

Well-being and health from age 70 to 100: findings from the Berlin Aging Study

JACQUI SMITH

Max Planck Institute for Human Development, Lentzeallee 94, D-14195 Berlin, Germany. E-mail: smith@mpib-berlin.mpg.de

An individual's personal sense of well-being (SWB) is an indicator of psychological adjustment and successful ageing. Health and functional capacity are viewed as important sources of life quality in old age but very little is known about their effects on SWB over time. Can older individuals maintain SWB despite declining health? Longitudinal data from the Berlin Aging Study¹, a locally representative sample of men and women aged 70 to 100+, indicate that cumulative health-related chronic life strains that characterize the Fourth Age set a constraint on the potential of the older individual to experience the positive side of life.

Introduction

The study of well-being and the relations between health and well-being in old age is both of social-political and theoretical importance. In social policy terms, one would like to ensure that the majority of older persons in a population have the opportunity, now and in the future, to live their final years of life in dignity and in conditions and contexts that are at least equal to those available for younger age groups. Much public health and epidemiological research has highlighted differences in life quality associated with socioeconomic factors². Socioeconomic and demographic factors also play a role in predicting survival beyond average life expectancy in a population. Individuals who reach an advanced age may, however, face an age-based inequality that compromises their opportunities to experience quality of life in their final years. Theoretically, from a psychological perspective, it is still an open question whether we should expect subjective well-being to decline for most older people and whether intervention strategies could minimize the risk of losses in well-being during old age.

To date, there have been few longitudinal analyses of subjective well-being in heterogeneous samples of old and very old individuals to provide answers to these general questions. Short-term changes in well-being have been examined in subgroups of adults over the age of

70: for example, with regard to the experience of specific late-life events, such as relocation to a home for seniors³⁻⁴ or adaptation to health conditions.⁵ The majority of studies focus on the well-being of individuals between the ages of 60 to 80 years. There is little information about differences between the young-old and oldest-old and changes in well-being during very old age. As outlined below, this has been one focus of research in the Berlin Aging Study (BASE¹). BASE is a multidisciplinary intensive study of a representative sample of men and women aged 70 to 100 + years ($N = 516$) living in the western districts of Berlin. This paper reviews cross-sectional and longitudinal findings from the Berlin Aging Study on relationships between well-being and health in old age.

Concepts of well-being

What constitutes well-being? Answers to this question roughly correspond to common sense theories that attribute the source of well-being either to an individual's material resources or to his/her life philosophy and disposition. Since the mid-20th century, the everyday meaning of well-being for individuals in most western societies has changed. An early focus on the general availability of material goods (such as adequate food, sanitation, acceptable housing, access to a wide-range of healthcare and community services, and sufficient finances) has changed to an emphasis on less tangible goods, such as a sense of security, personal dignity, opportunities to pursue personal interests, and to experience a satisfying life.

This transformation of meaning also applies, in part, to concepts of life quality in old age. Social expectations about well-being in late life cover not only the availability and maintenance of resources (e.g. finances, medical services), but also the idea that older persons have the right to enjoy life. In this context, contemporary models of successful ageing often use measures of life satisfaction or subjective well-being as outcome criteria rather than measures of objective resources.⁶ Health enters into these models as an asset, but this objective resource is often viewed as a prerequisite for higher level components of successful ageing. Rowe and Kahn,⁷ for example, outlined three components of successful ageing: low probability of disease and disease-related disability, high cognitive and physical functional capacity, and active engagement with life (especially interpersonal relations and productive activity). Clearly, these three components are interrelated. Rowe and Kahn suggested, however, that health and adequate cognitive functioning are prerequisites for the third component – engagement with life – which they considered to be the more important one for defining success.

Well-being is considered by psychologists to be multidimensional in nature. It is assessed in terms of individuals' cognitive evaluations of their lives as well as their feelings of enjoyment and upset associated with their life circumstances⁸⁻¹⁰. Measures biased toward the affective dimensions of well-being ask about the experience of enjoyment and happiness, the preponderance of happiness and pleasant feelings over unpleasant feelings, or the absence of emotional upset.^{11, 12} More cognitively-oriented measures of well-being focus on judgements of life quality, meaningfulness and satisfaction. Various researchers have also introduced other dimensions (e.g. adjustment, mastery, morale, satisfaction with one's ageing, valuation of life, purpose in life, or mental health).^{10, 13, 14} Unfortunately, many studies in the gerontological and epidemiological literature only include assessments of negative dimensions and the absence of well-being (e.g. depressivity, depression).

Defining well-being in terms of the individual's subjective experience of life has two advantages. First, it enables researchers to avoid the difficult task of establishing consensus about criteria of quality that satisfy both individuals and social institutions. The standards and/or needs of one target individual or group may not always match the standards and criteria of an observer (e.g. professional caregiver, government department, institution). Second, this assessment procedure allows researchers to ask questions about the associations between objective life conditions and subjective experiences at the individual level.⁸ Do life conditions that are judged to be of a high standard within a society ensure high life satisfaction and happiness? Are lower levels of reported life satisfaction consistent with decrements in life conditions?

Studies investigating questions about the relationships between objective life conditions and subjective life experience frequently find large discrepancies. Such findings have contributed to the development of a family of theories about the psychological processes associated with judgements of personal well-being.^{15–17} In essence, these theories outline how an individual adjusts his/her level of aspirations to the reality of present life conditions in order, on the one hand, to protect or 'immunize' the self against a loss of well-being and, on the other, to maintain a sense of purpose and challenge to achieve new goals. These psychological processes contribute to a positive aura of well-being and to seemingly paradoxical observations that some subgroups of individuals report low life satisfaction despite their extremely high status of life conditions, whereas other subgroups report high life satisfaction in contexts of relatively low status life circumstances.

Proposals about well-being in old age

What are the expectations about changes in well-being in old age? Theoretically, as a function of enduring personality characteristics and self-protective processes, an individual's level of SWB is expected to be generally stable across the lifespan, with short-term fluctuations contingent on negative events.⁹ Stability may also be due to consistencies in life circumstances over time. After the period of early adulthood, for example, housing, family, work, leisure and finances take on a degree of predictability for most people. Differences are expected between people in terms of level: some people are dispositionally happy and others chronically unhappy.¹⁸

Initial proposals that subjective well-being may decline in old age are derived from studies that have compared young, middle-aged and older adults, with the oldest participants usually being in their 70s. Such research has revealed different age trends for measures directed to affective versus cognitive components of well-being. Feelings of happiness show negative age correlations, whereas reports of satisfaction either reveal no age trends or a small increase with age.^{9, 19} Empirical findings about age differences in well-being vary depending upon whether analyses control for life circumstances, such as health, which may disadvantage many older individuals.²⁰ In particular, it is suggested that the increased risk of frailty, the accumulation of debilitating health conditions, functional impairments and personal losses during the period of old age may place constraints on life satisfaction.^{21–23} There are also suggestions that some dimensions of subjective well-being may be more susceptible to changes in relation to health status.

