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Longitudinal Effects of Subjective Aging on Health and Longevity: An Updated Meta-Analysis

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This article updates and extends an earlier meta-analysis (Westerhof et al., 2014) on the longitudinal effects of subjective aging (SA) on health outcomes. A systematic search in different databases (APA PsycInfo, PubMed, Web of Science, and Scopus) resulted in 99 articles, reporting on 107 studies. Participants: Studies had a median sample size of 1,863 adults with a median age of 66 years. A randomized effect meta-analysis showed a significant, small effect (likelihood ratio = 1.347; 95% confidence interval [1.300, 1.396]; $p < .001$), similar in magnitude to the previous meta-analysis of 19 studies. Although the results showed high heterogeneity in the longitudinal link between SA and health outcomes, there were no differences in effects according to chronological age of participants, welfare state status (more or less developed social security system), length of follow-up, type of health-related outcome, or quality of the study. Effects were stronger for multiitem measures of self-perceptions of aging than for the frequently used single-item measures assessing subjective age, especially for indicators of physical health. Based on this meta-analysis, building on five times more studies than the 2014 review, we consider the associations of measures of SA with health and longevity across time as robust, albeit small in size. Future research should concentrate on the clarification of pathways mediating the relation between SA and health outcomes, as well as potential bidirectional effects.

Public Significance Statement
This article focuses on the effects that measures of subjective aging (SA; i.e., how a person perceives, interprets, and evaluates their own aging) have on health outcomes later in life. Based on a systematic search of available literature, the results of over 100 studies were analyzed. Across all studies, it was found that measures of SA indeed have an effect on health outcomes later in life. Promoting positive views on SA in public health might therefore result in important health gains.

Keywords: subjective age, self-perceptions of aging, health, longevity, meta-analysis

The concept of subjective aging (SA) addresses how people reflect on their own development and aging as they move through adulthood and old age (Brandtstädter & Rothermund, 2002; Diehl et al., 2021; Wurm et al., 2017). That is, aside from using their chronological age as a marker of their position in the life course, individuals interpret their behavioral experiences with their own aging process to establish a sense of SA (Settersten & Hagestad, 2015). As has been argued, this sense of SA becomes an important part of aging individuals' self and

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identity (Diehl et al., 2015, 2021; Levy, 2022). Conceptually, SA is an individual-level variable indicating how a person perceives, interprets, and evaluates their own aging against existing cultural representations of what aging and old age may mean. The latter is frequently described as age stereotyping operating at the societal level, with potential differences between societies, countries, or cultures when seen in a more global context (e.g., Löckenhoff et al., 2009; Pinquart & Wahl, 2021). SA and age stereotypes are certainly interconnected, and SA has been found to mediate the connection among general age stereotypes and health at the individual level (Brothers et al., 2021).

Following an earlier meta-analysis on SA and health outcomes (Westerhof et al., 2014), the current meta-analysis focuses exclusively on consequences of SA for individuals' development and aging, with a particular emphasis on health-related outcomes (see also Wurm et al., 2017). Given the large increase of research interest in this topic in the past decade, the present study provides an update and extension of the earlier meta-analysis on the longitudinal effects of SA on health outcomes and longevity by Westerhof et al. (2014).

Previous Research

In the previous meta-analysis, Westerhof et al. (2014) synthesized the available evidence on associations between various indicators of SA with health-related outcomes up to June 2013. Solely relying on longitudinal studies ($N = 19$), the authors found an overall significant effect of measures of SA on a range of health markers, including functional health, health-related quality of life, physical illnesses, and longevity; likelihood ratio (LR) = 1.429; 95% confidence interval (CI) [1.273, 1.604]; $p < .001$. These findings were robust as observed effects did neither vary across different conceptualizations of SA (comparing measures of SA to measures of self-perceptions of aging [SPA]) nor by study quality. Furthermore, most studies controlled for a range of confounding variables, such as gender, level of education, baseline health, depressive symptoms, and loneliness. However, the analyses also revealed pronounced heterogeneity among the included studies. Studies with a shorter period of follow-up and focusing on health (vs. longevity) had a stronger effect, suggesting that more proximal effects were stronger than more distal effects. Stronger effects were found in studies with younger participants than older participants (age at baseline in the studies varied between 57 and 85 years, with a median age of 63 years), suggesting that the effects of SA are stronger when age-related health problems have not yet emerged and might still be more easily influenced. Finally, effects were stronger in countries where state provisions of welfare were minimal. Tying in with sociological descriptions of different welfare state regimes (Bambra, 2007; Deeming, 2017; Esping-Andersen, 1990), some welfare states (e.g., Scandinavian countries) give more state support to older citizens, for example, in ensuring basic health and retirement provisions. Other states, such as the United States, rely more on the responsibilities of individual citizens to care for themselves. In the first kind of welfare states, provisions are often tied to chronological age, making it more relevant to incorporate chronological age in one's SA. In the latter kind of welfare state regimes, SA might matter more for health-related outcomes as provisions are less equally distributed across individuals. In sum, measures of SA had a small but consistent and significant effect on health-related outcomes.

Because the meta-analysis of Westerhof et al. (2014) had only 19 available studies at the time, its statistical power was limited, in particular, with regard to the moderation analyses. Furthermore, it was not possible to distinguish between different measures of SA beyond subjective age versus SPA or between different health outcomes beyond health and longevity. An additional limitation was that the variables used in the moderation analyses were often confounded. For example, studies focusing on health had younger samples than studies on longevity, so it was unclear whether the outcome or the sample characteristics explained the results (Westerhof et al., 2014).

A recent flurry of systematic and meta-analytical reviews has further investigated the relation of SA with health-related outcomes (Alonso Debreczeni & Bailey, 2021; Chang et al., 2020; Diehl et al., 2021; Kotter-Grühn et al., 2016; Sabatini et al., 2020; Tully-Wilson et al., 2021; Westerhof & Wurm, 2018; Wurm et al., 2017). The systematic review by Chang et al. (2020) largely focused on ageism but also included more than 50 studies on SPA and health. Alonso Debreczeni and Bailey (2021) focused exclusively on subjective age and included data from 24 independent cross-sectional and longitudinal studies. Tully-Wilson et al. (2021) included longitudinal evidence from 21 independent datasets but considered only the unidimensional measure of attitudes toward one's own aging (Lawton, 1975) as an indicator of SA. Finally, Sabatini et al. (2020) analyzed data from six studies that used a multidimensional measure of SA based on the concept of awareness of age-related change (Diehl et al., 2021; Diehl & Wahl, 2010). These recently published reviews (Chang et al., 2020; Tully-Wilson et al., 2021) and meta-analyses (Alonso Debreczeni & Bailey, 2021; Sabatini et al., 2020) provide further evidence for the link between SA and health outcomes.

Even though the number of studies has increased over the past decade, the picture emerging from these recent reviews and meta-analyses on the effects of SA on health-related outcomes has remained incomplete for two reasons. First, several studies focused on a single specific SA construct and thus did not compare different, competing SA constructs. Second, several of these more recent reviews and meta-analyses (e.g., Alonso Debreczeni & Bailey, 2021; Sabatini et al., 2020) included cross-sectional studies in their study pool, potentially overestimating the associations between SA and outcomes and ignoring the fact that only data from longitudinal studies permit directional conclusions. Thus, we argue that a more comprehensive and integrative analysis of SA and health outcomes is in order, with the intention of updating and extending the meta-analysis of Westerhof et al. (2014) in a comprehensive way.

Update of Previous Meta-Analytical Findings

The first goal of the current meta-analysis was therefore to update the meta-analysis of Westerhof et al. (2014) across a larger number of longitudinal studies. In line with the earlier systematic reviews and meta-analyses, we hypothesized that SA is a significant predictor of health-related outcomes over time (Hypothesis 1.1). The update also included the analysis of potential moderators, expecting to confirm the earlier results. We hypothesized that effects would be similar (a) for measures of subjective age versus measures of SPA and (b) regardless of study quality (Hypothesis 1.2). Additionally, we hypothesized that effects would be larger for (a) markers of health as compared to longevity, (b) a shorter period of follow-up,

(c) a younger sample, and (d) states with a less supportive welfare regime (Hypothesis 1.3).

Extension 1: Comparing Different Measures of SA

A major limitation of recent systematic reviews and meta-analyses is that they were selective in terms of which measures of SA were included. For example, Alonso Debreczeni and Bailey (2021) only considered subjective age; Tully-Wilson et al. (2021) only included attitudes toward own aging as SA indicators. Westerhof et al. (2014) were forced to collapse unidimensional and multidimensional measures of SPA due to statistical power problems. Hence, no meta-analysis to date was able to make more fine-grained comparisons of measures of SA.

Authors have distinguished between several different constructs of SA (Diehl et al., 2014; Wurm et al., 2017), including subjective age (sometimes called age identity) and different conceptualizations regarding SPA. Subjective age refers to how old (or young) a person feels irrespective of their chronological age, whereas the term SPA refers to how a person interprets their own aging process (Diehl et al., 2014; Faudzi et al., 2019; Kastenbaum et al., 1972; Pinquart & Wahl, 2021). SPA may be further conceptualized as a unidimensional construct, placing adults' perceptions on a single continuum from positive to negative (e.g., attitudes toward one's own aging; Lawton, 1975; Miche et al., 2014), or as a multidimensional construct, capturing distinct dimensions of adults' aging experiences, such as perceived gains and losses in particular life domains due to growing older (Brothers et al., 2019; Laidlaw et al., 2007; Marquet et al., 2016; Steverink et al., 2001).

The importance of utilizing a multidimensional approach and distinguishing between the perception of age-related gains and losses was raised already by Keller et al. (1989). Furthermore, it dates back to the fundamental insight by Baumeister et al. (2001) and an extensive body of research that negative experiences and evaluations tend to have more impact on behavior than positive ones. Although a recent study found stronger support for adults' perceptions of age-related gains as predictors of longevity (Wurm & Schäfer, 2022), other studies have shown stronger associations between age-related losses and markers of health (Brothers et al., 2017, 2019; Dutt, Gabrian, & Wahl, 2018).

Hence, we assessed the differential impact of SA measures as follows: (a) subjective age, (b) unidimensional measures like attitudes toward one's own aging, (c) perceived age-related gains, and (d) perceived age-related losses as assessed by multidimensional measures. We expected that multidimensional measures of losses would show the strongest effects on health and longevity (Hypothesis 2.1).

Extension 2: Comparing Different Health Outcomes

Another important limitation of the existing systematic reviews and meta-analyses is that the analyses so far have been limited in their comparisons of the effects of SA across different potential health outcomes. Health outcomes that have been studied but could not be compared in detail are as diverse as well-being, health behaviors, biomarkers, mental health, subjective physical health, objective physical health, and longevity.

Theoretical frameworks, like the stereotype embodiment theory, have also been proposed that help to explain why SA is related to health outcomes across time (Diehl & Wahl, 2010; Levy, 2009; Weiss & Kornadt, 2018; Wurm et al., 2017). A first distinction can be made between pathways, health states, and longevity: pathways may contribute to important individual differences in health states across time (e.g., Boehmer, 2006; Levy, Slade, & Kunkel, 2002; Moser et al., 2011; Wurm et al., 2007). In the long run, these pathways may contribute to premature mortality or longevity, respectively (e.g., Kotter-Grühn et al., 2009; Levy, Slade, & Kunkel, 2002; Maier & Smith, 1999; Markides & Pappas, 1982; Wurm & Schäfer, 2022). Regarding health states, it has been argued that it is important to distinguish between mental health (e.g., depressive symptoms), subjective physical health (e.g., self-rated health), and objective physical health (e.g., physician-reported health; Diehl & Wahl, 2010; Wurm et al., 2017). Various pathways that have been distinguished are psychological, behavioral, and physiological pathways (Kuypers & Bengtson, 1973; Levy, 2009; Wurm et al., 2013).

Psychological pathways linking measures of SA to health indicators include, for instance, maintaining a positive perception of one's own aging process. This is generally considered an adaptive strategy in later life because it helps to maintain a consistent and positive self-concept in a culture that generally devalues old age and older adults (Levy, 2022; Westerhof & Barrett, 2005). A more consistent and positive self-concept contributes to well-being (Mock & Eibach, 2011; Wurm et al., 2008), which, in turn, has been found to be related to health and longevity over time (Chida & Steptoe, 2008; Lamers et al., 2012).

Behavioral pathways linking SA with health include preventive health behaviors and coping efforts. For example, individuals with younger and more positive SPA are more inclined to engage in preventive health behaviors, such as greater physical activity (e.g., Levy & Myers, 2004; Wurm et al., 2010). They are also more likely to engage in task-oriented as opposed to avoidance-oriented coping strategies (Boehmer, 2007), which, in turn, contribute to health and longevity across time.

Physiological pathways through which SA is linked to health indicators are manifold. For example, more negative SA may lead to physiological responses, such as greater cardiovascular stress (Levy et al., 2000). In addition, more negative SA has been found to be associated with higher plasma concentrations of inflammatory biomarkers, such as C-reactive protein (Stephan et al., 2015b). Overall, physiological pathways seem so far the least researched, and the various biomarkers are diverse and associated with health measures and longevity in complex ways (Schönstein et al., 2022).

The current meta-analysis assessed the impact of SA on a variety of health outcomes: pathways, health states, and longevity. Even though theoretical reasoning suggests that pathways might mediate between SA on the one hand, and health states on the other, and that health states might mediate between pathways and longevity, few studies have actually tested these mediating effects (e.g., see Levy & Bavishi, 2018, for an exception). Hence, we can only treat pathways, health states, and longevity as separate outcomes and not their interrelations in a mediating model. Specifically, we examined the associations of SA with several health-related outcomes, including (a) psychological pathways, (b) behavioral pathways, (c) physiological pathways, (d) mental health states, (e) subjective states of physical health, (f) objective states of physical health, and (g) longevity, or chance of survival after a number of years. We expected that the effects would be stronger for pathways (a–c) than for the mental and physical health states (d–f) as pathways theoretically contribute to the latter in the long run. We also expected that the effects would be stronger for health states (d–f) than for longevity (g), as the former contribute to longevity over time (Hypothesis 2.2).

