 61% of the sample was intact pairs of twins.

Table 1. Sample sizes and instruments in Studies I – IV.

| | Study I | Study II | Study III | Study IV |
|---|---------|----------|-----------|----------|
| Sample sizes* | | | | |
| Occasion 1 | 315 | 412 | 370 | 392 |
| Occasion 2 | - | 286 | 227 | - |
| Occasion 3 | - | 212 | 161 | - |
| Occasion 4 | - | 121 | 87 | - |
| Instruments | | | | |
| LSI-Z** | X | X | X | X |
| Demographics | | | | |
| Age | X | X | X | - |
| Years to death | - | - | X | - |
| Gender | X | X | - | X |
| Marital Status | X | X | - | - |
| Education | X | - | - | - |
| Socioeconomic status | X | X | X | - |
| Financial Satisfaction | - | X | - | - |
| Social network | | | | |
| Frequency of social contacts | X | - | - | - |
| Quality of social network | X | X | - | - |
| Social support | X | - | - | - |
| Health and functioning | | | | |
| Number of medications | X | - | - | - |
| Number of diagnoses | X | - | - | - |
| Expert multibased diagnoses | - | - | - | X |
| Health complaints | X | - | - | - |
| Self-rated health | X | X | X | - |
| IADL | X | - | - | - |
| PADL | X | - | - | - |
| Cognitive functioning: MMSE | X | - | - | - |
| Mental health and personal resources | | | | |
| Depressive symptoms (CES-D) | X | X | - | - |
| Locus of control | X | X | X | - |
| Personality: EPI | - | X | X | - |

Note. * The sample sizes in Study II and III varied across the analyses, thus the sample size of Study II refers to individuals who completed the LSI-Z, and the sample size of Study III refers to individuals who completed the LSI-Z and had died before December 2007. ** Outcome variable across all studies.

Separate attrition analyses for Studies I-IV are presented below. In Study I, the selected sample differed from excluded participants as it was younger, $t(700) = -4.512, p < .05$, had higher education, $t(654) = 3.105, p < .001$, reported greater self-rated overall health, $t(664) = 2.590, p < .001$, reported higher instrumental ADL, $t(581) = 7.283, p < .001$, and personal ADL, $t(626) = 5.463, p < .001$, performed better on the MMSE, $t(687) = 10.778, p < .001$, had more social contacts, $t(616) = 3.320, p < .05$, and was more satisfied with the social

network, $t(614) = 4.332, p < .01$. A corresponding comparison of the excluded participants and the 412 individuals included in Study II, showed a largely similar difference; the selected sample was younger, $t(700) = -5.032, p < .001$, reported better self-rated overall health, $t(664) = 2.146, p < .05$, reported higher instrumental ADL, $t(581) = 10.449, p < .001$, and personal ADL, $t(626) = 8.120, p < .001$, performed better on the MMSE, $t(687) = 14.966, p < .001$, had more social contacts, $t(616) = 3.089, p < .05$, and was more satisfied with the social network, $t(614) = 6.667, p < .001$. In Study III the attrition analysis of the selected sample and the excluded participants at wave 1 showed that the selected sample was older, $t(700) = 3.17, p = .002$, had fewer diagnoses, $t(700) = -6.11, p < .001$, but did not report better self-rated overall health, $t(584) = -1.10, p = .278$. In Study IV the included 453 participants were younger, $t(700) = -4.96, p < .001$, reported better self-rated overall health, $t(581) = 2.96, p < .05$, were rated higher on functional capacity (ADL), $t(695) = 14.12, p < .001$, and performed better on the MMSE, $t(687) = 13.06, p < .001$, compared to the excluded individuals. Taken together, the samples in Studies I-IV represent non-demented overall well-functioning and healthy individuals aged 80 and older.

Instruments

The OCTO-Twin study contains data on physical health, memory and cognition, functional capacity, interpersonal functioning, personality, well-being, and mental health. Study I included measures of life satisfaction, age, gender, marital status, SES, education, self-rated global health, medically based health (diagnoses and medicine use), functional capacity, cognitive functioning, depressive symptoms, locus of control, perceived social network, frequency of social contacts, and social support. Study II included measures of life satisfaction, age, gender, widowhood, SES, financial satisfaction, perceived social network, self-rated overall health, depressive symptoms, locus of control, neuroticism, extraversion. Study III included the measure of life satisfaction, age, gender, years to death, SES, overall load of disease measured as number of diagnoses, self-rated overall health, locus of control, neuroticism, and extraversion. Study IV included measure of life satisfaction and 25 expert multibased medical diagnoses represented in more than 5% of the selected sample. For an overview see Table 1.

Life satisfaction

The Life Satisfaction Index-Z is a 13-item version (Wood et al., 1969) of the original 20-item scale, developed by Neugarten, Havighurst, and Tobin for the purpose of portraying life

satisfaction in old age (Neugarten et al., 1961). Participants rated themselves on statements such as: “This is the dreariest time of my life”, “I have made plans for things I’ll be doing a month or a year from now”, “When I think back over my life, I didn’t get most of the important things I wanted”, “I have got more of the breaks in life than most of the people I know”, “These are the best years of my life”. Each statement was assessed on a five-point scale. The total score ranges from 13 to 65. Negative items were reversed, thus, higher scores reflect greater life satisfaction. Cronbach’s alpha at wave 1 was 0.78.

Demographic variables

Age is presented in years of age and education as years of education with scores ranging from 2 to 23 years. Socio-economic status refers to social group membership as determined according to occupation (Swedish Election Statistics, Socialforskningsinstitutet). The socio-economic status variable was coded 1 = lower class, 2 = middle class, and 3 = upper class. Housewives were given the same social group as their husbands.

Financial satisfaction

Financial satisfaction was based on the sum of three items “How do you believe your financial situation is today as compared to other people your age?” (Worse = 1, Same = 2 or Better = 3), “How well does the money cover your needs?” (Poorly = 1, Pretty poorly = 2, Pretty well = 3, or Well = 4) “Do you believe that your financial situation prevents you from doing what you want to do?” (Yes = 1, Yes, to a certain extent = 2 or No = 3). The sum ranges from 3 to 10. Cronbach’s alpha at wave 1 was 0.68.