The definition of 'health' with regard to old age is still open to debate in the research literature.^{24, 25} There is consensus that health in old age cannot meaningfully be defined as *the absence of disease* because the prevalence of diagnosable disorders in elderly populations is high. Instead, Rowe and Kahn²⁵ suggested that the health of subgroups of older adults be defined in terms of their status *relative* to age and cohort norms (e.g. successful, usual, versus pathological). Furthermore, disease is only one facet in many models of health. Health is considered to be multifaceted²⁴: the diagnosis of disease should be complemented by assessment of discomfort associated with symptoms (e.g. pain), life threat, treatment consequences (e.g. side-effects of medication), functional capacity and subjective health.

The different facets of health (e.g. diagnoses, morbidity, functional capacity, subjective health) are intercorrelated but need not necessarily be highly related. Clearly, some illnesses or functional impairments have few symptoms that limit daily activities whereas others impose great constraints. Some illnesses result in much pain and discomfort, whereas others are relatively pain-free. This heterogeneity of symptoms experienced by older adults may have important consequences for their interpretations of illness and perceived well-being, both in the short-term and over longer periods of time. Judgements of subjective health and satisfaction with one's health also reflect the operation of different values and motivational systems. Whereas two older adults with osteoarthritis may have the same limitations as assessed by an objective health status scale, they might assign very different levels of importance to their incapacity as a function of their life background and personal preferences.²⁶ There are large individual differences in the amount of time, discomfort, money and risk that older adults are prepared to invest in undertaking treatment and also in how individuals rate the limitations of one illness compared with another health state.

In old age, the challenges of dealing with chronic illness together with impairments in physical, sensory and cognitive functioning have a pervasive impact on the nature and routine of everyday life.^{27, 28} This ranges from arranging visits to doctors and keeping up regimes of treatment to adapting one's lifestyle to accommodate frailty, loss of energy, vision and hearing impairment, and restriction in mobility. It is not surprising therefore that health is a central theme in older adults' current self definitions and thoughts about the future.²⁹⁻³¹

Given the recent growth of the elderly population in developed countries, it has become very important to consider SWB in different phases of old age and to examine changes during old age. Suggestions about possible differences in SWB between the Third and Fourth Age (young-old versus oldest-old) are primarily based on social and theoretical conceptions about the nature of very old age.^{20, 32, 33} The Third Age is usually viewed as exemplifying positive features and the Fourth, dysfunction and death. Neugarten³² described those in the Third Age (young-old) as retirees from the workforce who are in relatively good health and are socially engaged. For her, the Fourth Age was typified by the onset of all the negative stereotypes of old age. Similarly, Laslett³³ described the Third Age as an era of personal achievement and fulfilment and the Fourth Age as an era of final dependence, decrepitude, and death.

Suzman *et al.*³⁴ identified 85 years of age as the criterion of membership in the oldest-old category. The population over age 85, unlike any other age strata, is typically characterized by an unique excess of women over men, higher levels of co-morbidity and institutionalization, and greater consumption of medical and care services. Individuals born between

1890–1915 who comprise the oldest-old observed in 2000 also exemplify a set of characteristics that are cohort-specific: for example, they have a lower level of education compared with subsequent cohorts and a higher likelihood of long-term widowhood. Whereas the majority of the young-old begin to deal with health challenges in collaboration with their spouse, the majority of the oldest-old (and in this case typically older women) deal with declining health during widowhood. The different life circumstances and health states associated with these proposed two phases of old age likely play a critical role with regard to the potential of the individual to maintain positive well-being.

Psychologists are beginning empirically to address questions about possible differences in functioning in the Third and Fourth Age. Systemic models of functioning in old age, which consider complex interdependencies across domains imply that there may be different orchestrations of psychological functioning in the Third and Fourth Age.^{21, 35, 36} It is argued that even though the onset time and regulation of decline may differ across psychological domains, all domains will eventually exhibit some type of dysfunctionality and that this may take the form of a cascade of decline. The Fourth Age would thus be characterized by a functional breakdown of the psychological system and less-desirable psychological profiles (e.g. loss of positive well-being, psychological dependence on others, poor memory and impaired reasoning). Associated with this perspective is the idea that, whereas functioning in the Third Age may be primarily age-related, functioning in the Fourth Age is death-related.

Overview of the Berlin Aging Study

The Berlin Aging Study (BASE^{1, 37}) was established in 1989 to investigate questions about very old age from the joint and collaborative perspectives of four disciplines: psychiatry, psychology, sociology, and internal medicine. Distinguishing features of the BASE design are: (a) a special focus on the very old (age range 70 to 103 years: sample stratified by age and sex); (b) sample heterogeneity achieved by local representativeness of the western districts of Berlin, and (c) intensive multidisciplinary data collection (involving 14 sessions and data from each individual collected over 3–5 months). Descriptions of the study design, procedure, sample representativeness (compared with city census data), and sample selectivity of the initial cross-sectional sample ($N = 516$) have been published elsewhere and so are described here only briefly.^{1, 38}

The study design aimed at a probability sample stratified by age and sex, meaning that the oldest-old (over 85 years) and the male population were over-sampled. The initial parent sample ($N = 1908$) was obtained from the city registry (in Germany, all residents must be registered). 516 participants (27% of the parent sample) completed all 14 sessions of assessment at the first measurement occasion (1990–93). The 14-session Protocol began with an initial two-hour multidisciplinary Intake Assessment followed by 13 sessions in which data specific to research topics of each of the four disciplines were collected (psychiatry, psychology, sociology and internal medicine). Assessment sessions, which typically were carried out in the participants' place of residence (private home or institution), each required on average 1.5 hours. Data were collected by trained full-time research assistants, as well as medical personnel including physicians, dentists, and psychiatrists. Throughout the study, each individual participant was assigned to one of the research assistants who served as a continuing

liaison agent. Individuals in the 14-session sample received DM500 (approximately \$350) for their participation.