Extension 3: Comparing Different Measures of SA on Different Health Outcomes

A last limitation of existing systematic reviews and meta-analyses is that there might have been some confounding among variables used in subgroup analyses and metaregression analyses. For example, the earlier finding that effects of SA are stronger for markers of health as compared to longevity could have also been the result of the fact that studies on markers of health had younger samples than the studies on longevity (Westerhof et al., 2014). Given the large increase in available studies in the past 10 years, the present study addressed these limitations as much as possible. Specifically, we aimed to determine the differential impact of subjective age versus SPA on pathways, health states, and longevity. In particular, we expected that Hypothesis 2.2 would be confirmed for both measures of subjective age and measures of SPA. That is, we expected to see no interaction between measures of SA and measures of pathways, health states, and longevity (Hypothesis 2.3).

Method

Transparency and Openness

The study was preregistered in Prospero (CRD42020197690), an international database for prospective registration of systematic reviews. We applied guidelines from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement on transparent reporting on meta-analyses, in particular, regarding search strategy, eligibility criteria, quality assessment, and publication bias (Moher et al., 2009). The general analytical approach for the present study was adapted from Westerhof et al. (2014). The source data were available in the articles, although some authors provided additional aggregated data upon request. Upon review, the Ethics Committee of the Faculty Behavioural, Management, and Social Sciences at the University of Twente, the Netherlands, exempted the study from ethical assessment following Dutch standards for ethical conduct of scientific research with humans (Study title: Assessing the Impact of Subjective Aging on Health-Related Outcomes: An updated Meta-Analysis of the Evidence from Longitudinal Studies; Protocol No.: BFD-BMS/EC-5-2022). The complete data, Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist, and ethics statement are available from https://osf.io/62rdf (Westerhof, 2022).

Search Strategy and Selection of Studies

A systematic search was performed in four electronic databases: APA PsycInfo, PubMed, Scopus, and Web of Science, up to January 26, 2022. The main search strategy was based on two key concepts: SA and longitudinal studies. The databases were searched for articles with these components in either title, abstract, or keywords. Terms referring to SA included the following while allowing for plurals and spelling differences (e.g., aging vs. ageing): age identity, aging-related cognitions, aging satisfaction, age views, aging views, attitude toward own aging, awareness of age-related change, cognitive age, felt age, images of aging, perceived age, psychological age, SPA, subjective age, SA, and views on aging. Terms referring to longitudinal studies included the following: longitudinal, panel, prospective, or over time. In order not to limit any health outcomes beforehand, we did not use terms referring to specific health outcomes in the search strategy but rather checked whether the study was health-related during the inclusion process. Studies in peer-reviewed journals were searched, applying no limitations on publication year or language. Furthermore, the reference lists of other recent meta-analyses were cross-checked, and the authors' expert base provided further insight into additional eligible studies, including recently published papers.

Three authors (ANB, JSS, and HYT) independently rated potentially eligible studies based on the full-text articles. All articles that were identified by the database searches were rated by two authors. Disagreements between raters were resolved by having the third rater review the article and with all raters reaching a consensus.

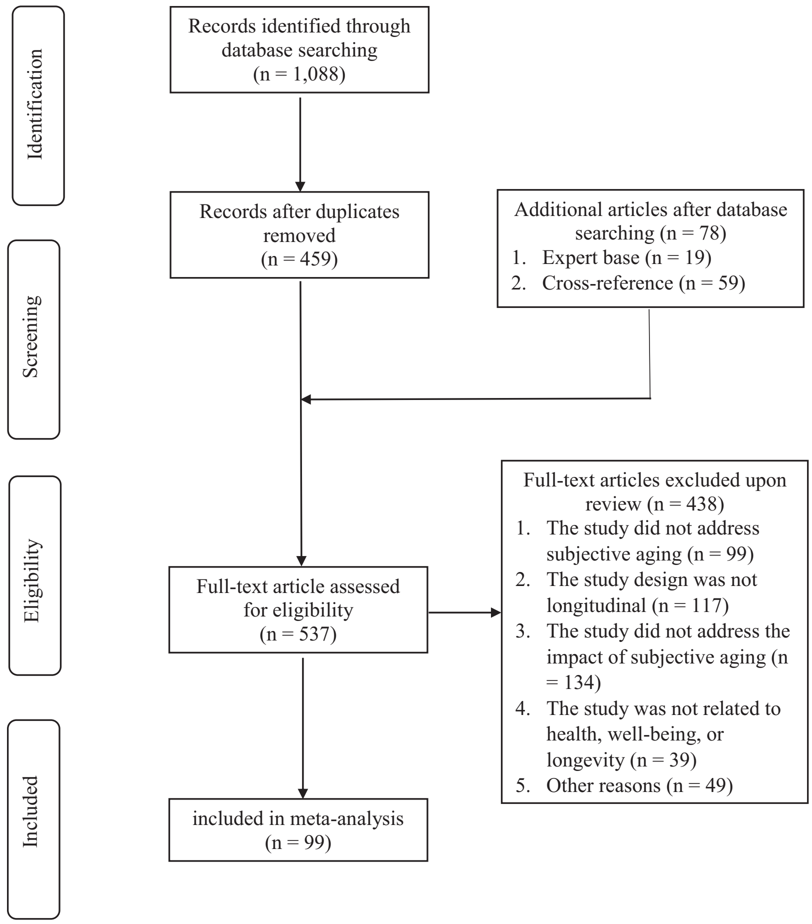
Studies were included if they reported the effects of SA on health-related outcomes, such as well-being, health behaviors, coping, biomarkers, functional measures, mental health, physical health, or longevity over time. Studies were excluded when any of the following conditions were met: (a) The study addressed other facets of ageism but not SA (e.g., perceived age discrimination, perceived age by others, stereotypes about older persons, societal age views); (b) the study did not address health-related outcomes (e.g., job performance, cognitive performance, personality); (c) the study design was not longitudinal (e.g., experimental study, cross-sectional study, intervention study); (d) the study did not focus on trait-like characterizations of SA (e.g., state-like measurements, such as daily ecological momentary assessment designs that focus on short-term variations in SA and health) because these studies offer microlongitudinal observational intervals that could not directly be compared with traditional longitudinal studies; (e) the study did not examine the impact of SA on health-related outcomes (e.g., studies addressing change in SA); or (f) the article did not report enough data to be included in the meta-analysis (even after consulting the authors when not enough data were obtained).

The flow diagram of the study selection is shown in Figure 1. Searching databases resulted in 1,088 unique records. After removing 629 duplicate records, 459 articles remained. Cross-checking the expert base and reference lists of other meta-analyses resulted in 78 additional articles. Of these 537 articles, 438 were excluded based on full-text reviews (see Figure 1, for reasons). This process resulted in a total of 99 articles included in the updated meta-analysis: five times more than the nineteen studies included in the meta-analysis from about a decade ago (Westerhof et al., 2014).

Data Extraction and Meta-Analytic Strategy

We used the software Comprehensive Meta-Analysis (CMA; Borenstein et al., n.d.) to meta-analytically combine study findings. The articles reported hazard ratios, risk ratios, odds ratios, LRs, regression coefficients, standardized effects in structural equation models, effects in multilevel models, correlations, or means. When both bivariate relations of SA to health-related outcomes and more advanced analyses were reported (e.g., controlling for confounders like demographic variables, psychosocial functioning, and baseline health variables), the results of the latter were used for the meta-analysis. We used findings of unidirectional models (e.g., the effect of SA on health) even when bidirectional models (e.g., including the

Figure 1
Flow Diagram of Study Selection



effects of both SA on health and health on SA) were available to make the best possible comparison between studies. Similarly, we used the baseline measure of SA and the follow-up health-related outcome rather than change across time as not all studies assessed change across time. In cases where sufficient data were not available in the published article, we contacted authors of published studies to request standardized estimates.

Two articles included two studies, and three articles included three studies with independent sampling of participants. These were considered separate studies, so the 99 articles reported findings from a total of 107 independent studies. We refer to a total of 107 studies (rather than 99 articles) in the remainder of the article. When studies presented findings at multiple time points, the findings for the longest follow-up were used. In total, this resulted in findings from 252 analyses. Several studies reported more than one health-related outcome, so a meta-analysis for the particular study was done to include only the average effect size per study. However, when a study reported results of SA measures that fell into different categories (e.g., both subjective age and SPA), the study results were analyzed separately in the subgroup analyses. The same logic was applied when health-related outcomes were reported across categories (e.g., both mental and physical health).

Hazard, risk, or odds ratios with their 95% CI were extracted. When regression coefficients or correlations were reported, these were converted to odds ratios in CMA. LRs (Lamers et al., 2012) were used to refer to different ratios (hazard, risk, and odds ratios). All ratios were computed so that LRs above 1 indicate a positive association of SA to health-related outcomes. All LRs were weighted by the inverse of their standard errors. An LR was considered statistically significant if the 95% CI did not include the value of 1. As we expected heterogeneity across studies, a random-effects meta-analysis was performed. This assumes that the studies are estimating different but related effects rather than being replicas of each other. It also adjusts the study weights according to the level of heterogeneity in order to compute the 95% CI around the pooled effect estimate (Deeks et al., 2008).

Study quality was assessed with a protocol that provides a total score for each included study. The protocol was based on the quality checklists outlined by Wong et al. (2008) and by Lamers et al. (2012) and reflects the protocol used in the Westerhof et al. (2014) meta-analysis. To note, the retention rate criterion utilized in the Westerhof et al. (2014) meta-analysis was replaced with the attrition information criterion to account for more information in the current meta-analysis. A total of six quality criteria were applied and coded as 0 (*not applicable*) or 1 (*applicable*): probability sampling (n = 70), response rate 60% or above (n = 37), attrition information (n = 68), multiitem scale with Cronbach's α .70 or higher (n = 39), control for any confounding variables, such as gender, chronological age, level of education, and loneliness (n = 97), and control for baseline values of outcome variables (n = 61; not coded for studies on longevity). The overall quality of the study was assessed by counting the number of applicable items and dividing them either by five (i.e., for longevity studies) or six (i.e., for all other studies), which resulted in scores between 0 and 1. Based on the scoring categorization applied in Westerhof et al. (2014), studies were classified into three groups: scores ≤ .33 (n = 10), between .34 and .66 (n = 39), and ≥.67 (n = 58). The information to rate study quality was extracted by ANB, AB, and HYT and was double-checked by GW. Discrepancies were resolved by reassessing the criteria for the article and, if necessary, generating a new study quality score.

The analysis proceeded in several steps. To assess Hypothesis 1.1, an analysis was performed to estimate the overall effect across all studies. We also examined heterogeneity or the variation in effect sizes between studies. The Q-test indicates the probability of heterogeneity, and the I^2 index indicates its magnitude (0%–30% is low; 30%–75% is moderate; 75%–100% is high; Deeks et al., 2008). Publication bias toward an overreporting of positive findings was assessed with three indices (Ferguson & Brannick, 2012): the funnel plot, skewness, and Egger's test of intercept. The funnel plot examines effect size (LR) against standard error. Skewed distributions toward the left or right indicate a possible publication bias. Egger's test of intercept is the correlation between the precision of the study (i.e., the inverse of the standard error) and the standardized effect (i.e., the effect size divided by its standard error). Duval and Tweedie's (2000) trim and fill analysis estimates effect sizes after correcting for publication bias.

To assess Hypotheses 1.2 and 1.3, four subgroups and two metaregression analyses were performed similar to those reported in Westerhof et al. (2014). SA measures were categorized into measures of subjective age versus measures of SPA, whereas outcomes were categorized into health-related outcomes versus longevity. We also extracted the length of follow-up in years (e.g., always the longest follow-up reported in a study), the average age of the sample (e.g., at the first, baseline measurement of the study), and the welfare support system in the country where the study was done (e.g., United States, Canada, Australia, United Kingdom with less state support and Germany, Switzerland, and Finland with more state support; Bambra, 2007; Esping-Andersen, 1990). Subgroup analyses compared the effect sizes according to SA measures (i.e., subjective age vs. SPA), outcome measures (i.e., health-related outcomes vs. longevity), welfare regimes (i.e., less or more state support), and quality scores (i.e., ranging from 1 to 3). Unrestricted maximum likelihood mixed-effects metaregression regressed the effect size per study at the time of follow-up and the average sample age.

To assess Hypothesis 2.1, SA measures were grouped into four categories: (a) subjective age, (b) unidimensional measures of SPA, (c) multidimensional gain-oriented, and (d) multidimensional loss-oriented assessments of SPA. The categorization was based on the actual use of the instrument. For example, some studies divided the attitudes toward aging instrument into subscales of gains and losses (e.g., Mejía et al., 2020), even though it is originally a unidimensional instrument (Lawton, 1975).

To assess Hypothesis 2.2, health-related outcomes were divided into seven categories: (a) psychological pathways (measures of well-being, like life satisfaction, positive affect, negative affect, psychological well-being), (b) behavioral pathways (measures like physical activity, preventive health behavior, coping behavior), (c) physiological measures (e.g., biomarkers), (d) mental health states (e.g., depressive symptoms, anxiety symptoms), (e) subjective physical health states (e.g., self-reported health conditions, self-reported hospitalizations, self-rated health), (f) objective physical health states (e.g., frailty or diagnosed diseases, dementia-related disorders), and (g) longevity.

Hypothesis 2.3 stated that the effects of different measures of SA would be similar for different measures of health-related outcomes. To have enough studies within each category, SA measures were divided into two categories (subjective age and SPA) and health-related outcomes into four categories (pathways: a–c, mental health: d, physical health: e and f, and longevity: g). In this way, similarities and differences in health-related outcomes could be assessed separately for subjective age and SPA and then compared to each other.