Social network

Three aspects of social network were assessed by the use of one structural measure; frequency of social contacts, and two functional measures; perceived quality of social network and social support. The variable frequency of social contacts includes assessed regularity of both personal meetings and telephone calls on a 7-point scale. Quality of social network refers to the participant’s evaluation of social contacts, and was measured by the following four questions; “Do you have acquaintances you can talk to?”, “Do you feel you are a part of a set of friends?”, “Do you lack company?”, and “Do you feel abandoned?”. The total score ranges from 0 to 12, with higher scores indicating greater satisfaction with the network. The variable social support reflects to what degree the participant has social contacts available for

emotional support and help in case of difficulties. Scores range from 0 to 4, with higher scores indicating greater perceived support. Cronbach's alpha at wave 1 was 0.75.

Self-rated overall health

Self-rated overall health was measured by 4 items: Global self-rated health "How do you perceive your health status?" (poor = 1, average = 2, good = 3), self-rated health via temporal comparison "How do you perceive your current health status compared to two years ago?" (worse = 1, about same = 2, better = 3), self-rated health via social comparison; "How do you perceive your health status compared to other people your age?" (worse = 1, about same = 2, better = 3), and the last item reflected functional aspects of self-rated health "Do you think your health status prevents you from doing things you want to do?" (yes = 1, to an extent = 2, not at all = 3). The total sum ranged from 4 to 12 points. Cronbach's alpha at wave 1 was 0.62.

Expert multibased diagnosis

A physician (co-author of Study IV S. E. Nilsson) examined three sources for each individual; medical records and registration of marker drugs dating back to 1985, and self-reports in order to determine ICD-10-classified medical diagnoses (Nilsson, Johansson, Berg, Karlsson, & McClearn, 2002). 99.1 % of the participants gave their permission to a review of their medical record. In Study I number of medications was included as a health measure.

Functional capacity

Activities of Daily Living (ADL) was based on two different types of ADL; personal activities of daily living (PADL) and instrumental activities of daily living (IADL) (Lawton, 1971). PADL included 14 items covering activities such as eating, bathing, and mobility with scores ranging from 0 to 43. IADL included 7 items reflecting activities such as housework, making purchases, and economical housekeeping with scores ranging from 0 to 21. Higher scores indicate higher level of functioning.

Cognitive functioning

The Mini-Mental State Examination (MMSE) is a brief screening-test designed to detect decline in cognitive status (Folstein et al., 1975). The MMSE contains tests of both verbal and performance abilities including orientation, memory (immediate and recall), attention, object naming, following commands, writing a sentence, and copying a pentagon. The test score has

a total range of 0 to 30, with low scores reflecting lower cognitive functioning. Despite the limited scope of the MMSE, it has been found to be useful for assessing severity of cognitive impairment (Tombaugh & McIntyre, 1992).

Depression

The Center for Epidemiologic Studies Depression Scale (CES-D) is a 20-item scale developed to assess symptoms of depression in the elderly (Radloff, 1977). On a 4-point scale, participants rated the frequency during the last week of 20 symptoms such as; “During the past week I felt that I could not shake off the blues even with help from my family and friends”, “During the last week I was bothered by things that usually don’t bother me” or “During the last week I did not feel like eating; my appetite was poor”. The total score ranges from 0 to 60, with higher scores meaning higher frequency of depressive symptoms. Radloff recommended that respondents with a total CES-D score of 16 or higher should be further examined for a diagnosis of major depression. The psychometric properties of the Swedish version of the scale have been examined in previous research (Gatz, Johansson, Pedersen, Berg, & Reynolds, 1993). Cronbach’s alpha at wave 1 was 0.75.

Control

The Locus of control-scale (Rotter, 1966) contains 12 questions exploring the individual’s perception of overall internal and external locus of control concerning their lives. Participants rated locus of control on 5-point-scaled items such as: “When I make plans, I am almost certain that I can make them work” (internal locus of control) or “Sometimes I feel that I don't have enough control over the direction my life is taking” (external locus of control). The total score ranges from 12 to 60. Items reflecting external control were reversed, thus, higher scores indicate higher level of perceived internal control. Cronbach’s alpha at wave 1 was 0.73.

Personality variables

The personality traits neuroticism and extraversion were measured with the 19-item Eysenck Personality Inventory, EPI. The neuroticism scale includes questions such as: “Are you sometimes happy, sometimes sad without any particular reason?” Are you sometimes so restless that you can’t sit still?” or “Do you have nervous problems?” The extraversion scale includes questions such as: “Do you always have something to say when people talk to you?” “Do you like telling jokes to your friends?” or “Are you rather lively?”. The items were

dichotomous: “Yes”= 1 and “No”= 0. Negative items were reverse-coded. The total sum of scores for the Extraversion scale was 0-9 with Cronbach’s alpha of 0.64 at wave 1. For Neuroticism, the range was 0-10 with Cronbach’s alpha of 0.75 at wave 1.

Procedure

Trained research nurses visited participants in their homes for data collection every second year from 1991 to 1999. Each occasion involved a single testing session that lasted for 3-4 hours including breaks. Tests of cognitive functions were executed during the first part of the session. Some questionnaires, including the Life Satisfaction Index-Z and Locus of control, were left with the participant with a request to complete and mail back. In addition to data collected directly from participants, medical records dating back to 1985 provided supplementary information on diagnoses and prescribed medications.

Study I

Specific aim

The aim of Study I was to investigate associations between life satisfaction and a number of psychosocial and health-related associates identified in previous research. The relative strength of the associations in the context of all associates was of particular interest. An additional aim of the study was to explore potential gender-specific patterns of associates.

Statistical analysis

Initially, potential gender differences in total scores of Life Satisfaction Index-Z were examined with the t-test. Pearson’s correlations between life satisfaction and the selected variables were conducted to examine variables of relevance. Finally, stepwise multiple regression analyses were conducted separately for men and women to be able to study gender-specific patterns of associates with life satisfaction. An alpha level of .05 was used for all statistical tests. All analyses were conducted in SPSS 15.