Problems of sample selectivity were expected because of the intensity and duration of the assessment procedure over a period of 3–5 months, the advanced age of the sample, and the location in a large metropolitan city. Persons who were incapable of understanding the purpose and conditions of the study or were evaluated by a psychiatrist or medical doctor as too ill to participate were excluded from the study (8% of the verified parent sample). To evaluate sample selectivity, individuals with different levels of participation (e.g. short contact ($N = 1219$), intake assessment only ($N = 928$) versus complete 14-session intensive protocol ($N = 516$) were compared on a spectrum of 25 variables including age, sex, one-year mortality and social status.¹ These analyses indicated that there was some positive selection involving level of functioning, although the effect sizes were small. Persons who completed the 14-session cross-sectional intensive protocol of BASE in 1990–93 ($N = 516$), for example, had a lower mortality in the 12 months following initial contact (5.6% compared with 13.5% in the parent sample) suggesting that, on average, they were perhaps healthier than members of the parent sample.

The cross-sectional BASE sample consisted of six age/cohort groups (age 70–74 years, born 1922–1915; age 75–79 years, born 1917–1910; age 80–84 years, born 1913–1905; age 85–89 years, born 1908–1900; age 90–94 years, born 1902–1896, and age 95–105 years, born 1897–1883). Because of the 3-year time interval required to acquire and assess the sample, there is some overlap in birth cohort membership across adjacent groups. Following the study design, there were equal numbers of men and women in each group ($n = 43$ respectively). The average age of participants at the first cross-sectional measurement was 85 years.

Fourteen percent of these 516 participants were institutionalized (e.g. in homes for seniors, nursing homes, hospitals) and 5% were non-German nationals, proportions that are consistent with city statistics for the Berlin population over the age of 70 years. In 1990–1993, 30% of the BASE sample were married, 55% widowed, 7% divorced and 8% had never married. Representative for these cohorts in Berlin, 65% of the sample had primary level education, 28% high school and college level and 8% university level.

Four longitudinal follow-ups of the survivors from the cross-sectional sample have since been completed at approximately two-yearly intervals. These follow-ups have involved different amounts of assessment. A single-session multidisciplinary assessment was collected in 1993–1994 ($N = 361$), reduced versions of the first occasion Intensive Protocol (six sessions) were collected in the periods 1995–1996 ($N = 206$) and 1997–1998 ($N = 132$), and a repeat of the single-session multidisciplinary assessment together with parts of the Psychology Battery was completed in 2000 ($N = 90$). In addition, we also regularly receive updated information regarding the mortality of the entire BASE sample from the City Register (in mid 2000, 70% were deceased).

Demographically speaking, the elderly population of the western districts of Berlin is more similar to that in other large cities of the former West Germany than one might expect from West Berlin's post-Second World War history of enclosure. There are, however, some demographic differences. Based on the 1989 micro-census and 1991 population registry information, 12% of West Berlin inhabitants were aged 70 years and above, compared with

10.5% in the former Federal Republic of West Germany. Moreover, economically and educationally, the older adults of the western districts of Berlin were somewhat better off than their West German counterparts. On a continuum of social stratification, participants in BASE were distributed as follows: lower class (7%), lower middle class (20%), middle class (31%), upper middle class (30%) to higher class (11%).

How about historical and culture-specific cohort effects? BASE participants have lived in the midst of many historical events. The oldest participants were born in 1886 and the youngest in 1920. The oldest birth cohorts were aged in their 20s at the time of the First World War and the youngest were born during or shortly after that war. All participants experienced the Second World War, although at different points in their lives. These cohort-specific experiences had, of course, an impact on the educational and occupational opportunities, health experiences and family lives of the individuals.³⁹ The age peers of BASE participants born in other parts of Europe (e.g. France, England, Russia, Italy, Poland) had different experiences of these historical events but also much in common on a day-to-day basis. There was also a large wave of migration from Germany to other parts of Europe, the USA, Australia and Canada from the 1930s to 1950s. Many of the people who left Germany to begin new lives have possibly been sampled in studies of old age carried out by researchers in their new country of residence. In order to tease out the specific effects of cohort and cultural (national) experience, it is important that studies undertaken in different countries include some common measures and exchange findings. BASE researchers, for example, have had regular exchanges with researchers from the MacArthur Successful Aging Network⁷ as well as large studies in England, Sweden, Denmark, France, the USA and Canada. Cultural differences are most likely to be observed in lifestyle, self-report and psychological measures, but it is also possible that different life histories and environmental interactions contribute to differences in disease prevalence, functional health, well-being and longevity. Societal and political systems, of course, also contribute to quality of life in old age (e.g. public health and pension systems). For the most part, we expect that patterns of age differences and changes in well-being similar to those that we find in BASE would also be found in studies carried out in large cities of other European societies.

Questions about well-being and health addressed in BASE

The focus of this report is on BASE analyses of the links between health and SWB. We speculated that different facets of health (e.g. specific physical illnesses, functional health, subjective health, and mortality) would be related to individual differences in specific components of SWB (e.g. life satisfaction, satisfaction with ageing, experience of positive and negative affect). It has been suggested that, among older adults, illness may only compromise perceived quality of life when it is accompanied by functional impairment.⁴⁰ Williamson and Schulz,⁴¹ for example, found that to the extent to which a physical illness led to a level of functional impairment or restriction that interfered with everyday routines, older adults (mean = 72 years) reported more depressive symptomatology.

The indices of health and well-being analysed for this paper are described in detail elsewhere.^{23, 42} BASE included a standard 20-item measure of the affective components of SWB, positive and negative affect (Positive and Negative Affect Schedule, PANAS¹²),

together with a 15-item measure specifically designed for use with older adults, which assessed two cognitive components, life satisfaction and satisfaction with ageing (Philadelphia Geriatric Center Morale Scale, PGCMS³). Examples of items in the latter scale include: 'Things keep getting worse as I get older'; 'I sometimes feel that life is not worth living'; and 'I am satisfied with my life right now'. Items in all measures were read aloud by an interviewer and simultaneously presented visually in large font. The individual's response to each item on a five-point scale was recorded by the interviewer. In addition, we also include information about an observer rating of depressivity (HRSD⁴³) completed in BASE by a gerontopsychiatrist.