Results

Descriptive Findings

Table 1 provides an overview of the 107 studies included. The median year of publication was 2018 (ranging from 1982 to 2022). The median sample size of the studies was 1,863 participants, varying from 58 to 18,373 participants. The median of the average participant age was 66 years (ranging from 40 to 90 years). The median follow-up time was 4.5 years, varying between 2 weeks and 23 years.

First, a total of 52 studies assessed *subjective age*, with the majority using a single-item felt-age question (n = 44 studies); 60 studies focused on *SPA*, with 27 studies using the Attitude Toward Own Aging (ATOA) subscale of the Philadelphia Geriatric Center Morale Scale (Lawton, 1975), nine studies used the Aging-Related Cognition-Scales (AgeCog; Steverink et al., 2001; Wurm et al., 2007), five used the Awareness of Age-Related Change (AARC) questionnaire (Brothers et al., 2019; Kaspar et al., 2019), four used the Attitudes to Aging Questionnaire (AAQ; Laidlaw et al., 2007; Marquet et al., 2016), and one used the Images of Aging Scale (IAS) as adapted for self-ratings (Levy et al., 2004). Studies using instruments to assess SPA were further divided into unidimensional measures (e.g., ATOA) and multidimensional measures (e.g., AgeCog, AARC, AAQ, IAS).

Second, for health-related outcome variables, 11 studies used measures of psychological pathways, 14 studies assessed behavioral pathways, 10 studies focused on physiological pathways, 25 studies used indicators of mental health, 35 used subjective indicators of physical health, 13 measured objective indicators of physical health, and longevity was included as an outcome variable in 20 studies.

Studies were conducted in the United States (n = 49), Europe (n = 45), Australia (n = 2), Israel (n = 7), Hong Kong (n = 1), and China (n = 4). Welfare regime for the country in which the study took place was also accounted for in the current meta-analysis. Israel and the European countries of Germany, Switzerland, Spain, Belgium, Finland, and Norway were categorized as having more state support, and the United States, Hong Kong, Ireland, Great Britain, China, and Australia as having less state support.

Table 1
Overview of Included Studies

Study ID	Author(s) (year)	Study	Country	*N*	Follow-up (year)	Study quality	Mean age (year)	Predictors: Sub age	Predictors: SPA	Predictors: Path	Health outcomes: Ment. hlth	Health outcomes: Phys. hlth	Health outcomes: Long
1.	Avidor, Levi-Beltz, and Solomon (2021)		IL	125	7	50	58	X			X		
2.1.	Avidor, Palgi, and Solomon (2021)	Study 1	IL	226	6	50	65	X			X		
2.2.	Avidor, Palgi, and Solomon (2021)	Study 2	IL	132	1	67	66	X			X		
3.	Ayalon (2016)	HRS	USA	4,121	4	100	74		U			Sub	
4.	Barnes-Farrell and Petery (2018)	HRS	USA	2,156	4	83	69	X			X	Sub	
5.	Barrett and Toothman (2016)	MIDUS	USA	872	9	83	50	X		Psy			
6.	Benyamini and Burns (2019)	RAH	USA	851	10	40	73	X					X
7.	Beyer et al. (2015)	DEAS	FRG	277	2.5	83	73		U	Beh		Sub	
8.	Beyer et al. (2019)	DEAS	FRG	2,367	3	83	73		G,L	Beh			
9.	Boeder and Tse (2021)	DEAS	FRG	3,745	6	67	61		U,L,G	Psy	X	Sub	
10.	Boehmer (2006)	BLS	FRG	159	0.42	0	63	X				Sub	
11.	Boehmer (2007)	BLS	FRG	159	0.42	0	63	X		Psy,Beh		Sub	
12.	Brothers et al. (2016)		FRG, USA	537	2.5	33	64		G,L	Psy			
13.	Cheng et al. (2012)		HKG	83	0.25	33	58		U			Ob	
14.	Choi and DiNitto (2014)	NHATS	USA	5,371	1	50	74	X			X		
15.	Cohn-Schwartz et al. (2021)	HRS	USA	1,823	8	100	68		U		X	Sub	
16.	Dutt, Gabrian, and Wahl (2018)		FRG	356	2.5	67	63		G,L		X		
17.	Dutt and Wahl (2019)		FRG	299	4.5	67	63		L		X		
18.	Dutt, Wahl, and Rupprecht (2018)		FRG	356	5	50	63		G,L		X		
19.	Faß et al. (2020)	DEAS	FRG	1,027	12	83	64		L			Sub	
20.	Freeman et al. (2016)	TILDA	IE	6,065	2	50	63		L		X		
21.	Fundenberger et al. (2022)	NHATS	USA	1,679	7	67	75	X				Sub	
22.	Gale et al. (2018)	LBC1936	GB	271	7	50	79		G,L	Beh			
23.	Gale and Cooper (2018)	ELSA	GB	3,505	6	83	70		L			Ob	
24.	Gum and Ayalon (2018)	HRS	USA	4,606	4	100	65		U		X		
25.	Hajek and König (2020)	DEAS	FRG	18,373	15	67	65	X		Psy			
26.	Han (2018)	HRS	USA	3,382	4	100	74		U		X	Sub	
27.	Han and Richardson (2015)	HRS	USA	3,921	4	100	65		U		X		
28.	Kaspar et al. (2021)		FRG	1,863	3.5	40	87		G,L				X
29.	Kim et al. (2014)	HRS	USA	6,177	4	83	71		U	Beh			
30.	Klusmann et al. (2019)	KLS	FRG	557	1	50	44		G	Beh			
31.	Kotter-Grühn et al. (2009)	BASE	FRG	496	16	80	85	X	U				X
32.	Kwak et al. (2014)	HRS	USA	5,938	4	100	65		U		X		
33.	Lahav et al. (2020)		IL	88	15	33	64	X		Phy			
34.	Levy et al. (2018)	HRS	USA	4,765	4	50	72		U			Ob	
35.	Levy and Bavishi (2018)	HRS	USA	4,149	6	80	68		U				X
36.	Levy and Myers (2004)	OLSAR	USA	241	20	50	57		U	Beh			
37.	Levy and Myers (2005)	OLSAR	USA	620	23	60	63		U				X
38.	Levy and Slade (2019)	HRS	USA	5,702	6	50	65		U	Beh			
39.	Levy, Slade, and Kasl (2002)	OLSAR	USA	433	20	50	62		U			Sub	
40.	Levy, Slade, and Kunkel (2002)	OLSAR	USA	660	23	60	63		U				X
41.	Li et al. (2021)	NHATS	USA	2,592	4	50	75	X				Ob	
42.	Liang (2018)	SSAPURs	CN	5,702	4	83	70	X				Sub	
43.	Liang (2020)	SSAPURs	CN	5,612	4	83	70	X			X		
44.	Lim et al. (2013)	ACPC	USA	290	1	20	63	X					X
45.	Losada-Baltar et al. (2022)		ES	1,549	.04	50	43		U		X		
46.	Luo and Li (2020)	HRS	USA	10,212	6	83	66		U			Sub	

(*table continues*)

Table 1 (*continued*)

Study ID	Author(s) (year)	Study	Country	*N*	Follow-up (year)	Study quality	Mean age (year)	Predictors		Health outcomes			
								Sub age	SPA	Path	Ment. hlth	Phys. hlth	Long
47.	Maier and Smith (1999)	BASE	FRG	513	4.5	60	85		U				X
48.	Markides and Pappas (1982)	SATX	USA	460	4	60	65	X					X
49.	McLachlan et al. (2020)	LBC1936	GB	758	8	40	73		G,L	Phy			
50.	Mejía and Gonzalez (2017)	HRS	USA	1,231	6	83	66		U			Sub	
51.	Mejía et al. (2020)	HRS	USA	2,717	4	83	66		G,L	Phy		Ob	
52.	Mock and Eibach (2011)	MIDUS	USA	1,170	10	50	53	X		Psy			
53.	Moser et al. (2011)	LC65+	CH	883	1	33	69		U			Sub	
54.	Nieves-Lugo et al. (2021)		USA	549	4.5	33	61	X	U			Ob	
55.	Palgi et al. (2018)	HRS	USA	4,938	6	50	69	X			X	Sub	
56.	Palgi et al. (2019)		IL	132	2	50	65	X			X		
57.	Petashnick et al. (2022)		IL	164	3	67	81	X		Phy	X	Sub	
58.	Qiao et al. (2021)	ELSA	GB	6,475	11	50	65	X				Ob	
59.	Rippon and Steptoe (2015)	ELSA	GB	6,489	9	40	66	X					X
60.	Rippon and Steptoe (2018)	ELSA	GB	7,546	4	67	66	X			X	Sub	
61.	Sargent-Cox et al. (2012)	ALSA	AUS	1,212	16	67	77		U			Ob	
62.	Sargent-Cox et al. (2014)	ALSA	AUS	1,507	16	40	77		U				X
63.	Schroyen et al. (2017)		BE	58	1	67	74		U	Psy		Sub	
64.	Schroyen et al. (2020)		BE	140	6	40	73		U				X
65.	Segel-Karpas et al. (2022)	MIDUS	USA	3,591	8	100	69		U		X		
66.	Siebert et al. (2018)	ILSE	FRG	260	12	67	63		U			Ob	
67.	Spuling et al. (2013)	DEAS	FRG	3,038	6	50	61	X			X	Sub	
68.1.	Stephan et al. (2015a)	HRS	USA	2,023	4	67	74	X		Phy			
68.2.	Stephan et al. (2015a)	NHATS	USA	3,279	2	67	76	X		Phy			
69.1.	Stephan et al. (2016)	MIDUS	USA	3,209	9	50	47	X				Sub	
69.2.	Stephan et al. (2016)	HRS	USA	3,779	4	50	68	X				Sub	
69.3.	Stephan et al. (2016)	NHATS	USA	3,418	2	50	76	X				Sub	
70.	Stephan et al. (2019)	HRS	USA	3,339	4	83	69	X		Phy			
71.1.	Stephan, Sutin, Bayard, and Terracciano (2017)	MIDUS	USA	2,350	9	67	56	X		Beh			
71.2.	Stephan, Sutin, Bayard, and Terracciano (2017)	HRS	USA	4,066	6	67	68	X		Beh			
71.3.	Stephan, Sutin, Bayard, and Terracciano (2017)	NHATS	USA	3,541	3	67	76	X		Beh			
72.	Stephan, Sutin, Luchetti, and Terracciano (2017)	HRS	USA	5,748	4	83	74	X				Ob	
73.	Stephan, Sutin, Luchetti, and Terracciano (2018)	NHATS	USA	4,262	4	83	76	X				Ob	
74.	Stephan, Sutin, Luchetti, and Terracciano (2021)	HRS	USA	2,253	7	83	67	X		Phy			
75.1.	Stephan, Sutin, and Terracciano (2018)	MIDUS	USA	4,898	19	60	48	X					X
75.2.	Stephan, Sutin, and Terracciano (2018)	HRS	USA	6,220	6	60	70	X					X
75.3.	Stephan, Sutin, and Terracciano (2018)	NHATS	USA	6,494	3	60	77	X					X
76.	Stephan, Sutin, Wurm and Terracciona (2021)	HRS	USA	10,695	9	33	69	X	U			Sub	
77.	Sun et al. (2017)	HRS	USA	4,735	4	100	69		U			Sub	
78.	Tovel et al. (2019)		IL	892	2	83	81		U			Sub	
79.	Uotinen et al. (2005)	EP	FIN	1,165	13	20	73	X					X
80.	Veenstra, Løset, and Daatland (2021)	NorLAG	NO	4,502	15	83	58	X		Psy		Sub	
81.	Veenstra, Daatland, et al. (2021)	NorLAG	NO	1,432	10	80	73	X					X

(*table continues*)

Table 1 (*continued*)

Study ID	Author(s) (year)	Study	Country	*N*	Follow-up (year)	Study quality	Mean age (year)	Predictors		Health outcomes			
								Sub age	SPA	Path	Ment. hlth	Phys. hlth	Long
82.	Warmoth et al. (2018)	ELSA	GB	2,418	6	100	70		U			Ob	
83.	Wettstein, Spuling, et al. (2021)	DEAS	FRG	5,039	3	50	64	X				Sub	
84.	Wettstein, Wahl, and Siebert (2021)	DEAS	FRG	4,588	3	67	64	X	U,G,L		X		
85.	Wettstein et al. (2020)	ILSE	FRG	894	20	67	54		U			Ob	
86.	Wettstein, Werner-Wahl and Spuling (2021)	DEAS	FRG	2,499	9	83	71		U,G,L			Sub	
87.	Whitehead (2019)		USA	89	.67	50	77		U	Phy		Sub	
88.	Wienert et al. (2015)		FRG	541	.08	67	40	X		Beh			
89.	Wienert et al. (2017)		FRG	571	.08	50	41	X		Beh			
90.	Wolff et al. (2017)	DEAS	FRG	252	2.5	100	73		L	Psy		Sub	
91.	Wurm et al. (2007)	DEAS	FRG	1,286	6	83	57		G,L			Sub	
92.	Wurm et al. (2008)	DEAS	FRG	1,286	6	67	57		G	Psy		Sub	
93.	Wurm et al. (2010)	DEAS	FRG	1,286	6	83	57		G	Beh			
94.	Wurm et al. (2013)	DEAS	FRG	678	0.5	100	73		L	Psy		Sub	
95.	Wurm and Benyamini (2014)	DEAS	FRG	1,286	3	83	62		L		X	Sub	
96.	Wurm and Schäfer (2022)	DEAS	FRG	2,400	23	80	59	X	G,L				X
97.	Zee and Weiss (2019)	MIDUS	USA	5,762	14	67	59	X		Phy			
98.	Zhang et al. (2020)	CLHLS	CN	10,051	8	60	90		L				X
99.	Zhao et al. (2017)	CLHLS	CN	10,051	9	60	85		U				X

Note. Study abbreviations: ALSA = Australian Longitudinal Study; BASE = Berlin Aging Study; BLS = Berlin Longitudinal Study on Quality of Life After Tumor Surgery; CLHLS = Chinese Longitudinal Healthy Longevity Survey; EP = evergreen project; DEAS = German Aging Survey; ELSA = English Longitudinal Study of Ageing; HRS = Health and Retirement Study; ILSE = Interdisciplinary Longitudinal Study of Adult Development; KLS = Konstanz Life Study; LBC1936 = Lothian Birth Cohort 1936; LC65+ = Lausanne Cohort Study; MIDUS = Survey on Midlife in the United States; NHATS = National Health and Aging Trends Study; NorLAG = Norwegian Life Course, Ageing and Generation Study; OLSAR = Ohio Longitudinal Study of Aging and Retirement; RAH = Rutgers Aging and Health Study; SSAPURs = Sample Survey of the Aged Population in Urban/Rural China; SATX = Survey in San Antonio, Texas; SSP = Study on chronically institutionalized Schizophrenia Patients; TILDA = The Irish Longitudinal Study on Ageing. Country Abbreviations: AUS = Australia; BE = Belgium; CH = Switzerland; CN = China; ACPC = adult cancer patients receiving chemotherapy; ES = Spain; SATX = Survey in San Antonio, Texas; FIN = Finland; FRG = Germany; GB = United Kingdom; HKG = Hong Kong; IE = Ireland; IL = Israel; NO = Norway; RU = Russia; USA = United States of America. Predictor categorization: Sub age = subjective age; SPA = self-perceptions of aging; U = unidimensional; L = multidimensional, loss-oriented; G = multidimensional, gains-oriented. Health outcome categorization: Pathways. Psy = psychological pathways (e.g., life satisfaction, positive or negative affect, psychological well-being). Beh = behavioral pathways (e.g., physical activity, preventive health services, coping). Phy = physiological pathways (e.g., biomarkers). Ment. Hlth = mental health states (e.g., depressive symptoms, anxiety symptoms). Phys. Hlth = physical sealth states. Sub = subjective indicators of physical health (e.g., self-reported health conditions, self-reported hospitalizations, self-rated health. Ob = objective indicators of physical health (e.g., frailty or diagnosed diseases). Long = longevity.