Results

The results from Study I showed that quality of social network was the variable most strongly related to life satisfaction in both men and women. Locus of control was the other associate of life satisfaction in common for both genders. With the exception of quality of social network and locus of control, the regression analysis showed that the overall pattern of associated variables was gender-specific. As illustrated in Table 2, life satisfaction was related to self-

rated health and depressive symptoms in women, whereas Table 3 shows that in men, life satisfaction was related to widowhood. There were no gender differences in level of life satisfaction,

Table 2. Stepwise regression analysis including variables associated with life satisfaction. Women.

| Step | Variable | <i>B</i> (95 % <i>C.I.</i>) | β | <i>R</i> ² change |
|--------------------------------|---------------------------|---------------------------------|---------|------------------------------|
| 1 | Quality of social network | 1.460*** (1.06 – 1.86) | .450 | .203*** |
| 2 | Self-rated global health | 4.134*** (2.86 – 5.67) | .349 | .117*** |
| 3 | Depressive symptoms | -.191** (-0.37 – -0.07) | -.204 | .032** |
| 4 | Internal locus of control | .293** (0.08 – 0.50) | .155 | .024** |
| Total | | | | .376 |
| Adjusted <i>R</i> ² | | | | .364 |

Note. *B* = unstandardized regression coefficient, β = standardized regression coefficient, *CI* = confidence interval. * *p* < .05. ** *p* < .01. *** *p* < .001.

Table 3. Stepwise regression analysis including variables associated with life satisfaction. Men.

| | Variable | <i>B</i> (95 % <i>C.I.</i>) | β | <i>R</i> ² change |
|--------------------------------|---------------------------|---------------------------------|---------|------------------------------|
| 1 | Quality of social network | 1.211*** (0.59 – 1.73) | .345 | .119*** |
| 2 | Internal locus of control | .623*** (0.30 – 0.95) | .324 | .105*** |
| 3 | Widower | -3.337* (-6.33 – -0.35) | -.186 | .034* |
| Total | | | | .257 |
| Adjusted <i>R</i> ² | | | | .237 |

Note. *B* = unstandardized coefficient, β = standardized regression coefficient, *CI* = confidence interval. * *p* < .05. ** *p* < .01. *** *p* < .001.

Discussion

The study of life satisfaction in the oldest-old and the most relevant covariates, as identified in regression analyses, has three important features. First, the identified gender-specific patterns of associates of life satisfaction contradict the notion that the experience of quality of life is related to identical sources in men and women. By investigating both genders concurrently valuable information is lost. Second, the finding that self-rated health, in contrast to medically based health, was related to life satisfaction confirms the importance of recognizing the

distinction between objective and subjective measures. Finally, in both women and men, quality of social network was more strongly related to life satisfaction than any of the measures of health and functioning. Even if the relevance of quality of social network has been found previously (Pinquart & Sorensen, 2000), the assumption that health is a major determinant of quality of life in late life has been dominant. The finding contributes to a more balanced view on the topic. Furthermore Carstensen's Socioemotional selectivity theory (Carstensen, 1992) receives support for the notion that it is the quality and not quantity of social contacts that is related to life satisfaction. In sum, satisfaction with life in old age is related to preserving emotionally rewarding contacts, the feeling of being in control of one's life, and the perception of one's health as good.

Study II

Specific aim

The aim of Study II was to investigate changes in life satisfaction across 4 occasions during a period of 6 years, and to test if the associates of life satisfaction identified in the regression analyses in Study I, that is, perceived quality of social network, self-rated health, depressive symptoms, locus of control, and widowhood, in addition to financial satisfaction and the personality traits of extraversion and neuroticism were significant predictors of potential variation and change over time.

Statistical analysis

Growth curves within a mixed, or multilevel, modelling (MLM) framework was conducted in SPSS to be able to study both overall trajectory and inter-individual differences in intra-individual changes in life satisfaction across a 6-year interval. The MLM-analysis provides fixed effects that reflect effects on the population mean trajectory, and random effects that reflect the covariance structures of the data. Furthermore, both within-person and within-pair variance needed to be accounted for as the sample consisted of pairs of twins. The MLM-method enables the investigation of hierarchically structured data in nested models, consequently 3-level models were applied to account for 3 levels of variance; within-individual (Level 1), between-individual (Level 2), and between-pair (Level 3). First, the within-person variance in life satisfaction was explored in an unconditional means model. The between-person and within-person changes were then explored in an unconditional growth model. Finally, predictors were separated into seven different models of life satisfaction and thereafter significant predictors that also contributed to improvements in model fit were

included in the final model. Time-invariant predictors were centred to facilitate interpretation of results, whereas time-varying predictors were represented with two variables to be able to model a time-level or person-level (Level 1) and between-person (Level 2) effects. An alpha level of .05 was used for all statistical tests.

Results

The results showed that overall level of life satisfaction decreased continuously over the 6-year interval. Similar trajectories of change were observed across the sample, indicating that individuals did not differ in pattern of change. The loss of spouse, in particular in men, and higher levels of depressive symptoms were related to lower levels of life satisfaction over time.

Discussion

The aim of the study was to investigate whether or not previously identified associates of life satisfaction also predict changes in life satisfaction over a 6-year period. The longitudinal findings that the loss of spouse was related to a drop in life satisfaction and that reporting fewer depressive symptoms across the study was associated with higher levels of life satisfaction show that associations of relevance for life satisfaction at one time point need to be examined within a longitudinal design. The model estimated in order to identify predictors that mattered among a range of competing predictors of isolated importance, showed that a set of predictors that accounted for cross-sectional variability was not related to changes in life satisfaction over time.

In sum, bereavement of spouse, and high levels of depressive symptoms are conditions related to lower satisfaction with life over a period of six years in late life.