Diagnoses of physical illnesses according to the ICD-9 codes were based on clinical examinations carried out in the field by a physician, medical history information, medication information, pathology findings (e.g. from blood, urine and saliva probes), and functional assessments (e.g. spirometry, ECG). Compiled information for each participant was discussed in conference between the BASE physicians and psychiatrists in order to reach consensus about the final diagnoses. Each diagnosis was subsequently rated for certainty, stage of illness (mild to severe), life threat, and severity of symptoms in this consensus conference. Additional measures of subjective health and functional capacity were collected by trained interviewers in a multidisciplinary assessment session. These included measures of vision and hearing acuity, balance and gait,⁴⁴ Activities of Daily Living (IADL, ADL⁴⁵) and hand grip strength.

Findings are described in the next two sections. To begin, I review a selection of cross-sectional results on health and SWB, focusing on differences found between the young-old and oldest-old and links between health, SWB and survival. The second section outlines recent BASE analyses of longitudinal change in SWB and estimation of change trajectories from age 70 to 100+.

Cross-sectional findings from BASE

Health status

The prevalence of physical illness is high amongst individuals aged 70 to 100+ years. At least one mild to severe internal, neurological, or orthopaedic disease was diagnosed for 96% of the BASE sample.⁴² BASE physicians estimated that this illness would be accompanied by moderate to severe symptoms in 71% of cases. Life-threatening illnesses, such as congestive heart failure, were observed in 33% of the sample. Multi-morbidity is also a fact of life for many older persons: 30% of BASE participants were diagnosed as having at least five severe physical illnesses. As is often reported in the literature, older women were more likely to belong to the subgroup with multiple chronic illnesses than older men. The most frequent diagnoses were for hyperlipidemia, cerebral arteriosclerosis, heart failure, osteoarthritis, degenerative diseases of the spine, and hypertension. Musculoskeletal disorders (e.g. osteoarthritis, osteoporosis) were at the top of the list of disorders considered to cause the individual most symptomatic discomfort. Of interest too, was the finding that the BASE dentists judged that about 75% of participants who had dentures would probably experience trouble chewing and speaking because their dentures needed to be renewed or repaired.

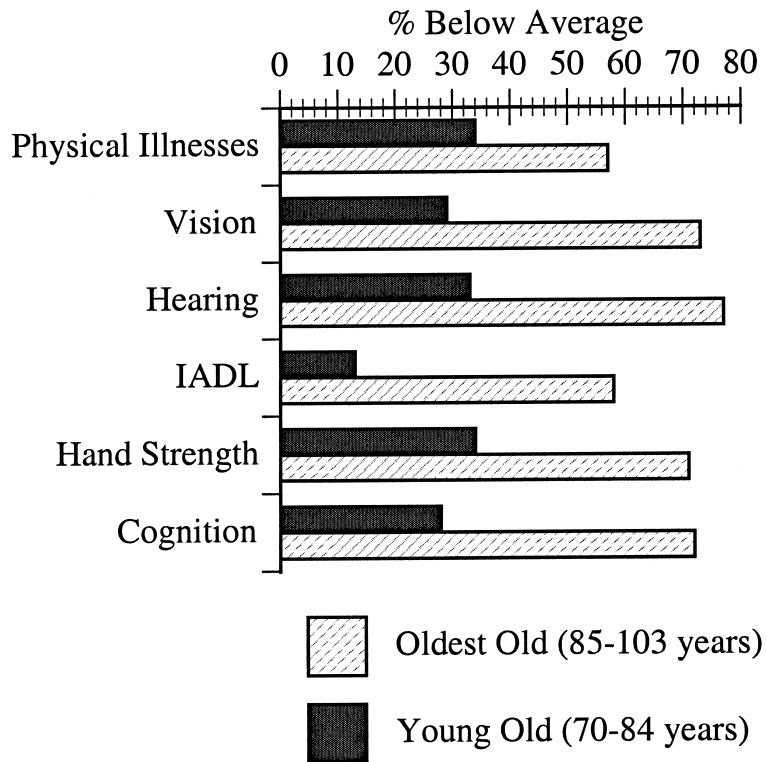


Figure 1. The risk of poor health is higher in the fourth age. Age/cohort differences in the percentage of people with below average (low status) functioning in physical and functional health indices.

Age and gender differences were apparent in the majority of functional health indicators.^{42, 46} For example, amongst the oldest-old (over age 85; $N = 258$), 60% of women but only 32% of men reported that they needed assistance in bathing or showering. Among the very old women (over 85 years), 81% had difficulties shopping and 84% could not use public transport. Whereas the handgrip strength of 70 year-old men was, on average, 21 ± 6 kg, for 70 year-old women it was 8 ± 5 kg. At age 90, this was reduced to 12 kg for men and 2 kg for women on average. Similar gender- and age-related differences were found in measures of physical mobility, balance and gait.

Visual acuity (even when tested with prescribed glasses) for reading and distance declined from 70 to 100 and was significantly worse for women than for men. At age 70–79, 21.5% of the BASE sample were classified (WHO standards) as being moderately or severely visually impaired, compared with 80% at the ages 90–100 years.¹ Hearing acuity showed similar age differences (47% were classified as having moderate or severe hearing impairment in the speech frequency range at age 70–79, compared with 93% for ages over 90 years). Whereas many 70 year olds could discriminate tones at 10 to 30 dB, no individuals over 90 could hear tones presented at less than 30 dB.