Update of Earlier Results

To assess Hypothesis 1.1, the overall effects of SA on health-related outcomes were analyzed. Figures 2 and 3 provide an overview of the results of the meta-analysis. LRs of 1 indicate no relation, LRs higher than 1 show that more youthful and positive SA was related to more positive health-related outcomes and those LR lower than 1 show that more youthful and positive SA was related to less positive health-related outcomes. The overall effect was significant (LR = 1.346; 95% CI [1.299, 1.396]; $p < .001$). It corresponds to a correlation of .12 and can be interpreted as small in size (Chen et al., 2010). The size of the effect was similar to the result from the previous meta-analysis as the CIs overlapped (LR = 1.429; 95% CI [1.273, 1.604]; Westerhof et al., 2014). Hence, as expected, more youthful and positive SA was related to more positive health-related outcomes.

The effect sizes differed across studies between LR = 1.004 (Veenstra, Løset, & Daatland, 2021) and LR = 3.772 (Markides & Pappas, 1982). Significant effects in the expected direction (e.g., positive SPA or younger subjective age-predicted health/longevity) were reported in 79 studies (74%), whereas 28 studies (26%) reported no significant effects. None of the studies reported any significant reverse effect (e.g., younger subjective age or more positive SPA associated with poorer health outcomes). Hence, not all studies supported Hypothesis 1.1, but when significant effects were found, they supported the hypothesis, such that more positive SA was associated with better health-related outcomes. The variability of the effect sizes was significantly larger than would be expected from sampling error alone ($Q_{106} = 2932.3$; $p < .001$; $I^2 = 96.4$). Some studies had LRs above 3.0 and could be considered possible outliers (Cheng et al., 2012; Markides & Pappas, 1982; Schroyen et al., 2017, 2020). As these studies were among the smaller ones in terms of number of participants, the overall effect was still significant and small after their exclusion (LR = 1.335; 95% CI [1.288, 1.384]; $p < .001$). Similarly, the variability was still significant and high ($Q_{102} = 2891.6$; $p < .001$; $I^2 = 96.5$).

With regard to publication bias, the funnel plot shows a concentration of studies on the right. Egger's test of intercept was significant ($t_{105} = 4.726$; $p < .001$), which indicates a significant positive correlation between study precision and standardized effect. The trim and fill analysis showed that looking for missing studies to the left of the mean resulted in an adjusted value with nine trimmed studies (LR = 1.305; 95% CI [1.258, 1.353]), which is not significantly different from the value in the current meta-analysis (LR = 1.346; 95% CI [1.299, 1.396]; $p < .001$). Keeping heterogeneity and possible publication bias in mind, these findings provided longitudinal support for Hypothesis 1.1 and SA as a predictor of subsequent health-related outcomes.

Subgroup analyses and metaregressions updating the results from the previous meta-analysis might explain some of the heterogeneity of effects. First, the predictor variables were categorized as measures of subjective age on the one hand, and measures of SPA on the other hand. As can be seen in Table 2, the predictive effects were stronger for SPA measures than for subjective age measures. Second, the study quality (e.g., categorized as low, intermediate, or high) moderated the effect sizes. Specifically, the effect sizes were higher for studies with lower quality. Third, when the health-related outcomes were grouped into two classes (health vs. longevity), no significant differences were found. Fourth, a metaregression was carried out for the number of years between the baseline measurement and the follow-up (e.g., range between 2 weeks and 23 years). The length of the follow-up period was not significantly related to outcomes (slope = 0.0002; 95% CI [−0.010, 0.010]; $p = .975$). Fifth, the average age of the sample at baseline was used in a metaregression analysis with the average age ranging between 40 and 90 years. No significant relation was found with effect sizes (slope = −0.002; 95% CI [−0.008, 0.003]; $p = .399$); studies with older participants showed less strong effects. Last, a country's welfare regime was assessed as a possible moderator of the effects; however, there were no differences between countries with more or less state support (Table 2).

To control for possible confounding relations between the different subgroups and moderators, a multivariate metaregression was conducted, including measure of SA (subjective age vs. SPA), study quality (lower, intermediate, higher), outcome type (health vs. longevity), length of follow-up, average sample age, and welfare state (more or less support). As in the bivariate analyses, only the type of SA measure and the study quality were significant: Measures of SPA and studies with lower quality had a stronger effect on health-related outcomes.

These findings were only partly in line with the earlier meta-analysis and our corresponding Hypotheses 1.2 and 1.3. In particular, studies using measures of SPA had a stronger effect than studies focusing on subjective age for both health and longevity, and studies with a lower quality had stronger effects. In contrast, no such differences had been found in the 2014 meta-analysis. Furthermore, the updated meta-analysis no longer supported significant differences in effect sizes according to the length of follow-up, average sample age, or welfare regime.

Extension 1: Comparing Different Measures of SA

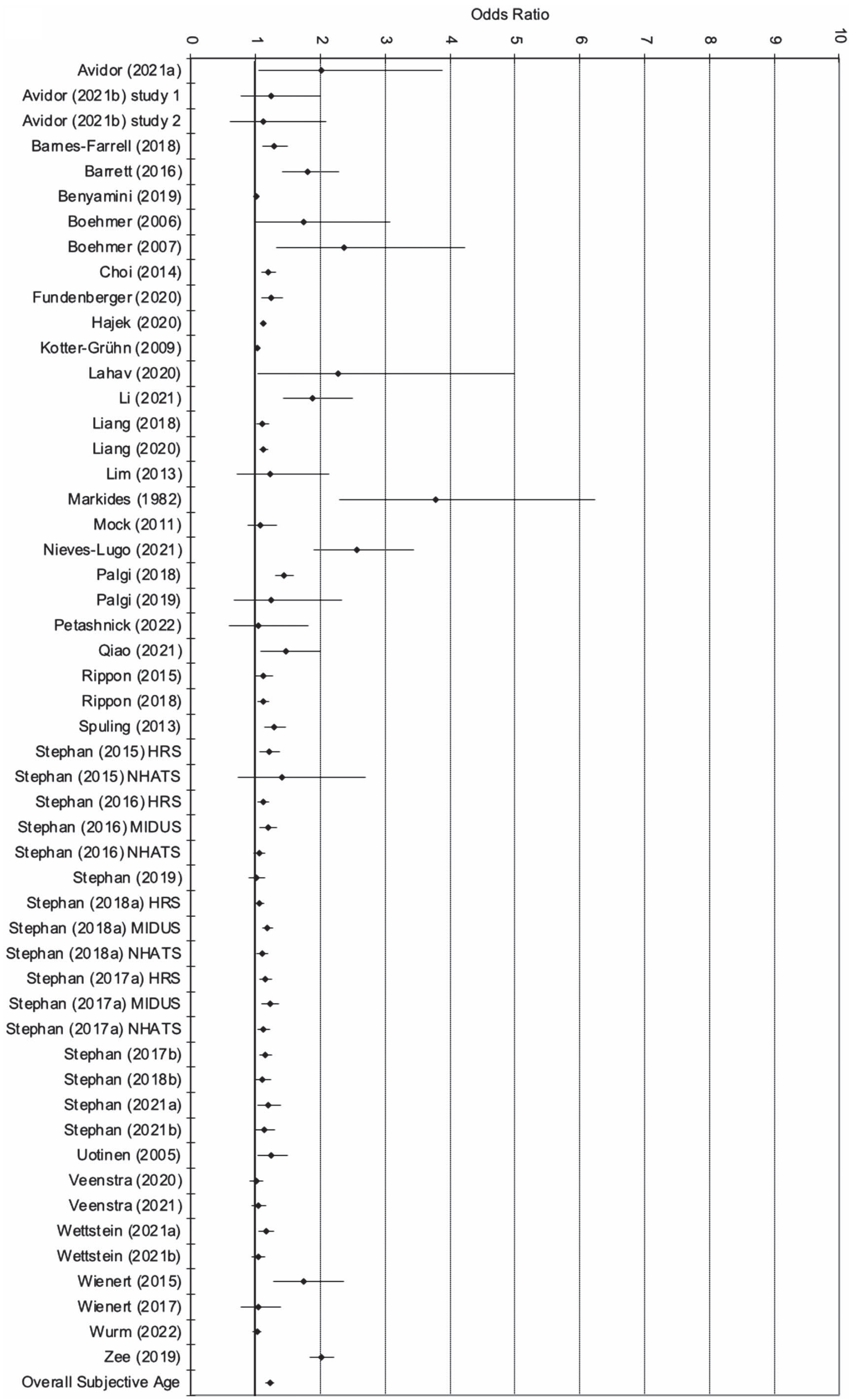
The second goal was to extend the analyses of the previous meta-analysis (Westerhof et al., 2014). The effects of different operationalizations of SA and the effects on different health-related outcomes could be analyzed with more precision due to the larger number of studies and broader variation in instruments. The SA measures were categorized into four classes: subjective age, attitudes toward own aging, multidimensional measures of age-related gains, and multidimensional measures of age-related losses. Table 3 shows that effects of the instruments focusing on perceptions of age-related gains were the only ones of the measures of SPA that did not significantly differ from the effects of subjective age measures. However, there were no significant differences among the three types of measures used to assess SPA. Hence, Hypothesis 2.1, which proposed that the effect of multidimensional measures of losses would show the strongest health effects, was not supported by the data.

Extension 2: Comparing Different Health Outcomes

The health-related outcome measures were also categorized into more fine-grained groups, comparing (a) psychological measures of well-being, (b) measures of health-related behaviors and coping behaviors, (c) physiological measures of health, (d) mental health states, (e) subjective physical health states, (f) objective physical health states, and (g) longevity. Overall, there were no significant differences between the outcomes (see Table 3). Hence, Hypothesis 2.2, which stated that the effect of SA would be strongest for the

Figure 2

Forest Plot of Effect Sizes (95% Confidence Interval; Subjective Age)



Note. HRS = Health and Retirement Study; NHATS = National Health and Aging Trends Study; MIDUS = Survey on Midlife in the United States.