Study III

Specific aim

The aim of Study III was to compare an age based and a time-to-death time metric in the study of change in life satisfaction across 4 measurement points over 6 years. The chronological age design provides answers about changes related to age whereas a time-to-death design provides answers about changes in life satisfaction related to distance from death. Furthermore, the association between time-to-death-related changes of life satisfaction and socio-demographic, health-related, and personality variables was of particular interest.

Statistical analysis

The study used growth curves within a mixed, or multilevel, modelling (MLM) equivalent to the analyses used in Study II. Growth curves were estimated for a chronological age model and time-to-death model. The time-invariant predictors of age, gender, SES, and both the time-invariant and the time-varying predictors of self-rated health and overall load of diseases were included in the time-to-death model. In a final step we included main effects and also interactions with the health variables of neuroticism, extraversion, and locus of control.

Results

The time-to-death model showed a significantly better fit as compared to the age-based model. Age, gender, SES, initial level and changes in self-rated overall health and overall load of disease were not associated with the death-related changes, see Table 4. There was however a cross-sectional significant relationship between the estimated level of life satisfaction at death and self-rated health and overall load of disease at the entry of the study. Furthermore, among individuals with lower self-rated health those with higher levels of neuroticism were less satisfied with their lives, and among individuals with higher overall load of disease those with more external locus of control were less satisfied with their lives.

Table 4. Model A: Time-to-death changes in life satisfaction: Parameter Estimates and Standard Errors for Age, Years to Death, Gender, SES, and Overall load of Disease. Model B: Time-to-death changes in life satisfaction: Parameter Estimates and Standard Errors for Age, Years to Death, Gender, SES, and Self-rated Health.

| Parameter and fit statistic | Model A: Overall load of disease | | Model B Self-rated health | |
|----------------------------------|-------------------------------------|------|------------------------------|------|
| | Estimate | SE | Estimate | SE |
| Fixed effects | | | | |
| Intercept | 46.13*** | 1.15 | 46.18*** | 1.20 |
| Linear Slope | -.45*** | .14 | -.53*** | .16 |
| Age | -.07 | .20 | .06 | .21 |
| Age*Slope | -.02 | .03 | -.01 | .03 |
| Years to death | .10 | .12 | .16 | .13 |
| Gender | .03 | 1.14 | -.18 | 1.15 |
| Gender*Slope | .20 | .15 | .26 | .15 |
| SES | -1.28 | .75 | -1.35 | .78 |
| SES*Slope | -.13 | .10 | -.12 | .11 |
| Overall load of disease-BP | -.49*** | .11 | | |
| Overall load of disease-BP*Slope | -.01 | .01 | | |
| Overall load of disease-WP | .02 | .17 | | |
| Overall load of disease-WP*Slope | .04 | .03 | | |
| Self-rated health-BP | | | 1.77*** | .32 |
| Self-rated health-BP*Slope | | | .05 | .04 |
| Self-rated health-WP | | | .40 | .30 |
| Self-rated health-WP*Slope | | | .00 | .05 |

Note. SE = Standard Error; * $p < .05$; *** $p < .001$.

Discussion

In the analysis of changes different time metrics may be applied and the results from study III illustrate that in the study of life satisfaction changes in the oldest-old, a time-to-death time metric showed better fit to data compared to the age-based model. The findings from the present study highlight the importance of considering alternative operationalizations of time in the study of life satisfaction changes in the oldest-old. Also, given that age, gender, SES, self-rated health or overall load of disease were unrelated to the change in life satisfaction, there are gaps in our knowledge of the relevant processes linked to life satisfaction change.

Study IV

Specific aim

The aim of Study IV was to investigate the relevance of ICD-10-classified medical diagnoses that were represented in more than 5 % of the sample, for level of life satisfaction in a sample of individuals aged 80 and over.

Statistical analysis

25 medical diagnoses were determined by a physician (for more information see Nilsson, 2002) who cross-controlled both diagnoses and prescribed medications in medical records and self-reports, see Table 5. Separate analyses of variance of Life Satisfaction Index-Z were conducted for each diagnosis including age, gender, and gender-diagnosis interaction as covariates. Because of the multiple comparisons the results were evaluated both with and without Bonferroni correction (0.05/25)

Table 5. Frequency of disease in the sample (N = 392): The diagnoses are based on drug registration, medical records, and self-report.

| Diagnosis | N | % (Women)* | Como** M (SD) | Diagnosis | N | % (Women)* | Como** M (SD) |
|----------------------|-----|---------------|------------------|--------------------|-----|---------------|------------------|
| Malignancy | 104 | 26.5 (60) | 4.1 (2.5) | Peptic Ulcer | 31 | 7.9 (52) | 5.2 (2.7) |
| Diabetes | 53 | 13.5 (53) | 4.5 (2.3) | Biliary tract dis. | 67 | 17.1 (67) | 4.4 (2.4) |
| B12 deficiency | 44 | 11.2 (57) | 4.4 (2.6) | Eczema | 75 | 19.1 (68) | 4.5 (2.3) |
| COPD and Asthma | 30 | 7.6 (47) | 3.9 (2.3) | Dorsaliga | 31 | 7.9 (68) | 5.4 (2.5) |
| Myocardial infarct. | 44 | 11.2 (52) | 5.0 (2.2) | Osteoporosis | 21 | 5.4 (86) | 5.1 (2.6) |
| Angina Pectoris | 58 | 26.7 (55) | 5.0 (2.6) | Gonarthrosis | 36 | 9.2 (64) | 5.0 (2.8) |
| Cong. Heart Failure | 37 | 9.4 (73) | 4.8 (2.7) | Coxarthrosis | 25 | 6.4 (64) | 4.4 (3.1) |
| Cardiac arrhythmia | 22 | 5.6 (55) | 3.9 (1.5) | Migraine | 59 | 15.1 (73) | 4.4 (2.2) |
| Art. Hypertension | 137 | 35 (64) | 4.1 (2.3) | Dizziness | 180 | 48.9 (64) | 4.0 (2.2) |
| Thromboembolism | 34 | 8.7 (76) | 4.4 (2.5) | Sleeping prob. | 182 | 46.4 (66) | 3.9 (2.2) |
| Stroke | 41 | 10.5 (46) | 4.8 (2.0) | Cataract | 83 | 21.2 (71) | 4.3 (2.3) |
| Prostate hyperplasia | 51 | 13 | 4.4 (2.3) | Glaucoma | 31 | 7.9 (68) | 4.8 (2.2) |
| Urinary Incontinence | 118 | 30.1 (71) | 4.5 (2.4) | | | | |

Note. *"Women" refer to proportion only of those diagnosed. (Women constitute 62% of the total sample). ** "Como" refers to load of comorbidity in terms of mean number of diagnoses attached to each diagnosis. (The mean number of diagnoses in the total sample: M = 3.1, SE = 2.3). The diagnoses migraine, urinary incontinence, eczema, sleeping problems, and dorsalgia are based on self-reports only.