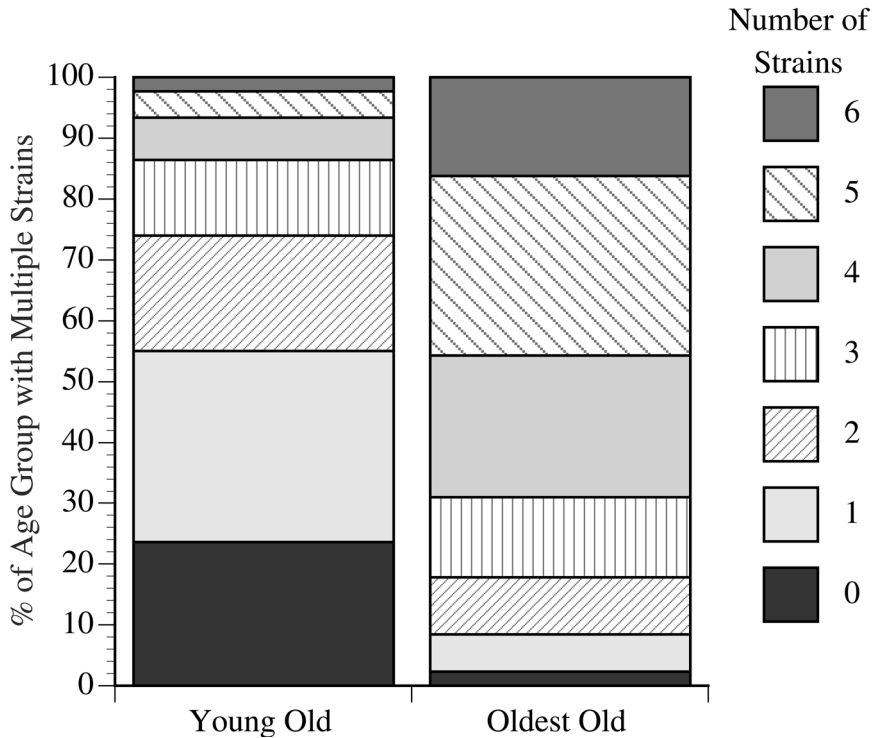


Figure 2. The proportion of individuals who endure multiple chronic health strains increases from the third to the fourth age. Accumulated strain in six domains: physical health (number of diagnosed severe illnesses), vision, hearing, functional capacity (ADL-IADL), hand strength, and cognitive functioning. Age correlation = 0.62.

Considered separately, the prevalence of chronic illness, frailty and incapacity is doubled in the Fourth Age. Figure 1 shows the percentage of the young-old (70–84 years) and oldest-old (85–103+ years) who were below average (low status) on physical and functional health indicators. It is clear from this figure that the majority of the oldest-old had impaired health. Some individuals over the age of 85 do, however, continue to have relatively good health.

Many individuals, as well as having severe illnesses are, at the same time, physically and cognitively impaired and so have multiple chronic life strains. Figure 2 illustrates the cumulative percentage in each age/cohort group with zero to six chronic life strains across the domains of physical illness, functional health (vision, hearing, IADL-ADL, grip strength), and cognition. As can be clearly seen, over 80% of individuals in the Fourth Age endure at least three chronic strains. In the Third Age, 25% fall in this category. Once again, here we also see that some exceptional people over the age of 85 years have few impairments.

Alongside this picture of the prevalence of illness and functional impairment, we found that 29% of BASE participants themselves rated their health as good or very good, and only 33% reported their health to be poor or very poor. Furthermore, self ratings of subjective health were not correlated with age⁴⁷ ($r = -0.01$).

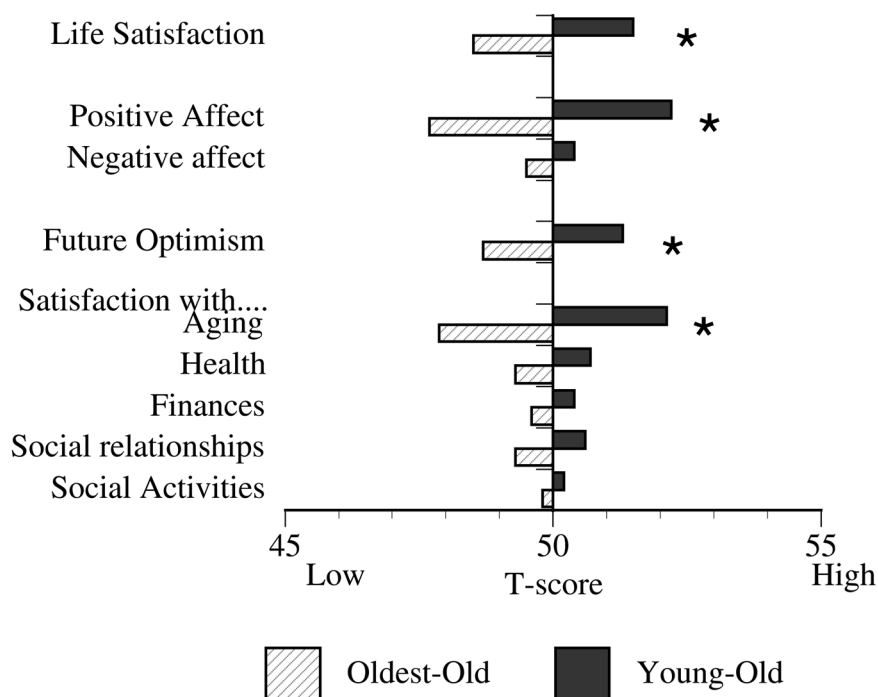


Figure 3. Age/cohort differences in well-being. Significant cross-sectional group differences ($p < 0.05$) are indicated by an asterisk. The young-old reported significantly higher positive well-being than the oldest-old on four dimensions: life satisfaction, experience of positive affect, optimism about the future, and satisfaction with aging. No differences were found for negative affect and satisfaction with specific life domains.

Age/cohort and subgroup differences in SWB

Overall, 63% of BASE participants reported that they were satisfied with their life at present and that they experienced positive affect more often than negative affect.²³ In addition, 83% reported that they were satisfied or very satisfied when they looked back over their life. These group levels of satisfaction are similar to those reported from earlier West German social welfare surveys.⁴⁸ The correlation between positive affect and negative affect was essentially zero, as is typically found in younger samples, supporting the notion that the experience of these two affect dimensions is independent and that they contribute differentially to overall well-being.^{9, 12} The prevalence of diagnosed major depression in BASE was 5%, somewhat higher than that reported in other studies of older populations.⁴⁹

As can be seen in Figure 3, significant differences between the young-old (70–84 years) and oldest-old (85–103 years) were found for the positive side of well-being (life satisfaction, satisfaction with ageing, the experience of positive affect, and future optimism) but were not evident on the negative side (e.g. experience of negative affect). The separate scales in Figure 2 have been standardised within the BASE sample to an overall mean of 50 ($SD = 10$). The young-old reported higher positive well-being than the oldest-old. Gender differences were

also found: the men in BASE reported higher life satisfaction and satisfaction with their own ageing, the women reported more frequent experience of negative affect.⁴⁶ Married persons generally reported higher subjective well-being than people in all other categories of marital status. In the BASE sample (as in most samples of older adults), many more men than women were currently married or living with a partner. Regression analyses indicated that age, gender, marital status and institutionalization together accounted for only 6% of the individual difference variance in subjective well-being,²³ a level that is similar to studies with younger samples.⁹

Several authors have pointed out that the institutionalized are an identifiable subgroup of older adults who appear to be at risk for lowered well-being.^{22, 40} This was also found in BASE. Participants living in institutions (14% of the sample) reported less frequent experience of positive affect compared with participants living in private homes (the difference was 0.5 SD). Participants diagnosed with possible early to mild dementia were significantly less satisfied with their life and reported less frequent experience of positive affect compared with BASE participants without signs of dementia (these effects remained even after controlling for institutionalization²³).