Figure 3

Forest Plot of Effect Sizes (95% Confidence Interval; Self-Perceptions of Aging)

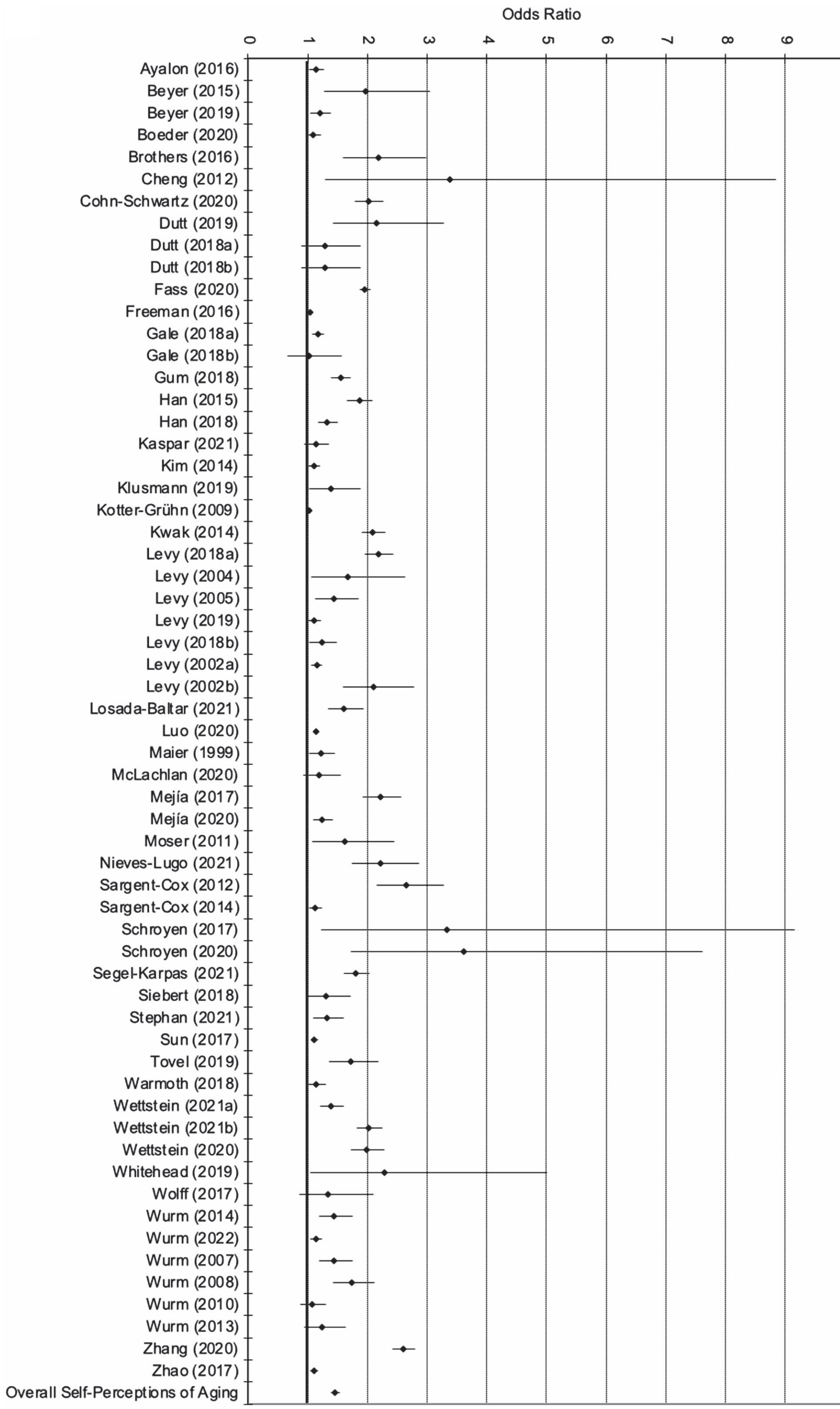


Table 2
Predictive Effects of SA Measures on Health Outcomes: Update of the Subgroup Analyses of Westerhof et al. (2014) Based on N = 107 Studies

Predictors	*N*	LR	95% CI	*Q*	*df*	*p*
Measures of subjective aging[a]				23.7	1	<.001
Subjective age	52	1.217	[1.155, 1.283]			
Self-perceptions of aging	61	1.455	[1.385, 1.529]			
Study quality				9.6	2	.008
Lower	10	1.673	[1.419, 1.972]			
Intermediate	39	1.277	[1.195, 1.365]			
Higher	58	1.371	[1.302, 1.443]			
Outcome measure				0.8	1	.383
Health	87	1.362	[1.305, 1.422]			
Longevity	20	1.306	[1.199, 1.422]			
Welfare state regime[b]				0.3	1	.555
Less state support	63	1.334	[1.274, 1.396]			
More state support	43	1.366	[1.281, 1.457]			

Note. *N* = number of studies; LR = likelihood ratio; CI = confidence interval; *df* = degrees of freedom; SA = subjective aging.
[a] Four studies measured both subjective age and self-perceptions of aging. [b] One study was carried out in both United States and Germany.

pathways, followed by indicators of health states and least strong for longevity was not supported by the data.

Extension 3: Comparing Different Measures of SA on Different Health Outcomes

Last, it was assessed whether different SA measures had similar effects on different health-related outcomes. To have sufficient number of studies across the categories, the SA measures were classified as subjective age measures versus measures of SPA. The effects were compared across four categories of health-related outcomes: pathways, mental health, physical health, and longevity. Overall, the effect across these two by four categories was significant (Table 3). When comparing the effects between subjective age and SPA, the differences were smallest for the pathways as compared to the differences for mental health, physical health, and longevity. However, the individual coefficients did not differ from each other. Hence, Hypothesis 2.3, that the effects on different

Table 3
Subgroup Analyses for Predictor and Outcome Measures

Outcome measures	*N*	LR	95% CI	*Q*	*df*	*p*
SA measures				25.5	3	<.001
Subjective age	52	1.233	[1.154, 1.316]			
Self-perceptions of aging						
Unidimensional	39	1.579	[1.464, 1.703]			
Losses	21	1.488	[1.343, 1.650]			
Gains	16	1.373	[1.220, 1.546]			
Health measures				7.4	6	.283
Psychological pathways	9	1.351	[1.128, 1.617]			
Behavioral pathways	14	1.256	[1.093, 1.442]			
Physiological pathways	11	1.441	[1.227, 1.693]			
Mental health	25	1.529	[1.381, 1.693]			
Subjective physical health	35	1.391	[1.279, 1.513]			
Objective physical health	14	1.499	[1.307, 1.719]			
Longevity	20	1.327	[1.190, 1.481]			
Health measures by SA measures				19.0	7	<.001
Subjective age						
All three pathways	16	1.282	[1.130, 1.454]			
Mental health	12	1.362	[1.169, 1.587]			
Physical health	21	1.290	[1.160, 1.436]			
Longevity	11	1.154	[0.999, 1.332]			
Self-perceptions of aging						
All three pathways	15	1.348	[1.178, 1.542]			
Mental health	14	1.608	[1.414, 1.828]			
Physical health	30	1.520	[1.386, 1.542]			
Longevity	11	1.447	[1.251, 1.674]			

Note. LR = likelihood ratio; CI = confidence interval; *df* = degrees of freedom; SA = subjective aging.

measures of health would be similar for different measures of SA was supported.

Discussion

This article provides an update and extension of a meta-analysis of longitudinal studies on the relation between different measures of SA and health outcomes (Westerhof et al., 2014). The fact that we were able to identify 80 new articles since the previous meta-analysis, with five times more studies in total, shows this is a vibrant research field. The increase might be related to (a) the availability of longitudinal data that examine the impact of SA on health outcomes, (b) a growing awareness of the potential impact of SA on health, and (c) the possibilities for interdisciplinarity that the topic of SA holds (i.e., it brings together behavioral sciences with social sciences and health sciences). Overall, these articles provide an interesting empirical piece of the puzzle that shows that aging is not a universal, biologically programmed process of decline, but also depends a good deal on individual and societal constructions.

The first goal of the article was to update the earlier meta-analysis with the findings from studies that have been published since 2014. The increase in the number and diversity of studies allowed for a more comprehensive, representative, and valid picture of the longitudinal associations of SA with health-related outcomes. The main findings showed that both measures of subjective age and SPA have an effect on health-related outcomes over time (Hypothesis 1.1). This confirmed findings from the earlier meta-analysis (Westerhof et al., 2014) and other systematic reviews and meta-analyses (Alonso Debreczeni & Bailey, 2021; Chang et al., 2020; Diehl et al., 2021; Kotter-Grühn et al., 2016; Sabatini et al., 2020; Tully-Wilson et al., 2021; Westerhof & Wurm, 2018; Wurm et al., 2017) and thereby showed the consistency of the effects. Similar to the previous meta-analysis, the overall effect size was small, though the observed effects were statistically significant. There were some indications of publication bias, but effect size did not seem to be overestimated in the trim and fill analysis. Furthermore, studies of lower quality found stronger effects. As the effect was still significant in the trim-and-fill analysis and in studies of higher quality, consistent with the conclusions of other systematic reviews and meta-analyses in the field (Alonso Debreczeni & Bailey, 2021; Chang et al., 2020; Diehl et al., 2021; Kotter-Grühn et al., 2016; Sabatini et al., 2020; Tully-Wilson et al., 2021; Westerhof & Wurm, 2018; Wurm et al., 2017), and comparable to other psychosocial variables related to health and longevity (e.g., social isolation and loneliness, Holt-Lunstad et al., 2015; or well-being, Chida & Steptoe, 2008), it can be concluded that the findings showed a meaningful pattern of longitudinal associations with health and longevity.

Whereas the current meta-analysis focused on individual perspectives on SA, it would be interesting to take a more societal perspective as well. The longitudinal relation of SA to health outcomes might have important consequences for health care, for example. This would ask for studies from a public health perspective to relate the effects of SA to health economics, like healthcare consumption and costs, similar to those that have been computed for age stereotypes (Levy et al., 2020). Similar to interpretations of health gains related to well-being, more positive SA at the individual level might result in important health gains at the population level (Huppert, 2009).

Yet, there was considerable heterogeneity among studies. In contrast to Hypotheses 1.2 and 1.3 that were derived from the earlier meta-analysis (Westerhof et al., 2014), we found that measures of SPA had a stronger impact on health-related outcomes than measures of subjective age. As there were more studies that were better balanced across the different analyses in the current meta-analysis, this suggests that there might have been a confounding between the moderators that were assessed in the earlier meta-analysis. The finding that the type of SA measure was the only significant moderator could also be interpreted as an indicator of the robustness of the association of SA with health-related outcomes. That is, the effect sizes did not vary by participants' age, welfare state regime, or length of follow-up. This suggests that the effects of SA were not very much influenced by contextual factors and may reflect more of an intrinsic psychological process. Yet, further studies need to clarify how the existing heterogeneity can be best explained, beyond the two types of measures of SA.

The finding that measures of SPA had stronger effects on health outcomes than subjective age can be related to methodological factors: the former measures are more reliable as they consist of multiple items that cover a broader range of experiences across time, whereas subjective age is commonly measured with a single item, assessing a generalized feeling at a particular moment. Additionally, subjective age is differently operationalized, with some studies using a continuous variable (e.g., felt age) and others using a categorical variable (e.g., feeling younger, about the same, or older than one's chronological age). As subjective age still showed a significant effect, a single item can be a parsimonious solution, for example, in large-scale epidemiological studies that need to plan the number of items carefully. Measures of SPA should, however, be the method of choice when there is more room for in-depth assessment of SA. As relations with health-related outcomes tend to be stronger for SPA, studies could rely on less participants in achieving appropriate statistical power.

The second goal of this article was to contribute to this area of inquiry by extending the previous meta-analysis (Westerhof et al., 2014). Hypothesis 2.1 extended the comparison between subjective age and SPA to different measures of the latter concept. Contrary to the a priori study hypothesis, no significant differences were found between unidimensional and multidimensional measures of SPA. Nevertheless, it should be noted that relatively new and more diverse instruments were used to assess adults' perceived gains and losses, in particular, life domains (Brothers et al., 2019; Laidlaw et al., 2007; Marquet et al., 2016; Steverink et al., 2001), resulting in a more limited number of studies. In contrast, unidimensional measures of SPA included the ATOA scale, which is itself already some 50 years old (Lawton, 1975; Miche et al., 2014) and has been used in many more studies. A recent study (Wurm & Schäfer, 2022) compared the impact of gain-related SPA (i.e., perceptions of ongoing personal development) with two loss-related measures (i.e., perceptions of physical and social losses) for longevity. This study showed a greater importance of gain-related SPA for longevity (Wurm & Schäfer, 2022). In contrast, another study that examined the impact of gain- and loss-related SPA on depressive symptoms pointed to a larger role of loss-related SPA for this health outcome (Dutt, Wahl, & Rupprecht, 2018). This suggests a need to further investigate the interaction of various SA measures with a variety of health outcomes. Hence, the advantage of going multidimensional in SA assessment as compared to unidimensional in health prediction remains an open issue. This is especially true as some multidimensional instruments assess gains and losses in different domains of life (e.g., psychological gains and social and physical losses; Steverink et al., 2001). One strategy to deal with this currently open issue would be to include several measures of both subjective age and different dimensions of SPA in a single study to control for their interrelations and thereby better assess their relative impact on different health-related outcomes. Overall, it is important to further examine the validity of different SA measures (e.g., Spuling et al., 2020), compare differences in scales' reliabilities, and make choices about instruments more explicit in relation to the purpose and conceptual background of studies.

Hypothesis 2.2 extended the comparison across seven different classes of health-related outcomes but was not supported by the findings. That is, no significant differences were found between the different health outcomes. Interestingly, these findings also open up the possibility to further explore mediating effects, for example, those of the pathways on health states and/or those of health states on longevity. Although some studies have assessed mediation (e.g., Levy & Bavishi, 2018), the number of studies that have done so was too small to carry out a meta-analysis on these mediating effects.

Finally, Hypothesis 2.3 was supported by the results. Although the differences between subjective age and SPA were smallest for the pathways in comparison to mental and physical health and longevity, SPA had stronger effects on health outcomes than subjective age. This finding further supports the results of Hypothesis 2.1.

Limitations

To our knowledge, this study provides the most up-to-date meta-analysis on the longitudinal effects of measures of SA on health-related outcomes. Nevertheless, we made some choices to restrict the inclusion of studies in the current meta-analysis. For example, we did not include dissertations, chapters, or gray literature. This might have helped to counteract the publication bias. Furthermore, we did not consider cognitive decline as an outcome in this meta-analysis. The primary reason for doing so is that two recently published meta-analyses already considered cognitive performance, in general, as an outcome in relation to two SA indicators that continue to represent the bulk of existing SA research, namely subjective age (Alonso Debreczeni & Bailey, 2021) and attitudes toward own aging (Tully-Wilson et al., 2021). Both found a weak but significant effect in the expected direction; that is, an older subjective age and less positive attitudes toward one's own aging predicted, on average, more cognitive decline over time. Another limitation concerns the attribution of causality. Although most studies did control for other variables known to be related to health-related outcomes, it cannot be ruled out that other variables might still confound or even explain the effects of SA found in this article. Similarly, there might also be a reverse causality in that health effects have an impact on SA. Available studies seem to be more in support that the direction of effects goes from SA to health-related outcomes rather than from health-related outcomes to SA (e.g., Spuling et al., 2013) and the current meta-analysis only used longitudinal studies where SA preceded the health outcomes in time.

To summarize, in assessing the effects of measures of SA on health-related outcomes, the current meta-analysis provides evidence that SPA show stronger associations with health outcomes across time than subjective age, but both have a significant impact on a large variety of measures of health and longevity across many studies and countries.

References

References marked with an asterisk indicate studies included in the meta-analysis.