Results

Among the 25 diagnoses only stroke, urinary incontinence, eczema, and sleeping problems were linked to lower levels of life satisfaction in both men and women. Men with angina pectoris and eczema were less satisfied with life as compared to men without the diagnoses, whereas women with peptic ulcer were less satisfied with life as compared to women without the diagnosis.

Discussion

Few diagnoses were related to level of life satisfaction in our study, further confirming previous findings of a weak relationship between medically based measures of health and life satisfaction. However, there were cross-gender and gender-specific links between life satisfaction and diagnoses that need to be acknowledged. Stroke brings several indirect and direct disabling conditions that may explain the lower satisfaction with life in this group. The

condition of urine incontinence has been found to be related to social isolation and may thereby represent a threat to life satisfaction. The sleeping problems diagnosis may be directly related to lower life satisfaction but may of course also be a mediating factor in the links between conditions of poor mental or physical health and life satisfaction. The gender-specific relationship between peptic ulcer, angina pectoris, and general malignancy may partly be explained by differing courses and dissimilar risk of mortality tied to the diseases in men and women. In sum, as medically based diagnoses have infrequently been used in population based studies of life satisfaction the present study provides significant results in support of the assumption that diagnoses or medically based health measures are unreliable predictors of quality of life.

General discussion

The aim of the thesis was to examine psychosocial and health-related associates of life satisfaction in the oldest-old, and to further explore associates of significance in relation to possible changes in life satisfaction within a longitudinal design. The results show no gender difference in the level of life satisfaction. The pattern of relevant associates was, however, gender-specific. Life satisfaction was related to quality of social network, self-rated health, depressive symptoms, and locus of control in women, and quality of social network, locus of control, and widowhood in men. Level of life satisfaction decreased over the 6-year interval, and individuals generally changed in similar ways. Among the associates identified in Study I, initial high level of depressive symptoms and becoming widowed were related to decline in overall level of life satisfaction. In addition, the variables added in Study II; financial satisfaction and the personality traits neuroticism, and extraversion, showed a significant cross-sectional effect on level of life satisfaction. In sum, the results from Study I and II show that different conclusions are drawn from cross-sectional and longitudinal studies.

Study III elaborated the effects of applying different time metrics in the study of changes in life satisfaction. Chronological age and distance to death were contrasted and although there was a significant linear decline in life satisfaction in both models, the model using a distance to death-structure in the estimation of life satisfaction changes showed a significantly better fit as compared to the age based model. Age, years to death, gender, SES, self-rated overall health or overall load of disease were not related to the decline. However, among individuals with higher overall load of disease more external locus of control was related to lower

satisfaction with life, and among individuals with poorer self-rated health more neuroticism was related to lower satisfaction with life.

Finding that self-rated health was more strongly related to life satisfaction compared to number of diagnoses in Study I, the question arises; could the use of specific diagnoses serve as a more appropriate marker of life satisfaction given that different diagnoses bring varying degrees of affliction that may threaten satisfaction with life? Among 25 diagnoses only sleeping problems, urinary incontinence, and stroke were significantly related to life satisfaction in both men and women. Among men, angina pectoris, malignancy, and eczema were related to lower life satisfaction, whereas among women, peptic ulcer was related to lower life satisfaction. The finding suggests that although a more accurate measure of health provides more information as compared to just number of diagnoses, relatively few medical conditions in terms of diagnoses were related to satisfaction with life.

Changes in life satisfaction

According to the top-down and bottom-up integration models, both objective life circumstances and the perception of these are determinants of life satisfaction (Brief et al., 1993). The perception is also assumed to be influenced by stable personality traits (Okun & George, 1984). Life satisfaction is therefore expected to be stable (Diener et al., 1999). Adaptation theory (Brickman & Campbell, 1971) also proposes stability as a result of the innate tendency in individuals to adapt to changing life circumstances, with only short-term shifts in satisfaction before returning to a fixed level.

The longitudinal results from this thesis partly challenge the notion of life-span stability in the oldest-old. A decline in life satisfaction was in fact observed over a 6-year period. The result corresponds with a recent study by Mroczek and Spiro (2005) who found a peak in life satisfaction at the age of 65 and then a decrease during later life. In contrast to their findings, individuals did not differ in pattern or rate of decrease in the present study. The conflicting results may stem from the application of different time metrics. Mroczek and Spiro used an age-based model in which individuals were recruited to the study at different ages, a model that is unable to separate the cohort effects from the developmental changes in life satisfaction. Consequently, the age-based time metric includes cohort-effects that resemble results from cross-sectional studies.

An age-based time metric, which reflects changes related to time from birth, also fails to properly account for the heterogeneity in level of functioning and health status that characterizes the oldest-old age segment. In addition to the age-graded processes that are assumed to underlie psychological change across the lifespan, psychological change in old individuals in contrast to younger samples, also comprises mortality and pathology related processes (Baltes & Smith, 1997; Berg, 1996). The consideration of the mortality-related processes that may contribute to life satisfaction changes in the oldest-old is preferably investigated in a time-to-death time metric of change. In our third study we tested a model of change related to time from death that showed a better fit to data as compared to an age-based model. The significant linear decline as individuals approached death despite the effects of age, gender, SES, level and change in overall self-rated health and overall load of disease shows that the mortality-related process behind the decline in life satisfaction was prominent. The results support the findings from the first study (to our knowledge) that examined death-related changes in life satisfaction in very old people by Gerstorf et.al. (Gerstorf, Ram, Rocke, Lindenberger, & Smith, 2008).