Associations between health and SWB

Several analyses of the BASE data have indicated that functional health and self-reported (subjective) health are significant sources of SWB.^{23, 50} Self-evaluations of illness and functional status (vision, hearing, mobility, strength) were stronger predictors of SWB than were the measures of illness status (e.g. number of diagnosed severe illnesses).²³ Satisfaction with current finances and satisfaction with social activities are also unique predictors in hierarchical regression analyses. Physical health, as indicated by the number of diagnosed illnesses, predicted the subjective evaluation of physical impairment, satisfaction with social participation, and satisfaction with social relationships (after statistical controls for socio-demographic variables). This latter finding provides a hint about one mechanism underlying the relationship between health and SWB. Over time, physical illnesses, especially those accompanied by severe symptoms, likely influence functional health together with the routines of daily life and so place constraints on social participation and social contact. Social participation and social contact are thought to be very important sources of affective experience.⁵¹

We have also found that SWB is associated with mortality in old age. The predictive power of subjective health over and above objective health indicators in terms of mortality is well-known.⁵² Maier and Smith used Cox proportional hazards regression analyses to examine the associations between functioning on 17 indices of psychological functioning and subsequent risk of death.⁵³ At the zero-order level, low intellectual functioning, low positive affect, dissatisfaction with ageing, dissatisfaction with life, low extraversion, low openness to new experience and emotional loneliness were associated with an increased hazard of dying. Low intellectual functioning (e.g. poor memory, slow perceptual response speed, poor reasoning) and low SWB (especially dissatisfaction with aging) were found to be associated with an increased mortality risk after statistical controls for age, socio-demographic characteristics and health measures. For every one standard deviation decrease in level of

intellectual functioning, the risk of subsequent death doubled. A similar increase in aging dissatisfaction was associated with a 1.36 times higher relative risk of death.

Few other studies have investigated perceived well-being in relation to mortality. It could be that evaluations of how one is ageing reflect quite accurate summary perceptions about individuals' present status with respect to functioning in a variety of domains. In subsequent analyses of BASE data, we have examined perceived functional decline (a composite of subjective change in seven domains including vision, hearing memory, mobility and ADL) as a predictor of mortality.⁵⁴ The relative risk of death was 46% greater for participants who perceived much functional decline over two years compared with those who reported little. Individuals who perceived no decline lived at least 2 years longer on average.

Longitudinal findings in BASE

Our longitudinal analyses of BASE data are still in progress, but already it is clear to us that the cross-sectional age differences reported above reflect age-related change. The focus of our present analyses has been to estimate change trajectories from 70 to 100+ years using latent growth curve modelling. We ask whether change is best represented by a linear model or a model in which change is located primarily in particular phases of old age (e.g. the Fourth Age). Subsequently, we will examine whether health predicts individual differences in level of SWB and rate of change in SWB (see, however, Ref. 50 for analyses of 4-year relationships between functional health indices, positive and negative affect).

Clearly, we have not followed individuals over 30 years, rather between 8 and 10 years. Furthermore, at each successive longitudinal follow-up, fewer and fewer of the BASE participants have survived for re-assessment. Four measurements of all aspects of SWB are available, for example, for 132 people and five for 90. Longitudinal latent growth curve analysis allows us to make use of all available data at all measurement points in order to estimate the 30-year trajectory.

Our analyses to date reveal trajectories of decline from 70 to 100+ years in some aspects of subjective well-being, and stability in others.⁵⁵ Decline was evident in the positive side of well-being, ageing satisfaction, life satisfaction, and positive affect. For ageing satisfaction, the total estimated decline from 70 to 100+ years was equivalent to 1.1 SD, for life satisfaction, 0.8 SD, and positive affect 0.7 SD. Negative affect was characterized by stability – there was neither decline nor increase in very old age. There were large individual differences in average level on each component of SWB, but no significant inter-individual differences in intra-individual change (i.e. regardless of level, individuals changed at approximately the same rate). The number of chronic strains (across six domains) recorded at the first measurement occasion, has proved to be a significant predictor of individual differences in average level of functioning over time. Models testing whether stability was the best estimate for the 70s and decline for the 80s were found to fit well for ageing satisfaction and positive affect. These findings suggest that the period of transition from the Third (young-old) to the Fourth Age (oldest-old) may be critical for these two aspects of positive well-being.

Interestingly, the majority of those few individuals whom we have followed from age 95 to 100+ years, showed significant increases in positive affect around the time of their 100th birthday. This effect ('happy to reach 100') needs to be replicated of course, but it does

point to the importance of life context effects in measures of SWB. In old age, becoming a centenarian is a socially recognized achievement and a point of individual pride. It may be one of the few such occasions in the very old

Future perspectives

Rather than setting our own criteria for what constitutes 'a good life', we accepted the BASE participants' own reports of their personal sense of emotional well-being and life satisfaction. The majority reported being satisfied and contented. However, we found strong evidence that, during old age, the positive side of well-being decreases (less life satisfaction, less satisfaction with the way one is ageing, less frequent experience of positive affect). The transition from the Third to the Fourth Age and the accumulated chronic strain of dealing with the effects of multiple physical illnesses, frailty, functional impairment and social losses that characterize the Fourth Age, appear to test the limits of adaptive self-related processes⁵⁶. Whereas the majority of the young-old may enjoy high SWB, the capacity to maintain positive SWB in the face of loss and chronic life strain is reduced in the oldest-old. It is important to note that, so far, we have found no evidence that the negative side of well-being increases during old age: frequency of negative affect, depressivity (assessed by observer-ratings), and prevalence of diagnosed major depression were not related to age.

Health plays a critical role in the reduction of the positive components of SWB during old age. In general, the effects of physical illnesses are minimal by themselves, but when combined with such symptoms as pain, functional impairments in vision, hearing, strength, and physical mobility, and subjective evaluations of health status, health does predict a sizeable proportion of the individual difference variance in SWB (15% to 35% depending on the component examined). Social participation and social contacts are prime sources of positive affect. Clearly, older adults who have great difficulty seeing and hearing, and rarely move beyond the confines of their place of residence are at risk in terms of reduced opportunity for social contacts. They typically have to rely on the 'social world' to come to them.