Alonso Debreczeni, F., & Bailey, P. E. (2021). A systematic review and meta-analysis of subjective age and the association with cognition, subjective well-being, and depression. *The Journals of Gerontology: Series B*, *76*(3), 471–482. https://doi.org/10.1093/geronb/gbaa069

*Avidor, S., Levi-Belz, Y., & Solomon, Z. (2021). What predicts unremitting suicidal ideation? A prospective examination of the role of subjective age in suicidal ideation among ex-prisoners of war. *Psychological Trauma: Theory, Research, Practice, and Policy*, *13*(3), 338–348. https://doi.org/10.1037/tra0000958

*Avidor, S., Palgi, Y., & Solomon, Z. (2021). The moderating role of views of aging in the longitudinal relationship between physical health and mental distress. *The Journals of Gerontology: Series B*, *76*(5), 871–880. https://doi.org/10.1093/geronb/gbaa212

*Ayalon, L. (2016). Satisfaction with aging results in reduced risk for falling. *International Psychogeriatrics*, *28*(5), 741–747. https://doi.org/10.1017/S1041610215001969

Bambra, C. (2007). Going beyond The three worlds of welfare capitalism: Regime theory and public health research. *Journal of Epidemiology and Community Health*, *61*(12), 1098–1102. https://doi.org/10.1136/jech.2007.064295

*Barnes-Farrell, J. L., & Petery, G. A. (2018). The moderating role of employment status and gender on relationships between psychological age and health: A two-wave cross-lagged panel analysis of data from the Health and Retirement Study. *Work, Aging and Retirement*, *4*(1), 79–95. https://doi.org/10.1093/workar/wax019

*Barrett, A. E., & Toothman, E. L. (2016). Explaining age differences in women's emotional well-being: The role of subjective experiences of aging. *Journal of Women & Aging*, *28*(4), 285–296. https://doi.org/10.1080/08952841.2015.1017426

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology*, *5*(4), 323–370. https://doi.org/10.1037/1089-2680.5.4.323

*Benyamini, Y., & Burns, E. (2019). Views on aging: Older adults' self-perceptions of age and of health. *European Journal of Ageing*, *17*(4), 477–487. https://doi.org/10.1007/s10433-019-00528-8

*Beyer, A. K., Wiest, M., & Wurm, S. (2019). There is still time to be active: Self-perceptions of aging, physical activity, and the role of perceived residual lifetime among older adults. *Journal of Aging and Physical Activity*, *27*(4), 807–815. https://doi.org/10.1123/japa.2018-0380

*Beyer, A. K., Wolff, J. K., Warner, L. M., Schüz, B., & Wurm, S. (2015). The role of physical activity in the relationship between self-perceptions of ageing and self-rated health in older adults. *Psychology & Health*, *30*(6), 671–685. https://doi.org/10.1080/08870446.2015.1014370

*Boeder, J., & Tse, D. C. K. (2021). Measuring self-perceptions of aging: Differences between measures when predicting health outcomes. *The Journals of Gerontology: Series B*, *76*(5), 825–835. https://doi.org/10.1093/geronb/gbaa064

*Boehmer, S. (2006). Does felt age reflect health-related quality of life in cancer patients? *Psycho-Oncology*, *15*(8), 726–738. https://doi.org/10.1002/pon.1011

*Boehmer, S. (2007). Relationships between felt age and perceived disability, satisfaction with recovery, self-efficacy beliefs and coping strategies. *Journal of Health Psychology*, *12*(6), 895–906. https://doi.org/10.1177/1359105307082453

Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (n.d.). *Comprehensive meta-analysis* (Version 2.0). http://www.metaanalysis.com/pages/downloads/Meta-Analysis-Manual.pdf

Brandtstädter, J., & Rothermund, K. (2002). The life-course dynamics of goal pursuit and goal adjustment: A two-process framework. *Developmental Review*, *22*(1), 117–150. https://doi.org/10.1006/drev.2001.0539

*Brothers, A., Gabrian, M., Wahl, H. W., & Diehl, M. (2016). Future time perspective and awareness of age-related change: Examining their role in predicting psychological well-being. *Psychology and Aging*, *31*(6), 605–617. https://doi.org/10.1037/pag0000101

Brothers, A., Gabrian, M., Wahl, H.-W., & Diehl, M. (2019). A new multidimensional questionnaire to assess Awareness of Age-Related Change (AARC). *The Gerontologist*, *59*(3), e141–e151. https://doi.org/10.1093/geront/gny006

Brothers, A., Kornadt, A. E., Nehrkorn-Bailey, A., Wahl, H. W., & Diehl, M. (2021). The effects of age stereotypes on physical and mental health are mediated by self-perceptions of aging. *The Journals of Gerontology: Series B*, *76*(5), 845–857. https://doi.org/10.1093/geronb/gbaa176

Brothers, A., Miche, M., Wahl, H. W., & Diehl, M. (2017). Examination of associations among three distinct subjective aging constructs and their relevance for predicting developmental correlates. *The Journals of Gerontology: Series B*, *72*(4), 547–560. https://doi.org/10.1093/geronb/gbv085

Chang, E.-S., Kannoth, S., Levy, S., Wang, S.-Y., Lee, J. E., & Levy, B. R. (2020). Global reach of ageism on older persons' health: A systematic review. *PLOS ONE*, *15*(1), Article e0220857. https://doi.org/10.1371/journal.pone.0220857

Chen, H., Cohen, P., & Chen, S. (2010). How big is a big odds ratio? Interpreting the magnitudes of odds ratios in epidemiological studies. *Communications in Statistics. Simulation and Computation*, *39*(4), 860–864. https://doi.org/10.1080/03610911003650383

*Cheng, S. T., Yip, L. C., Jim, O. T., & Hui, A. N. (2012). Self-perception of aging and acute medical events in chronically institutionalized middle-aged and older persons with schizophrenia. *International Journal of Geriatric Psychiatry*, *27*(9), 907–913. https://doi.org/10.1002/gps.2798

Chida, Y., & Steptoe, A. (2008). Positive psychological well-being and mortality: A quantitative review of prospective observational studies. *Psychosomatic Medicine*, *70*(7), 741–756. https://doi.org/10.1097/PSY.0b013e31818105ba

*Choi, N. G., & DiNitto, D. M. (2014). Felt age and cognitive–affective depressive symptoms in late life. *Aging & Mental Health*, *18*(7), 833–837. https://doi.org/10.1080/13607863.2014.886669

*Cohn-Schwartz, E., Segel-Karpas, D., & Ayalon, L. (2021). Longitudinal dyadic effects of aging self-perceptions on health. *The Journals of Gerontology: Series B*, *76*(5), 900–909. https://doi.org/10.1093/geronb/gbaa082

Deeks, J. J., Higgins, J. P. T., & Altman, D. G. (2008). Analysing data and undertaking meta-analysis. In J. P. T. Higgins & S. Green (Eds.), *Cochrane handbook for systematic reviews of interventions* (pp. 243–296). Wiley. https://doi.org/10.1002/9780470712184.ch9

Deeming, C. (2017). The lost and the new 'liberal world' of welfare capitalism: A critical assessment of Gøsta Esping-Andersen's the three worlds of welfare capitalism a quarter century later. *Social Policy and Society*, *16*(3), 405–422. https://doi.org/10.1017/S1474746415000676

Diehl, M., Brothers, A., & Wahl, H.-W. (2021). Self-perceptions and awareness of aging: Past. present. and future. In K. W. Schaie & S. L. Willis (Eds.), *Handbook of the psychology of aging* (9th ed., pp. 155–179). Academic Press. https://doi.org/10.1016/B978-0-12-816094-7.00001-5

Diehl, M. K., & Wahl, H. W. (2010). Awareness of age-related change: Examination of a (mostly) unexplored concept. *The Journals of Gerontology: Series B*, *65B*(3), 340–350. https://doi.org/10.1093/geronb/gbp110

Diehl, M. K., Wahl, H. W., Barrett, A. E., Brothers, A. F., Miche, M., Montepare, J. M., Westerhof, G. J., & Wurm, S. (2014). Awareness of aging: Theoretical considerations on an emerging concept. *Developmental Review*, *34*(2), 93–113. https://doi.org/10.1016/j.dr.2014.01.001

Diehl, M. K., Wahl, H.-W., Brothers, A., & Miche, M. (2015). Subjective aging and awareness of aging: Toward a new understanding of the aging self. In M. Diehl & H.-W. Wahl (Eds.), *Annual review of gerontology and geriatrics, Vol. 35*, 2015: *Subjective aging: New developments and future directions* (pp. 1–28). Springer Publishing.

*Dutt, A. J., Gabrian, M., & Wahl, H. W. (2018). Awareness of age-related change and depressive symptoms in middle and late adulthood: Longitudinal associations and the role of self-regulation and calendar age. *The Journals of Gerontology: Series B*, *73*(6), 944–953. https://doi.org/10.1093/geronb/gbw095

*Dutt, A. J., & Wahl, H. W. (2019). Future time perspective and general self-efficacy mediate the association between awareness of age-related losses and depressive symptoms. *European Journal of Ageing*, *16*(2), 227–236. https://doi.org/10.1007/s10433-018-0482-3

*Dutt, A. J., Wahl, H. W., & Rupprecht, F. S. (2018). Mindful vs. mind full: Processing strategies moderate the association between subjective aging experiences and depressive symptoms. *Psychology and Aging*, *33*(4), 630–642. https://doi.org/10.1037/pag0000245

Duval, S., & Tweedie, R. (2000). Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, *56*(2), 455–463. https://doi.org/10.1111/j.0006-341X.2000.00455.x

Esping-Andersen, G. (1990). *The three worlds of welfare capitalism*. Princeton University Press.

*Faß, E., Pyun, H., & Schlesinger, T. (2020). Perception of aging in the relation between sport activity and self-rated health in middle and older age—A longitudinal analysis. *SSM—Population Health*, *11*, Article 100610. https://doi.org/10.1016/j.ssmph.2020.100610

Faudzi, F. N. M., Armitage, C. J., Bryant, C., & Brown, L. J. E. (2019). A systematic review of the psychometric properties of self-report measures of attitudes to aging. *Research on Aging*, *41*(6), 549–574. https://doi.org/10.1177/0164027518825117

Ferguson, C. J., & Brannick, M. T. (2012). Publication bias in psychological science: Prevalence, methods for identifying and controlling, and implications for the use of meta-analyses. *Psychological Methods*, *17*(1), 120–128. https://doi.org/10.1037/a0024445

*Freeman, A. T., Santini, Z. I., Tyrovolas, S., Rummel-Kluge, C., Haro, J. M., & Koyanagi, A. (2016). Negative perceptions of ageing predict the onset and persistence of depression and anxiety: Findings from a prospective analysis of the Irish Longitudinal Study on Ageing (TILDA). *Journal of Affective Disorders*, *199*, 132–138. https://doi.org/10.1016/j.jad.2016.03.042

*Fundenberger, H., Stephan, Y., Hupin, D., Barth, N., Terracciano, A., & Canada, B. (2022). Prospective associations between subjective age and fear of falling in older adults. *Aging & Mental Health*, *26*(1), 86–91. https://doi.org/10.1080/13607863.2020.1856775

*Gale, C. R., & Cooper, C. (2018). Attitudes to ageing and change in frailty status: The English Longitudinal Study of Ageing. *Gerontology*, *64*(1), 58–66. https://doi.org/10.1159/000477169

*Gale, C. R., Čukić, I., Chastin, S. F., Dall, P. M., Dontje, M. L., Skelton, D. A., Deary, I. J., & the Seniors USP Team. (2018). Attitudes to ageing and objectively-measured sedentary and walking behaviour in older people: The Lothian Birth Cohort 1936. *PLOS ONE*, *13*(5), Article e0197357. https://doi.org/10.1371/journal.pone.0197357

*Gum, A. M., & Ayalon, L. (2018). Self-perceptions of aging mediate the longitudinal relationship of hopelessness and depressive symptoms. *International Journal of Geriatric Psychiatry*, *33*(4), 591–597. https://doi.org/10.1002/gps.4826

*Hajek, A., & König, H. H. (2020). Feeling too old? Consequences for subjective well-being. Longitudinal findings from the German Ageing Survey. *Archives of Gerontology and Geriatrics*, *90*, Article 104127. https://doi.org/10.1016/j.archger.2020.104127

*Han, J. (2018). Chronic illnesses and depressive symptoms among older people: Functional limitations as a mediator and self-perceptions of aging as a moderator. *Journal of Aging and Health*, *30*(8), 1188–1204. https://doi.org/10.1177/0898264317711609

*Han, J., & Richardson, V. E. (2015). The relationships among perceived discrimination, self-perceptions of aging, and depressive symptoms: A longitudinal examination of age discrimination. *Aging & Mental Health*, *19*(8), 747–755. https://doi.org/10.1080/13607863.2014.962007

Holt-Lunstad, J., Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspectives on Psychological Science*, *10*(2), 227–237. https://doi.org/10.1177/1745691614568352

Huppert, F. A. (2009). A new approach to reducing disorder and improving well-being. *Perspectives on Psychological Science*, *4*(1), 108–111. https://doi.org/10.1111/j.1745-6924.2009.01100.x

Kaspar, R., Gabrian, M., Brothers, A., Wahl, H. W., & Diehl, M. (2019). Measuring awareness of age-related change: Development of a 10-item short form for use in large-scale surveys. *The Gerontologist*, *59*(3), e130–e140. https://doi.org/10.1093/geront/gnx213

*Kaspar, R., Wahl, H. W., & Diehl, M. (2021). Awareness of age-related change as a behavioral determinant of survival time in very old age. *Frontiers in Psychology*, *12*, Article 727560. https://doi.org/10.3389/fpsyg.2021.727560

Kastenbaum, R., Derbin, V., Sabatini, P., & Artt, S. (1972). "The ages of me": Toward personal and interpersonal definitions of functional aging. *Aging & Human Development*, *3*(2), 197–211. https://doi.org/10.2190/TUJR-WTXK-866Q-8QU7