Life satisfaction and quality of social network

Among all examined variables, the social network quality was the strongest associate with life satisfaction in both women and men at the first measurement occasion, and higher levels of perceived quality of network were also related to higher levels of life satisfaction across the study. The relevance of quality of social network, in contrast to frequency of contacts, has previously been found in a study of the old-old (Newsom & Schulz, 1996), and this thesis confirms the validity of the finding also in the oldest-old. The close relationship between satisfaction with life and satisfaction with social network points at central aspects of the topic of quality of life in old age. Socioemotional selectivity theory explains this aging-related tendency as an expression of the need for fewer and more emotionally rewarding contacts at the expense of a large social network (Carstensen, 1992). On the other hand, aging-related diseases and disability, which are exceedingly common in later life might also explain why quality, and not quantity, of social network gradually becomes more important to life satisfaction (Pinquart & Sorensen, 2000). As a result of health-related deterioration, people experience increased dependency on support and their social network. Frequent social contacts based on dependency do possibly meet basic practical needs, but do not necessarily correspond to the need for rewarding social interactions that contribute to quality of life. The

relevance of satisfying social contacts in late life is probably an expression of both health-related dependency and a propensity to be more selective in the choice of company.

Another possible explanation for the identified strong links between social network and life satisfaction in the thesis may be related to twinship. The inclusion criteria of the OCTO Twin-study were complete pairs of same-sex twins aged 80 and over. This means that all participants have not only grown up with a twin partner, but have also reached the age of 80 or more together with their twin. Thus, the question is to what extent we can generalize the finding of a strong relationship between quality of social network and life satisfaction to the overall population of the oldest-old. One way to explore the effect of twinship is to investigate if frequency of contact with the twin is related to life satisfaction. In the present sample the Pearson's correlation coefficient between life satisfaction and frequency of contact with a sibling was .028 ($N = 451$, $p = .550$) and between life satisfaction and telephone contact the correlation was .063 ($N = 437$, $p = .192$). Accordingly, as twins who meet or talk on the phone more frequently were not more satisfied with life there is reason to believe that the effect of a twinship at the age of 80 and over is limited. Although, it is possible that twins are inclined to utilize social contacts to preserve life satisfaction, the findings of strong links between quality of social network and life satisfaction in samples of singletons (Newsom & Schulz, 1996; Pinguart & Sorensen, 2000) suggests that the results of the thesis are likely to be valid even in the general oldest-old population.

Life satisfaction and feeling of control

Locus of control was the other variable found to be related to life satisfaction in both women and men (Study I). The results from Study III also showed that among individuals with higher levels of comorbidity, those with more external locus of control were less satisfied with their lives. The importance of locus of control has been identified previously (Femia et al., 1997; Hickson et al., 1988; Landau & Litwin, 2001; Newsom & Schulz, 1996), but the relative strength of the association in the context of variables such as health and functioning in this study, is interesting. Even if the effects of control were restricted to a cross-sectional level, not predicting changes in life satisfaction over time, our findings generate knowledge of the pattern of associations. The relevance of locus of control appeared in individuals with higher levels of comorbidity; an external locus of control was related to less satisfaction with life. Previous studies have found rather complex relationships between control in old age and other variables connected to well-being. For example, in a study of well-being in the context of a

range of social network and support variables, Newsom and Schulz (1996) found tangible support to be most influential. The result was explained as an expression of an aging-related increase in the need for basic security, which implicitly reflects the need for improving primary control (Heckhausen & Schulz, 1995). With the awareness of increased dependency and restrictions in one's own resources, the feeling of control has been found to become influential (Skinner, 1995). Hence, the relationship between control and life satisfaction may become strengthened in a period of life characterized by increased dependency on support. This aging-related tendency should be acknowledged and addressed in the implementation of health care efforts.

Life satisfaction and personality

More extraversion and less neuroticism were related to higher levels of life satisfaction in Study II. The finding is in line with previous research (Costa & McCrae, 1980; Headey & Wearing, 1989; Hillerås, Jorm, Herlitz, & Winblad, 1999; Hillerås et al., 2001), and the conclusion is that certain personality traits are indeed related to satisfaction with life. In Study III we further investigated the personality traits in relation to time-to-death related changes and found only cross sectional relationships. However, in individuals with poorer self-rated health, more neuroticism was related to lower life satisfaction. The result may be interpreted as a finding in support of integration of top-down and bottom-up perspectives on life satisfaction judgments. Possibly, individuals with more neuroticism who are less emotionally stable may perceive their health status as poorer compared to more emotionally stable individuals. Another interpretation may be that individuals with poorer self-rated health also rate themselves higher on the neuroticism scale. No firm conclusions can be drawn about the causal relationships or what variable comes first. However, self-rated health has repeatedly been identified as a powerful predictor of mortality in older samples and the exploration of factors that may interact with self-rated health may facilitate the identification of groups at particular risk for mortality and lower life satisfaction (Idler & Benyamini, 1997).

Life satisfaction - gender and physical and mental health

Self-rated overall health was associated with life satisfaction in the cross-sectional study in women only. This gender difference confirms previous research (Nagata et al., 1999). Gender-specific relationships between health and quality of life have been linked to gender differences in disease and disability trajectories. Women tend to live longer with illness and to experience more disability related diseases, compared to men who tend to fall ill with more

life-threatening health conditions leading to shorter periods of impaired health (Gold et al., 2002; Murtagh & Hubert, 2004; Verbrugge, 1989). The gender-specific disease pattern in old age probably accounts for a part of the explanation why women's perceptions of quality of life are more connected to health. A differentiation of the medically based health measure into disability-related and life-threatening diseases would have provided the possibility of a formal empirical testing of the hypothesis. Another explanation of the finding is related to marital status. Because women on average live longer than men, a greater proportion of women experience widowhood (Soldo, Hurd, Rodgers, & Wallace, 1997). Accordingly, men and women experience illness in different contexts; men are more likely to receive support from a partner, whereas women more often have to cope with illness in solitude (Troll, 1994).