The multimorbid life contexts of the oldest-old highlight the salience of issues of dependency and the personal 'cost' of ageing. Future efforts should be directed towards developing what Paul Baltes has called a culture of old age²¹ and, in particular, one directed to the minimization of health-related life restrictions and chronic life strain.²¹ Such compensatory efforts may then allow more individuals to maintain the positive components of SWB in very old age.

Acknowledgements

Data are presented from the Berlin Aging Study (BASE), a study which was financially supported by two German Federal Departments: The Department of Research and Technology (13 TA 011: 1988–1991) and the Department of Family and Senior Citizens (1991–1998). From 1999, the project has been funded by the Max Planck Institute for Human Development, Berlin, where the study is housed. Members of the Steering Committee are P. B. Baltes and J. Smith (psychology), K. U. Mayer (sociology), E. Steinhagen-Thiessen and M. Borchelt (internal medicine and geriatrics), H. Helmchen and F. Reischies (psychiatry). Field research was coordinated at various phases by R. Nuthmann, M. Neher and K. Fröhlich.

References

1. P. B. Baltes and K. U. Mayer (eds) (1999) *The Berlin Aging Study: Aging from 70 to 100* (New York: Cambridge University Press).
2. M. Marmot, C. Ryff, L. L. Bumpass, M. Shipley and N. F. Marks (1997) Social inequalities and health: next questions and converging evidence. *Social Sciences and Medicine*, **44**, 901–910.
3. K. C. Kling, M. M. Seltzer and C. D. Ryff (1997) Distinctive late-life challenges: implications for coping and well-being. *Psychology and Aging*, **12**, 288–295.
4. D. C. Reitzes, E. J. Mutran and M. E. Fernandez (1996) Does retirement hurt well-being? Factors influencing self-esteem and depression among retirees and workers. *Gerontologist*, **36**, 649–656.
5. L. M. Verbrugge, J. M. Reoma and A. L. Gruber-Baldini (1994) Short-term dynamics of disability and well-being. *Journal of Health and Social Behavior*, **35**, 97–117.
6. P. B. Baltes and M. M. Baltes (1990) Psychological perspectives on successful aging: the model of selective optimization with compensation. In P. B. Baltes and M. M. Baltes (eds), *Successful Aging: Perspectives from the Behavioral Sciences* (New York: Cambridge University Press) pp. 1–34.
7. J. W. Rowe and R. L. Kahn (1997) Successful aging. *Gerontologist*, **37**, 433–440.
8. A. Campbell, P. E. Converse and W. L. Rodgers (1976) *The Quality of American life: Perceptions, Evaluations, and Satisfactions* (New York: Russell Sage Foundation).
9. E. Diener, E. M. Suh, R. E. Lucas and H. L. Smith (1999) Subjective well-being: three decades of progress. *Psychological Bulletin*, **125**, 276–302.
10. C. D. Ryff and B. Singer (1998) The contours of positive human health. *Psychological Inquiry*, **9**, 1–28.
11. N. M. Bradburn (1969) *The Structure of Psychological Wellbeing* (Chicago, IL: Aldine).
12. D. Watson, L. A. Clark and A. Tellegen (1988) Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology*, **54**, 1063–1070.
13. M. P. Lawton (1975) The Philadelphia Geriatric Center Morale Scale: a revision. *Journal of Gerontology*, **30**, 85–89.
14. M. P. Lawton, M. Moss, C. Hoffman, R. Grant, T. TenHave and M. Kleban (1999) Health, valuation of life, and the wish to live. *The Gerontologist*, **39**, 406–416.
15. J. Brandtstädter and W. Greve (1994) The aging self: stabilizing and protective processes. *Developmental Review*, **14**, 52–80.
16. D. Kahneman, E. Diener and N. Schwarz (eds) (1999) *Well-being: The Foundations of Hedonic Psychology* (New York: Russell Sage Foundation).
17. S. E. Taylor and J. D. Brown (1988) Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin*, **103**, 193–210.
18. P. T. Costa, Jr. and R. R. McCrae (1980) Influence of extraversion and neuroticism on subjective well-being: happy and unhappy people. *Journal of Personality and Social Psychology*, **38**, 668–678.
19. A. R. Herzog, W. L. Rodgers and J. Woodworth (1982) *Subjective Well-being among Different Age Groups* (Research Report Series) (Ann Arbor, MI: University of Michigan, Institute for Social Research, Survey Research Center).
20. D. K. Mroczek and C. M. Kolarz (1998) The effect of age on positive and negative affect: A developmental perspective on happiness. *Journal of Personality and Social Psychology*, **75**, 1333–1349.
21. P. B. Baltes (1997) On the incomplete architecture of human ontogeny: selection, optimization, and compensation as foundation of developmental theory. *American Psychologist*, **52**, 366–380.