Keller, M. L., Leventhal, E. A., & Larson, B. (1989). Aging: The lived experience. *International Journal of Aging & Human Development*, *29*(1), 67–82. https://doi.org/10.2190/DEQQ-AAUV-NBU0-3RMY

*Kim, E. S., Moored, K. D., Giasson, H. L., & Smith, J. (2014). Satisfaction with aging and use of preventive health services. *Preventive Medicine*, *69*, 176–180. https://doi.org/10.1016/j.ypmed.2014.09.008

*Klusmann, V., Sproesser, G., Wolff, J. K., & Renner, B. (2019). Positive self-perceptions of aging promote healthy eating behavior across the life span via social-cognitive processes. *The Journals of Gerontology: Series B*, *74*(5), 735–744. https://doi.org/10.1093/geronb/gbx139

*Kotter-Grühn, D., Kleinspehn-Ammerlahn, A., Gerstorf, D., & Smith, J. (2009). Self-perceptions of aging predict mortality and change with approaching death: 16-year longitudinal results from the Berlin Aging Study. *Psychology and Aging*, *24*(3), 654–667. https://doi.org/10.1037/a0016510

Kotter-Grühn, D., Kornadt, A. E., & Stephan, Y. (2016). Looking beyond chronological age: Current knowledge and future directions in the study of subjective age. *Gerontology*, *62*(1), 86–93. https://doi.org/10.1159/000438671

Kuypers, J. A., & Bengtson, V. L. (1973). Social breakdown and competence. A model of normal aging. *Human Development*, *16*(3), 181–201. https://doi.org/10.1159/000271275

*Kwak, M., Ingersoll-Dayton, B., & Burgard, S. (2014). Receipt of care and depressive symptoms in later life: The importance of self-perceptions of aging. *The Journals of Gerontology: Series B*, *69*(2), 325–335. https://doi.org/10.1093/geronb/gbt128

*Lahav, Y., Avidor, S., Stein, J. Y., Zhou, X., & Solomon, Z. (2020). Telomere length and depression among ex-prisoners of war: The role of subjective age. *The Journals of Gerontology: Series B*, *75*(1), 21–29. https://doi.org/10.1093/geronb/gby006

Laidlaw, K., Power, M. J., Schmidt, S., & the WHOQOL-OLD Group. (2007). The Attitudes to Ageing Questionnaire (AAQ): Development and psychometric properties. *International Journal of Geriatric Psychiatry*, *22*(4), 367–379. https://doi.org/10.1002/gps.1683

Lamers, S. M., Bolier, L., Westerhof, G. J., Smit, F., & Bohlmeijer, E. T. (2012). The impact of emotional well-being on long-term recovery and survival in physical illness: A meta-analysis. *Journal of Behavioral Medicine*, *35*(5), 538–547. https://doi.org/10.1007/s10865-011-9379-8

Lawton, M. P. (1975). The Philadelphia geriatric center morale scale: A revision. *Journal of Gerontology*, *30*(1), 85–89. https://doi.org/10.1093/geronj/30.1.85

Levy, B. (2009). Stereotype embodiment: A psychosocial approach to aging. *Current Directions in Psychological Science*, *18*(6), 332–336. https://doi.org/10.1111/j.1467-8721.2009.01662.x

Levy, B. R. (2022). The role of structural ageism in age beliefs and health of older persons. *JAMA Network Open*, *5*(2), Article e2147802. https://doi.org/10.1001/jamanetworkopen.2021.47802

*Levy, B. R., & Bavishi, A. (2018). Survival advantage mechanism: Inflammation as a mediator of positive self-perceptions of aging on longevity. *The Journals of Gerontology: Series B*, *73*(3), 409–412. https://doi.org/10.1093/geronb/gbw035

Levy, B. R., Hausdorff, J. M., Hencke, R., & Wei, J. Y. (2000). Reducing cardiovascular stress with positive self-stereotypes of aging. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *55*(4), 205–213. https://doi.org/10.1093/geronb/55.4.P205

Levy, B. R., Kasl, S. V., & Gill, T. M. (2004). Image of aging scale. *Perceptual and Motor Skills*, *99*(1), 208–210. https://doi.org/10.2466/pms.99.1.208-210

*Levy, B. R., & Myers, L. M. (2004). Preventive health behaviors influenced by self-perceptions of aging. *Preventive Medicine*, *39*(3), 625–629. https://doi.org/10.1016/j.ypmed.2004.02.029

*Levy, B. R., & Myers, L. M. (2005). Relationship between respiratory mortality and self-perceptions of aging. *Psychology & Health*, *20*(5), 553–564. https://doi.org/10.1080/14768320500066381

*Levy, B. R., & Slade, M. D. (2019). Positive views of aging reduce risk of developing later-life obesity. *Preventive Medicine Reports*, *13*, 196–198. https://doi.org/10.1016/j.pmedr.2018.12.012

Levy, B. R., Slade, M. D., Chang, E. S., Kannoth, S., & Wang, S. Y. (2020). Ageism amplifies cost and prevalence of health conditions. *The Gerontologist*, *60*(1), 174–181. https://doi.org/10.1093/geront/gny131

*Levy, B. R., Slade, M. D., & Kasl, S. V. (2002). Longitudinal benefit of positive self-perceptions of aging on functional health. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *57*(5), 409–417. https://doi.org/10.1093/geronb/57.5.P409

*Levy, B. R., Slade, M. D., Kunkel, S. R., & Kasl, S. V. (2002). Longevity increased by positive self-perceptions of aging. *Journal of Personality and Social Psychology*, *83*(2), 261–270. https://doi.org/10.1037/0022-3514.83.2.261

*Levy, B. R., Slade, M. D., Pietrzak, R. H., & Ferrucci, L. (2018). Positive age beliefs protect against dementia even among elders with high-risk gene. *PLOS ONE*, *13*(2), Article e0191004. https://doi.org/10.1371/journal.pone.0191004

*Li, Y., Liu, M., Miyawaki, C. E., Sun, X., Hou, T., Tang, S., & Szanton, S. L. (2021). Bidirectional relationship between subjective age and frailty: A prospective cohort study. *BMC Geriatrics*, *21*(1), Article 395. https://doi.org/10.1186/s12877-021-02344-1

*Liang, K. (2018). The longitudinal association between age identity and physical functioning among urban Chinese older adults. *Journal of Aging and Physical Activity*, *26*(3), 486–491. https://doi.org/10.1123/japa.2017-0023

*Liang, K. (2020). Differential associations between subjective age and depressive symptoms among urban and rural Chinese older adults. *Aging & Mental Health*, *24*(8), 1271–1277. https://doi.org/10.1080/13607863.2019.1663489

*Lim, M. Y., Stephens, E. K., Novotny, P., Price, K., Salayi, M., Roeker, L., Peethambaram, P., & Jatoi, A. (2013). Self-perceptions of age among 292 chemotherapy-treated cancer patients: Exploring associations with symptoms and survival. *Journal of Geriatric Oncology*, *4*(3), 249–254. https://doi.org/10.1016/j.jgo.2013.02.001

Löckenhoff, C. E., De Fruyt, F., Terracciano, A., McCrae, R. R., De Bolle, M., Costa, P. T., Jr., Aguilar-Vafaie, M. E., Ahn, C. K., Ahn, H. N., Alcalay, L., Allik, J., Avdeyeva, T. V., Barbaranelli, C., Benet-Martinez, V., Blatný, M., Bratko, D., Cain, T. R., Crawford, J. T., Lima, M. P., … Yik, M. (2009). Perceptions of aging across 26 cultures and their culture-level associates. *Psychology and Aging*, *24*(4), 941–954. https://doi.org/10.1037/a0016901

*Losada-Baltar, A., Martínez-Huertas, J. Á., Jiménez-Gonzalo, L., Pedroso-Chaparro, M. D. S., Gallego-Alberto, L., Fernandes-Pires, J., & Márquez-González, M. (2022). Longitudinal correlates of loneliness and psychological distress during the lockdown situation due to COVID-19. Effects of age and self-perceptions of aging. *The Journals of Gerontology: Series B*, *77*(4), 652–660. https://doi.org/10.1093/geronb/gbab012

*Luo, M. S., & Li, L. W. (2020). Are self-perceptions of aging associated with health trajectories among middle-aged and older adults? *The Gerontologist*, *60*(5), 841–850. https://doi.org/10.1093/geront/gnz092

*Maier, H., & Smith, J. (1999). Psychological predictors of mortality in old age. *The Journals of Gerontology: Series B, Psychological Sciences and Social Sciences*, *54*(1), 44–54. https://doi.org/10.1093/geronb/54B.1.P44

*Markides, K. S., & Pappas, C. (1982). Subjective age, health, and survivorship in old age. *Research on Aging*, *4*(1), 87–96. https://doi.org/10.1177/016402758241004

Marquet, M., Missotten, P., Schroyen, S., van Sambeek, I., van den Akker, M., Van Den Broeke, C., Buntinx, F., & Adam, S. (2016). A validation of the French version of the Attitudes to Aging Questionnaire (AAQ): Factor structure, reliability and validity. *Psychologica Belgica*, *56*(2), 80–100. https://doi.org/10.5334/pb.301

*McLachlan, K. J. J., Cole, J. H., Harris, S. E., Marioni, R. E., Deary, I. J., & Gale, C. R. (2020). Attitudes to ageing, biomarkers of ageing and mortality: The Lothian Birth Cohort 1936. *Journal of Epidemiology and Community Health*, *74*(4), 377–383. https://doi.org/10.1136/jech-2019-213462

*Mejía, S. T., Giasson, H. L., Smith, J., & Gonzalez, R. (2020). Concurrent and enduring associations between married partners' shared beliefs and markers of aging. *Psychology and Aging*, *35*(7), 925–936. https://doi.org/10.1037/pag0000515

*Mejía, S. T., & Gonzalez, R. (2017). Couples' shared beliefs about aging and implications for future functional limitations. *The Gerontologist*, *57*(Suppl. 2), S149–S159. https://doi.org/10.1093/geront/gnx071

Miche, M., Elsässer, V. C., Schilling, O. K., & Wahl, H. W. (2014). Attitude toward own aging in midlife and early old age over a 12-year period: Examination of measurement equivalence and developmental trajectories. *Psychology and Aging*, *29*(3), 588–600. https://doi.org/10.1037/a0037259

*Mock, S. E., & Eibach, R. P. (2011). Aging attitudes moderate the effect of subjective age on psychological well-being: Evidence from a 10-year longitudinal study. *Psychology and Aging*, *26*(4), 979–986. https://doi.org/10.1037/a0023877

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & the PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine*, *151*(4), 264–269, W64. https://doi.org/10.7326/0003-4819-151-4-200908180-00135

*Moser, C., Spagnoli, J., & Santos-Eggimann, B. (2011). Self-perception of aging and vulnerability to adverse outcomes at the age of 65–70 years. *The Journals of Gerontology: Series B*, *66*(6), 675–680. https://doi.org/10.1093/geronb/gbr052

*Nieves-Lugo, K., Ware, D., Althoff, K., Brennan-Ing, M., Meanley, S., Brown, A. L., Haberlen, S. A., Masters, M., Egan, J. E., Friedman, M. R., & Plankey, M. (2021). Negative perception of aging is associated with frailty transitions within a cohort of sexual minority men. *Innovation in Aging*, *5*(4), Article igab035. https://doi.org/10.1093/geroni/igab035

*Palgi, Y., Ayalon, L., Avidor, S., Segel-Karpas, D., & Bodner, E. (2018). On the edge: The association between extreme values of proportional felt-age and functioning. *Psychiatry Research*, *270*, 538–543. https://doi.org/10.1016/j.psychres.2018.10.035

*Palgi, Y., Shrira, A., Avidor, S., Hoffman, Y., Bodner, E., & Ben-Ezra, M. (2019). Understanding the long-term connections between posttraumatic stress, subjective age, and successful aging among midlife and older adults. *European Journal of Psychotraumatology*, *10*(1), Article 1583523. https://doi.org/10.1080/20008198.2019.1583523

*Petashnick, J. R., Shrira, A., Hoffman, Y., Palgi, Y., Kavé, G., & Shmotkin, D. (2022). Subjective Age and Late-Life Functional Status: Mediating and Moderating Effects. *The Journals of Gerontology: Series B*, *77*(1), 61–70. https://doi.org/10.1093/geronb/gbab181

Pinquart, M., & Wahl, H. W. (2021). Subjective age from childhood to advanced old age: A meta-analysis. *Psychology and Aging*, *36*(3), 394–406. https://doi.org/10.1037/pag0000600

*Qiao, H., Du, X., Li, S., Sun, Y., Feng, W., & Wu, Y. (2021). Does older subjective age predict poorer cognitive function and higher risk of dementia in middle-aged and older adults? *Psychiatry Research*, *298*, Article 113807. https://doi.org/10.1016/j.psychres.2021.113807

*Rippon, I., & Steptoe, A. (2015). Feeling old vs being old: Associations between self-perceived age and mortality. *JAMA Internal Medicine*, *175*(2), 307–309. https://doi.org/10.1001/jamainternmed.2014.6580

*Rippon, I., & Steptoe, A. (2018). Is the relationship between subjective age, depressive symptoms and activities of daily living bidirectional? *Social Science & Medicine*, *214*, 41–48. https://doi.org/10.1016/j.socscimed.2018.08.013

Sabatini, S., Silarova, B., Martyr, A., Collins, R., Ballard, C., Anstey, K. J., Kim, S., & Clare, L. (2020). Associations of awareness of age-related change with emotional and physical well-being: A systematic review and meta-analysis. *The Gerontologist*, *60*(6), e477–e490. https://doi.org/10.1093/geront/gnz101

*Sargent-Cox, K. A., Anstey, K. J., & Luszcz, M. A. (2012). The relationship between change in self-perceptions of aging and physical functioning in older adults. *Psychology and Aging*, *27*(3), 750–760. https://doi.org/10.1037/a0027578