In Study IV we further elaborated the seemingly weak relationship between life satisfaction and so called "objective" health measures found (regression analyses in Study I) by replacing the number of diagnoses and medications health variables with specific chronic diagnoses. Few diagnoses were significantly related to life satisfaction. However, there were gender differences that need to be addressed. The gender specific relationship between diagnosis and life satisfaction have several possible explanations. There may be biological differences between men and women that affect the expressions and courses of disease, as well as gender differences in the strategies employed to cope with the psychological, social, and everyday functional dimensions of compromised health. For instance, angina pectoris was linked to lower life satisfaction in men, a finding that may be explained by the fact that women with angina pectoris have longer survival, are at a lower risk of subsequent myocardial infarction or cardiac death, and are also on average 10 years older when they receive the diagnosis. Likewise, gender specific symptoms and treatment consequences of peptic ulcer may also explain why women with the diagnosis reported lower satisfaction with life as compared to women without the diagnosis in our study. Recurrent peptic ulcer is more frequent in men (Heppell, Bess, McIlrath, & Dozois, 1983; Hoffmann, Shokouh-Amiri, Klarskov, Madsen, & Jensen, 1986), but women are more likely to undergo remedial peptic ulcer surgery; an intervention commonly accompanied with complications and morbidity especially in women (Eckhauser, Knol, Raper, & Guice, 1988; Forstner-Barthell et al., 1999). The finding that among men the eczema diagnosis was related to lower satisfaction with life is presumably not related to gender differences in the actual expression of diagnosis but more probably reflects men's failure to treat their eczema properly with skin lotions. In considering the importance of medical diagnoses for life satisfaction in old age, a gender perspective is likely to contribute

to a better understanding of the complex relationships between actual diseases and effects on life satisfaction.

Mental health in terms of depressive symptoms also showed a gender-specific relation to life satisfaction at the cross-sectional level. The association between depressive symptoms and life satisfaction has been found previously (Blazer et al., 1992; Chamberlain, 1988), and depressed women have been found to report lower quality of life compared to depressed men (Doraiswamy, Khan, Donahue, & Richard, 2002). The reasons why depression seems to be more strongly related to perception of life in general among women are still largely unidentified. One possible explanation is that men are less inclined to report negative attitudes, indicating that the thresholds for reporting low quality of life are higher as compared to women. However, in Study II, concurrent level of depressive symptoms were related to level of life satisfaction across the 4 measurement occasions when both men and women were included in the sample, suggesting a cross-gender relationship between depressive symptoms and satisfaction with life. The result highlights the importance of improving methods of detecting depressive symptoms in old age and the initiation of adequate treatment.

Life satisfaction and widowhood

Widowhood is another gender-specific factor that accounted for variance in life satisfaction in Study I. Bereavement was related to lower levels of life satisfaction across study II, and in line with previous research, the negative effect of the loss of spouse on life satisfaction was more pronounced in men (Cheng & Chan, 2006; Chipperfield & Havens, 2001). The finding may partly be an expression of age when widowed; men generally experience widowhood later in life than women, leaving them less time to adjust to a life without their spouse (Barer, 1994). The association is probably also related to gender differences of a psychosocial nature. As men in our cohort tend to have fewer close friends than women, the spouse is often the only confidant (Chappell, 1989; Strain & Chappell, 1982) entailing a more pronounced loss of social and emotional support when bereaved. Also, diverging marital roles in men and women concerning housework represents a third disadvantage for men in this context. Men in older cohorts are in general less accustomed than women to taking care of domestic chores such as cooking and cleaning; consequently they also experience practical difficulties of widowhood. In light of these findings, bereavement has additional negative consequences for men. As gender differences in these areas presumably become less pronounced in subsequent cohorts, the observed gender differences in the relationship between life satisfaction and widowhood

should also decrease. The proposed explanations therefore suggest that the gender difference will be less distinct in younger cohorts.

Limitations of the studies

The studies in this thesis have limitations related to selection, attrition, and gender distribution in the sample. In addition, some remarks concerning the selection of associates and predictors need to be addressed. Firstly, is it adequate to generalize results from a sample of twins to the overall population of the oldest-old? As the OCTO-Twin Study at baseline included only same-sex complete pairs of twins aged 80 and over, the sample consists of individuals with experiences and life circumstances that seem rather unique as compared to the overall population. In a detailed analysis Simmons et al (Simmons et al., 1997) addressed the question of sample selectivity by comparing the OCTO-Twin sample with an age matched sample of singletons across the domains of vitality, well-being, physical and cognitive functioning, and health utilization. First, due to the criterion of complete pairs of twins in twin studies the participation rate (80% for individuals and 64% for complete pairs) was slightly lower in the OCTO-Twin study as refusal from one twin automatically excludes the other twin). However, when controlling for age, education, and gender the two samples differed in only 3 out of a total of 20 comparisons. Twins performed better on the IADL (Instrumental Activities of Daily Living) and left handgrip strength. Singletons performed better on a memory test (prose recall). There was no difference between singletons and twins in health utilization, vitality (blood pressure, pulse, lung capacity, handgrip strength right), physical functioning (PADL (Personal Activities of Daily Living) and mobility), cognitive functioning (MMSE, MIR Memory Test, Clock Test, Count Money Test), or well-being (CES-D, Subjective health, Subjective memory). In line with previous studies that have compared twins and non-twins (Christensen, Vaupel, Holm, & Yashin, 1995; Herskind et al., 1996), Simmons et al concluded that as complete pairs of twins aged 80 and over are similar to an age-matched representative sample of nontwins in health status and bio-behavioral functioning it is adequate to generalize results from twin studies to the overall population. Secondly, the procedure of leaving questionnaires with the participants to complete and mail back resulted in a systematic attrition; those who mailed back were in general both physically and psychologically more healthy. In addition, the selection criterion used in Study I required selected participants to have values on all variables, which further reduced the sample size. Altogether, this implies that the generalization of the results presented in the thesis should be restricted to a non-demented, overall healthier group among the oldest-old. Furthermore, the