22. J. E. Birren, J. E. Lubben, J. C. Rowe and D. E. Deutchman (eds) (1991) *The Concept and Measurement of Quality of Life in the Frail Elderly* (San Diego, CA: Academic Press).
23. J. Smith, W. Fleeson, B. Geiselmann, R. A. Jr. Settersten and U. Kunzmann (1999) Sources of well-being in very old age. In P. B. Baltes and K. U. Mayer (eds) *The Berlin Aging Study: Aging from 70 to 100* (New York: Cambridge University Press), pp. 450–471.
24. M. P. Lawton and R. H. Lawrence (1994) Assessing health. *Annual Review of Gerontology and Geriatrics*, **14**, 23–56.
25. J. W. Rowe and R. L. Kahn (1987) Human aging: Usual and successful. *Science*, **237**, 143–149.
26. J. Tsevat, J. C. Weeks, E. Guadagnoli, A. N. A. Tosteson, C. M. Mangione, J. S. Pliskin, M. C. Weinstein and P. D. Cleary (1994) Using health-related quality-of-life information: clinical encounters, clinical trials, and health policy. *Journal of General Internal Medicine*, **9**, 576–582.
27. M. M. Baltes, I. Maas, H.-U. Wilms, M. Borchelt and T. D. Little (1999) Everyday competence in old and very old age: theoretical considerations and empirical findings. In P. B. Baltes and K. U. Mayer (eds), *The Berlin Aging Study: Aging from 70 to 100*, (New York: Cambridge University Press), pp. 384–402.
28. M. P. Lawton, M. R. DeVoe and P. Parmelee (1995) Relationship of events and affect in the daily life of an elderly population. *Psychology and Aging*, **10**, 469–477.
29. A. M. Freund and J. Smith (1999) Content and function of the self-definition in old and very old age. *Journal of Gerontology: Psychological Sciences*, **54B**, P55–P67.
30. K. Hooker (1992) Possible selves and perceived health in older adults and college students. *Journal of Gerontology: Psychological Sciences*, **47**, P85–P95.
31. J. Smith and A. M. Freund (in press) The dynamics of possible selves in very old age. *Journal of Gerontology: Psychological Sciences*, **54**.
32. B. L. Neugarten (1974) Age groups in American society and the rise of the young-old. *Annals of the American Academy of Politics and Social Sciences*, September, 187–198.
33. P. Laslett (1991) *A Fresh Map of Life: The Emergence of the Third Age*. Cambridge (MA: Harvard University Press).
34. R. M. Suzman, D. P. Willis and K. G. Manton (eds) (1992) *The Oldest Old* (New York: Oxford University Press).
35. P. B. Baltes and J. Smith (1999) Multilevel and systemic analyses of old age: theoretical and empirical evidence for a fourth age. In V. L. Bengtson and K. W. Schaie (eds), *Handbook of Theories of Aging*, (New York: Springer) pp. 153–173.
36. J. E. Birren and J. J. F. Schroots (1996) History, concepts, and theory in the psychology of aging. In J. E. Birren and K. W. Schaie (eds) *Handbook of the Psychology of Aging*, 4th edn (San Diego, CA: Academic Press), pp. 3–23..
37. P. B. Baltes, K. U. Mayer, H. Helmchen and E. Steinhagen-Thiessen (1993) The Berlin Aging Study (BASE): Overview and design. *Ageing and Society*, **13**, 483–515.
38. P. B. Baltes and J. Smith (1997) A systemic-wholistic view of psychological functioning in very old age: introduction to a collection of articles from the Berlin Aging Study. *Psychology and Aging*, **12**, 395–409.
39. I. Maas, M. Borchelt and K. U. Mayer (1999) Generational experiences of old people in Berlin. In P. B. Baltes and K. U. Mayer (eds), *The Berlin Aging Study: Aging from 70 to 100* (New York: Cambridge University Press), pp. 83–110.
40. M. P. Lawton (1991) A multidimensional view of quality of life in frail elders. In J. E. Birren, J. E. Lubben, J. C. Rowe and D. E. Deutchman (eds), *The Concept and Measurement of Quality of Life in the Frail Elderly* (San Diego, CA: Academic Press), pp. 3–27.

41. G. M. Williamson and R. Schulz (1992) Physical illness and symptoms of depression among elderly outpatients. *Psychology & Aging*, **7**, 343–351.
42. E. Steinhagen-Thiessen and M. Borchelt (1999) Morbidity, medication, and functional limitations in very old age. In P. B. Baltes and K. U. Mayer (eds), *The Berlin Aging Study: Aging from 70 to 100*, (New York: Cambridge University Press), pp. 131–166.
43. M. Hamilton (1967) Development of a rating scale for primary depressive illness. *British Journal of Consulting and Clinical Psychology*, **6**, 278–296.
44. M. E. Tinetti (1986) A performance-oriented assessment of mobility problems in elderly patients. *Journal of the American Geriatrics Society*, **34**, 119–126.
45. F. I. Mahoney and D. W. Barthel (1965) Functional evaluation: the Barthel Index. *Maryland Medical Journal*, **14**, 61–65.
46. J. Smith and M. M. Baltes (1998) The role of gender in very old age: profiles of functioning and everyday life patterns. *Psychology and Aging*, **13**, 676–695.
47. M. Borchelt, R. Gilberg, A. L. Horgas and B. Geiselmann (1999) On the significance of morbidity and disability in old age. In P. B. Baltes and K. U. Mayer (eds), *The Berlin Aging Study: Aging from 70 to 100* (New York: Cambridge University Press), pp. 403–429.
48. W. Glatzer (1992) Die Lebensqualität älterer Menschen in Deutschland [Quality of life of older people in Germany]. *Zeitschrift für Gerontologie*, **25**, 137–144.
49. H. Helmchen, M. M. Baltes, B. Geiselmann, S. Kanowski, M. Linden, F. M. Reischies, M. Wagner, T. Wernicke and H.-U. Wilms (1999) Psychiatric illnesses in old age. In P. B. Baltes and K. U. Mayer (eds), *The Berlin Aging Study: Aging from 70 to 100* (New York: Cambridge University Press), pp. 167–196.
50. U. Kunzmann, T. D. Little and J. Smith (2000) Is age-related stability of well-being a paradox? Cross-sectional and longitudinal evidence from the Berlin Aging Study. *Psychology and Aging*, **15**, 511–526.
51. L. L. Carstensen (1993) Motivation for social contact across the life span: a theory of socioemotional selectivity. *Nebraska Symposium on Motivation*, **40**, 209–254.
52. E. L. Idler (1993) Age differences in self-assessments of health: age changes, cohort differences, or survivorship? *Journal of Gerontology: Social Sciences*, **48**, S289–S300.
53. H. Maier and J. Smith (1999) Psychological predictors of mortality in old age. *Journal of Gerontology: Psychological Sciences*, **54B**, P44–P54.
54. D. Jopp, I. Lißmann and J. Smith (2000) Perceived negative changes across multiple areas of functioning: A unique predictor of mortality in very old age. Paper presented at the *Annual Meetings of the Gerontological Society of America*, Washington, November.
55. J. Smith, A. M. Freund, U. Kunzmann and P. B. Baltes (2001) Changes in personality and well-being: Age 70 to 100. Unpublished manuscript, Max Planck Institute for Human Development, Berlin, Germany.
56. J. Smith and P. B. Baltes (1997) Profiles of psychological functioning in the old and oldest old. *Psychology and Aging*, **12**, 458–472.

About the Author

Jacqui Smith is a Senior Research Scientist in the Center for Lifespan Psychology at the Max Planck Institute for Human Development in Berlin and Interim Chair of a Research Group on Psychological Gerontology in the Medical School of the Free University of Berlin. Her research interests as a lifespan developmental psychologist include the study of profiles of psychological functioning in older adults, the application of intelligence and wisdom-related knowledge in everyday life, and psychological mortality.