*Sargent-Cox, K. A., Anstey, K. J., & Luszcz, M. A. (2014). Longitudinal change of self-perceptions of aging and mortality. *The Journals of Gerontology: Series B*, *69*(2), 168–173. https://doi.org/10.1093/geronb/gbt005

Schönstein, A., Trares, K., & Wahl, H.-W. (2022). Subjective views on aging and objective aging biomarkers: Achievements and questions in an emerging research area. In Y. Palgi, A. Shrira, & M. Diehl (Eds.), *Subjective views of aging: Theory, research, and practice* (pp. 153–168). Springer Nature. https://doi.org/10.1007/978-3-031-11073-3_9

*Schroyen, S., Letenneur, L., Missotten, P., Jérusalem, G., & Adam, S. (2020). Impact of self-perception of aging on mortality of older patients in oncology. *Cancer Medicine*, *9*(7), 2283–2289. https://doi.org/10.1002/cam4.2819

*Schroyen, S., Missotten, P., Jerusalem, G., Van den Akker, M., Buntinx, F., & Adam, S. (2017). Association between self-perception of aging, view of cancer and health of older patients in oncology: A one-year longitudinal study. *BMC Cancer*, *17*(1), Article 614. https://doi.org/10.1186/s12885-017-3607-8

*Segel-Karpas, D., Cohn-Schwartz, E., & Ayalon, L. (2022). Self-perceptions of aging and depressive symptoms: The mediating role of loneliness. *Aging & Mental Health*, *26*(7), 1495–1501. https://doi.org/10.1080/13607863.2021.1991275

Settersten, R. A., Jr., & Hagestad, G. O. (2015). Subjective aging and new complexities of the life course. *Annual Review of Gerontology & Geriatrics*, *35*(1), 29–53. https://doi.org/10.1891/0198-8794.35.29

*Siebert, J. S., Wahl, H. W., Degen, C., & Schröder, J. (2018). Attitude toward own aging as a risk factor for cognitive disorder in old age: 12-year evidence from the ILSE study. *Psychology and Aging*, *33*(3), 461–472. https://doi.org/10.1037/pag0000252

Spuling, S. M., Klusmann, V., Bowen, C. E., Kornadt, A. E., & Kessler, E. M. (2020). The uniqueness of subjective ageing: Convergent and discriminant validity. *European Journal of Ageing*, *17*, 445–455. https://doi.org/10.1007/s10433-019-00529-7

*Spuling, S. M., Miche, M., Wurm, S., & Wahl, H.-W. (2013). Exploring the causal interplay of subjective age and health dimensions in the second half of life: A cross-lagged panel analysis. *Zeitschrift für Gesundheitspsychologie*, *21*(1), 5–15. https://doi.org/10.1026/0943-8149/a000084

*Stephan, Y., Sutin, A. R., Bayard, S., & Terracciano, A. (2017). Subjective age and sleep in middle-aged and older adults. *Psychology & Health*, *32*(9), 1140–1151. https://doi.org/10.1080/08870446.2017.1324971

*Stephan, Y., Sutin, A. R., Luchetti, M., & Terracciano, A. (2017). Feeling older and the development of cognitive impairment and dementia. *The Journals of Gerontology: Series B*, *72*(6), 966–973. https://doi.org/10.1093/geronb/gbw085

*Stephan, Y., Sutin, A. R., Luchetti, M., & Terracciano, A. (2018). Subjective age and risk of incident dementia: Evidence from the National Health and Aging Trends survey. *Journal of Psychiatric Research*, *100*, 1–4. https://doi.org/10.1016/j.jpsychires.2018.02.008

*Stephan, Y., Sutin, A. R., Luchetti, M., & Terracciano, A. (2021). An older subjective age is related to accelerated epigenetic aging. *Psychology and Aging*, *36*(6), 767–772. https://doi.org/10.1037/pag0000607

*Stephan, Y., Sutin, A. R., & Terracciano, A. (2015a). "Feeling younger, walking faster": Subjective age and walking speed in older adults. *Age*, *37*(5), Article 86. https://doi.org/10.1007/s11357-015-9830-9

Stephan, Y., Sutin, A. R., & Terracciano, A. (2015b). Younger subjective age is associated with lower C-reactive protein among older adults. *Brain, Behavior, and Immunity*, *43*, 33–36. https://doi.org/10.1016/j.bbi.2014.07.019

*Stephan, Y., Sutin, A. R., & Terracciano, A. (2016). Feeling older and risk of hospitalization: Evidence from three longitudinal cohorts. *Health Psychology*, *35*(6), 634–637. https://doi.org/10.1037/hea0000335

*Stephan, Y., Sutin, A. R., & Terracciano, A. (2018). Subjective age and mortality in three longitudinal samples. *Psychosomatic Medicine*, *80*(7), 659–664. https://doi.org/10.1097/PSY.0000000000000613

*Stephan, Y., Sutin, A. R., & Terracciano, A. (2019). Subjective age and cystatin C among older adults. *The Journals of Gerontology: Series B*, *74*(3), 382–388. https://doi.org/10.1093/geronb/gbx124

*Stephan, Y., Sutin, A. R., Wurm, S., & Terracciano, A. (2021). Subjective aging and incident cardiovascular disease. *The Journals of Gerontology: Series B*, *76*(5), 910–919. https://doi.org/10.1093/geronb/gbaa106

Steverink, N., Westerhof, G. J., Bode, C., & Dittmann-Kohli, F. (2001). The personal experience of aging, individual resources, and subjective well-being. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *56*(6), 364–373. https://doi.org/10.1093/geronb/56.6.P364

*Sun, J. K., Kim, E. S., & Smith, J. (2017). Positive self-perceptions of aging and lower rate of overnight hospitalization in the US population over age 50. *Psychosomatic Medicine*, *79*(1), 81–90. https://doi.org/10.1097/PSY.0000000000000364

*Tovel, H., Carmel, S., & Raveis, V. H. (2019). Relationships among self-perception of aging, physical functioning, and self-efficacy in late life. *The Journals of Gerontology: Series B*, *74*(2), 212–221. https://doi.org/10.1093/geronb/gbx056

Tully-Wilson, C., Bojack, R., Millear, P. M., Stallman, H. M., Allen, A., & Mason, J. (2021). Self-perceptions of aging: A systematic review of longitudinal studies. *Psychology and Aging*, *36*(7), 773–789. https://doi.org/10.1037/pag0000638

*Uotinen, V., Rantanen, T., & Suutama, T. (2005). Perceived age as a predictor of old age mortality: A 13-year prospective study. *Age and Ageing*, *34*(4), 368–372. https://doi.org/10.1093/ageing/afi091

*Veenstra, M., Daatland, S. O., & Aartsen, M. (2021). The role of subjective age in sustaining wellbeing and health in the second half of life. *Ageing and Society*, *41*(11), 2446–2466. https://doi.org/10.1017/S0144686X2000032X

*Veenstra, M., Løset, G. K., & Daatland, S. O. (2021). Socioeconomic inequalities in mortality after age 67: The contribution of psychological factors. *Frontiers in Psychology*, *12*, Article 717959. https://doi.org/10.3389/fpsyg.2021.717959

*Warmoth, K., Tarrant, M., Abraham, C., & Lang, I. A. (2018). Relationship between perceptions of ageing and frailty in English older adults. *Psychology Health and Medicine*, *23*(4), 465–474. https://doi.org/10.1080/13548506.2017.1349325

Weiss, D., & Kornadt, A. E. (2018). Age-stereotype internalization and dissociation: Contradictory processes or two sides of the same coin? *Current Directions in Psychological Science*, *27*(6), 477–483. https://doi.org/10.1177/0963721418777743

Westerhof, G. J. (2022). *Assessing the impact of subjective aging on health-related outcomes: An updated meta-analysis of the evidence from longitudinal studies* [Data, Prisma checklist, and ethical approval]. https://doi.org/10.17605/OSF.IO/62RDF

Westerhof, G. J., & Barrett, A. E. (2005). Age identity and subjective well-being: A comparison of the United States and Germany. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *60*(3), S129–S136. https://doi.org/10.1093/geronb/60.3.S129

Westerhof, G. J., Miche, M., Brothers, A. F., Barrett, A. E., Diehl, M., Montepare, J. M., Wahl, H.-W., & Wurm, S. (2014). The influence of subjective aging on health and longevity: A meta-analysis of longitudinal data. *Psychology and Aging*, *29*(4), 793–802. https://doi.org/10.1037/a0038016

Westerhof, G. J., & Wurm, S. (2018). Subjective aging and health. In B. G. Knight & H.-W. Wahl (Eds.), *Oxford research encyclopedia of psychology and aging* (pp. 1–30). Oxford University Press. https://doi.org/10.1093/acrefore/9780190236557.013.4

*Wettstein, M., Spuling, S. M., Cengia, A., & Nowossadeck, S. (2021). Feeling younger as a stress buffer: Subjective age moderates the effect of perceived stress on change in functional health. *Psychology and Aging*, *36*(3), 322–337. https://doi.org/10.1037/pag0000608

*Wettstein, M., Wahl, H. W., & Kornadt, A. E. (2021). Longitudinal associations between perceived stress and views on aging: Evidence for reciprocal relations. *Psychology and Aging*, *36*(6), 752–766. https://doi.org/10.1037/pag0000632

*Wettstein, M., Wahl, H. W., & Siebert, J. S. (2020). 20-year trajectories of health in midlife and old age: Contrasting the impact of personality and attitudes toward own aging. *Psychology and Aging*, *35*(6), 910–924. https://doi.org/10.1037/pag0000464

*Wettstein, M., Werner-Wahl, H., & Spuling, S. M. (2021). Nine-year changes in self-reported problems with vision and hearing among older adults: Do subjective age views matter? *Aging & Mental Health*, *25*(12), 2200–2212. https://doi.org/10.1080/13607863.2020.1822290

*Whitehead, B. R. (2019). Investigating the function spiral in later life: Aging attitudes, physical activity, and gait. *Journal of Health Psychology*, *24*(14), 1955–1964. https://doi.org/10.1177/1359105317710814

*Wienert, J., Gellert, P., & Lippke, S. (2017). Physical activity across the life-span: Does feeling physically younger help you to plan physical activities? *Journal of Health Psychology*, *22*(3), 324–335. https://doi.org/10.1177/1359105315603469

*Wienert, J., Kuhlmann, T., & Lippke, S. (2015). Direct effects of a domain-specific subjective age measure on self-reported physical activity: Is it more important how old you are or how old you feel? *Health Psychology Report*, *3*(2), 131–139. https://doi.org/10.5114/hpr.2015.51450

*Wolff, J. K., Schüz, B., Ziegelmann, J. P., Warner, L. M., & Wurm, S. (2017). Short-term buffers, but long-term suffers? Differential effects of negative self-perceptions of aging following serious health events. *The Journals of Gerontology: Series B*, *72*(3), 408–414. https://doi.org/10.1093/geronb/gbv058

Wong, W. C., Cheung, C. S., & Hart, G. J. (2008). Development of a quality assessment tool for systematic reviews of observational studies (QATSO) of HIV prevalence in men having sex with men and associated risk behaviours. *Emerging Themes in Epidemiology*, *5*(1), Article 23. https://doi.org/10.1186/1742-7622-5-23

*Wurm, S., & Benyamini, Y. (2014). Optimism buffers the detrimental effect of negative self-perceptions of ageing on physical and mental health. *Psychology & Health*, *29*(7), 832–848. https://doi.org/10.1080/08870446.2014.891737

Wurm, S., Diehl, M., Kornadt, A. E., Westerhof, G. J., & Wahl, H.-W. (2017). How do views on aging affect health outcomes in adulthood and late life? Explanations for an established connection. *Developmental Review*, *46*, 27–43. https://doi.org/10.1016/j.dr.2017.08.002

*Wurm, S., & Schäfer, S. K. (2022). Gain- but not loss-related self-perceptions of aging predict mortality over a period of 23 years: A multidimensional approach. *Journal of Personality and Social Psychology*, *123*(3), 636–653. https://doi.org/10.1037/pspp0000412

*Wurm, S., Tesch-Römer, C., & Tomasik, M. J. (2007). Longitudinal findings on aging-related cognitions, control beliefs, and health in later life. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *62*(3), 156–164. https://doi.org/10.1093/geronb/62.3.P156

*Wurm, S., Tomasik, M. J., & Tesch-Römer, C. (2008). Serious health events and their impact on changes in subjective health and life satisfaction: The role of age and a positive view on ageing. *European Journal of Ageing*, *5*(2), 117–127. https://doi.org/10.1007/s10433-008-0077-5

*Wurm, S., Tomasik, M. J., & Tesch-Römer, C. (2010). On the importance of a positive view on ageing for physical exercise among middle-aged and older adults: Cross-sectional and longitudinal findings. *Psychology & Health*, *25*(1), 25–42. https://doi.org/10.1080/08870440802311314

*Wurm, S., Warner, L. M., Ziegelmann, J. P., Wolff, J. K., & Schüz, B. (2013). How do negative self-perceptions of aging become a self-fulfilling prophecy? *Psychology and Aging*, *28*(4), 1088–1097. https://doi.org/10.1037/a0032845

*Zee, K. S., & Weiss, D. (2019). High-quality relationships strengthen the benefits of a younger subjective age across adulthood. *Psychology and Aging*, *34*(3), 374–388. https://doi.org/10.1037/pag0000349

*Zhang, X., Kamin, S. T., Liu, S., Fung, H. H., & Lang, F. R. (2020). Negative self-perception of aging and mortality in very old Chinese adults: The mediation role of healthy lifestyle. *The Journals of Gerontology: Series B*, *75*(5), 1001–1009. https://doi.org/10.1093/geronb/gby136

*Zhao, Y., Dupre, M. E., Qiu, L., & Gu, D. (2017). Changes in perceived uselessness and risks for mortality: Evidence from a National sample of older adults in China. *BMC Public Health*, *17*(1), Article 561. https://doi.org/10.1186/s12889-017-4479-1

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