fact that the selected sample represents a more homogenous group of the oldest-old also provides a possible explanation for the modest individual differences in change in life satisfaction. Finally, missing data across measurement occasions in Studies II and III, and in particular the small sample size at the fourth time point, represent another limitation. However, longitudinal studies of older populations inherently have enlarged attrition due to high mortality rates at these ages and the limitation is therefore a matter of losing power in statistical analyses rather than a matter of selectivity. Furthermore, because full-information maximum likelihood estimation was used under the assumption of missing at random (i.e., that attrition is random once scores from previous time-points and model predictors are taken into account), the findings are likely to be more reflective of true population estimates than would be those from a complete cases analysis. Finally, there is a problem specifically related to the unequal gender distribution in particular in Study I. In the regression analysis independent variables are included in accordance with a critical value related to the correlation coefficient to the dependent variable life satisfaction. Consequently, an unequal number of men and women affects the significance level of the correlation coefficients, which in turn probably reduced the number of independent variables in the analysis. Considering this reservation, the results from Study I still suggest a different hierarchical priority of variables in men and women, a finding also demonstrated in previous research.

There are also limitations related to the selection of associates and predictors of life satisfaction. The selected variables in the study do obviously not cover all potential health-related and psychosocial aspects that may be of relevance to life satisfaction. For example, previous research has demonstrated strong connections between personality traits and life satisfaction (Eid & Diener, 2004; Heller et al., 2004). On the other hand, the present studies contribute by illuminating contextual variables of relevance, and do not aim at investigating the complex relationship of life satisfaction and personality. Another limitation in the selection of variables is related to health. The understanding of life satisfaction and medically based health measures could be improved by the inclusion of a more specific health measure in addition to the current quantitative health variable. The consideration of the consequences of diseases in terms for example of severity and prognosis for survival or functional limitations would more precisely reflect burden of disease. However, the overall aim of including a wide range of psychosocial and health-related covariates, known to be related to life satisfaction in old age, provided a general picture of the hierarchical priority of associates from which a further penetration of effects might continue. Finally, the inclusion of

depressive symptoms as an associate and predictor in Study I and Study II respectively, may be problematic given the interrelation between affect and life satisfaction. However, life satisfaction is distinguishable from both positive and negative affect (Lucas et al., 1996). In addition, previous findings of diverging associations between life satisfaction and depressive symptoms in men and women (Doraiswamy et al., 2002) suggest that the inclusion of depressive symptoms in this context is appropriate.

Study IV has limitations related to the selection of included covariates. First, the effect of drugs and the side effects that may threaten satisfaction with life (Westerbotn, Agüero-Torres, Fastbom, & Hillerås, 2005) was not accounted for in the study. It is of great importance to gain knowledge about how diseases relate to quality of life directly or via side effects of drugs in order to preserve quality of life in the oldest-old age segment with a substantial use of medications. Second, the study of level of life satisfaction related to single diagnoses fails to incorporate the effects of comorbidity. The possible magnified effects of diagnoses that commonly coalesce on life satisfaction need to be further explored. However, the purpose of Study IV was only to study the relationship between life satisfaction and a range of common diagnoses. The effects of co-morbidity, use of drugs, and potential mediating effects between the various diagnoses and life satisfaction need to be addressed using more elaborate analyses.

Conclusions

The thesis provides novel research findings in the infrequently explored research area of life satisfaction among the oldest-old. Above all, the thesis questions a life-long stability in life satisfaction as individuals became less satisfied with life over time, but do also show that mortality related processes are involved in the observed change in life satisfaction. In fact, mortality-related processes seem to be more pronounced as compared to age-related processes. Time-to-death related changes have previously largely been investigated in cognitive domains; in that way, the thesis shows that distance from death is also an appropriate framework for the understanding of life satisfaction changes. Furthermore, individuals who were more satisfied with their social contacts were also more satisfied with their lives, and changes in the perception of social network were associated with changes in life satisfaction across the study. The finding suggests that the Socioemotional selectivity theory (Carstensen, 1995) provides an applicable framework for the understanding of cross-sectional and longitudinal links between satisfaction with social contacts and satisfaction with life even among the oldest-old. Emotionally rewarding social contacts in contrast to a large

social network are likely to become more important with the increasingly powerful perception of a limited time left to live. Although the analyses do not allow conclusions about causal relationships, facilitating the maintenance of social contacts of preference are most likely vital to preserve satisfaction in late life. Furthermore, feelings of being in control of one's life were related to life satisfaction but did also interact with overall disease load. The relevance of control also seemed to grow stronger with more serious afflictions. Previous research has found a magnified effect of the perception of control on well-being in situations characterized by dependency (Heckhausen & Schulz, 1995; Skinner, 1995). Being in control and the experience of participation apparently constitutes a vital component in late life. Within this explanatory framework, the finding communicates a need for individual adjustments of for example health care efforts in order to preserve or improve life satisfaction in the elderly. Comorbidity and frailty is distinctive of the age group of the oldest-old and would be expected to represent a threat to life satisfaction. However, the present thesis showed that the association appeared predominantly in the life satisfaction-self-rated health relationship. Among medically based diagnoses that were represented in more than 5% of the sample, few diagnoses were actually related to satisfaction with life, and the effect of overall disease load was of minor relevance in the presence of subjective perceptions of health. The relationship between health and life satisfaction are certainly characterized by great complexity and therefore in need of investigation within a methodological context that may elucidate the complexity.

The identification of predictors of distance from death related decline in life satisfaction should be a subject of future research in order to improve our understanding of the contribution from the age-graded, morbidity-related, and mortality-related processes that may relate to change in life satisfaction in late life. Individuals aged 80 and over still represent a most heterogeneous group; all the same, a majority shares the challenge of coping with deteriorated health and psychosocial losses. There are many reasons both for society and science to acknowledge the multidimensionality of life satisfaction, including medical, psychological, and social dimensions, in further studies of the constantly growing oldest-old age segment in modern populations.

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