This is a peer-reviewed, accepted author manuscript of the following research article: Boeder, J., & Tse, D. C. K. (2020). Measuring self-perceptions of aging: differences between measures when predicting health outcomes. *The journals of gerontology. Series B, Psychological sciences and social sciences*, *76*(5), 825-835. https://doi.org/10.1093/geronb/gbaa064

Measuring Self-Perceptions of Aging:

Differences Between Measures when Predicting Health Outcomes

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Word Count
Main Text: 5294
Abstract: 250
Number of References: 50
Number of Tables: 2
Number of Figures: 2

Abstract

Objectives: The majority of self-perceptions of aging (SPA) research uses either a combination of the Aging-related Cognitions (AgeCog) scales of Ongoing Development and Physical Loss, or the Attitudes Towards Own Aging (ATOA) subscale to assess views on aging. Although these scales are used interchangeably, the valence (positive/negative) and the specificity of the view on aging (domain-based/general) being assessed are not consistent. This study investigates how different measures of SPA relate to one another and whether they differentially predict various types of health outcomes (psychological/physiological; well-being/ill-being).

Method: Data from the 2008 and 2014 waves of the German Aging Survey (DEAS; N=3,745), a population-based representative survey of adults aged 40 to 95, was used to examine the relationship between the AgeCog scales and the ATOA subscale, as well as the differences in the types of health outcomes each predicts.

Results: The correlations between the AgeCog scales and the ATOA were higher than the correlation between the AgeCog scales ($p < .001$). The AgeCog scale of Ongoing Development significantly predicted psychological health outcomes across a six-year period, while the AgeCog scale of Physical Loss and the ATOA subscale predicted both physiological and psychological health outcomes.

Discussion: Evidence supports using the AgeCog scale of Ongoing Development to predict domain-relevant, psychological health outcomes. However, the multidimensionality of SPA is best measured by the ATOA subscale or a combination of the two AgeCog scales. Both forms of measurement were found to maximize the amount of explained variance for psychological and physiological indicators of well-being and ill-being.

Keywords: Attitudes Towards Own Aging, Views of Aging, Depression, Life Satisfaction, Physical Functioning

Measuring Self-Perceptions of Aging:
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One of the fundamental postulates of aging research is that any form of development includes both gains and losses (Baltes, 1987, 1997; Baltes, Lindenberger, & Staudinger, 2006). Research continually evidences this idea as older adults experience gains in emotion regulation (Charles & Carstensen, 2010), wisdom (Ardelt, 2000), and crystallized intelligence (Schaie, 1994), while simultaneously experiencing losses in physical functioning (Baltes, Lindenberger, & Staudinger, 2006) and fluid intelligence (Schaie, 1994). With research finding both gains and losses later in life, it is possible for older adults to don a holistic, and multidimensional, view of their aging as a process filled with both adaptive and maladaptive changes.

One's thoughts and beliefs regarding their aging process are referred to as self-perceptions of aging (SPA). Longitudinal and experimental research over the past 20 years has supported the impact of SPA on the mental and physical health trajectory of individuals, with more positive SPA associated with better health (for literature reviews see Westerhof et al., 2014; Wurm, Diehl, Kornadt, Westerhof, & Wahl, 2017). Moreover, SPA is found to be a better predictor of health than health is of SPA (Wurm, Tesch-Römer, & Tomasik, 2007). The aging stereotypes that become our SPA are internalized across the lifespan, operate non-consciously, and affect our health through three different pathways—psychological, behavioral, and physiological (Levy, 2009). The psychological pathway affects one's health through age stereotypes creating expectations that become self-fulfilling prophecies (Levy & Leifheit-Limson, 2009). The behavioral pathway is characterized by the healthy practices one engages in (or does not), depending on whether they believe health declines from aging are inevitable or within one's control. Lastly, the physiological pathway affects health through the autonomic

nervous system as negative age stereotypes can heighten one's cardiovascular response to stress (Levy, 2009). With a large body of research supporting the effects of these three pathways, it is important to note that SPA is malleable and can be changed through targeted interventions to bolster positive health outcomes (see Kotter-Grühn, 2015, for a review).

Although research has consistently found support for SPA as a significant predictor of a multitude of health indicators, there are several different operationalizations and conceptualizations of the construct that may impact the comparability of findings. SPA is one dimension of the superordinate construct known as Awareness of Aging (AoA; Diehl et al., 2014). Other aspects of AoA include subjective age, age identity/age identification, attitudes toward aging and age stereotypes, and awareness of aging-related change. Due to the many aspects of AoA, a plethora of scales have been created to measure these different dimensions (see Diehl et al., 2014, for a review). SPA is distinct from many of the other related constructs as it is a multifaceted construct that mirrors the multidimensionality of aging expectations and aging stereotypes (Diehl et al, 2014). For the same reasons, SPA is considered to be a more informative version of the single item measures of aging beliefs like subjective age (Kastenbaum, Derbin, Sabatini, & Artt,1972) and age identity (Kaufman & Elder, 2002). Moreover, SPA has become a prominent aspect of AoA because of its strong theoretical foundation that links it to the actual aging experience and self-knowledge (Diehl et al., 2014).

The two most common measures of SPA are the Attitude Towards Own Aging subscale (ATOA), and the Aging-related Cognitions (AgeCog) scales of Ongoing Development and Physical Loss, which represent positive and negative views on aging, respectively (PVA; NVA). The ATOA represents a domain-general operationalization of SPA and measures views of aging on a positive continuum. In contrast, the AgeCog scales take a multidimensional, domain-

specific approach, measuring the various positive and negative aspects of the aging experience separately. The relationship between these different operationalizations and whether positive and negative SPA differentially predict health outcomes has not been thoroughly investigated. Other areas of psychological research suggest that "positive" and "negative" versions of constructs can predict different outcomes, and do not just mirror the same effect in the opposite direction. For example, research finds optimism and pessimism to be distinct constructs (Palgi, Shrira, Ben-Ezra, Cohen-Fridel, & Bodner, 2011) that share similarities in their relation to certain health outcomes (Benyamini, 2005), but can also be distinct, especially when predicting physiological health outcomes (Kubzansky, Kubzansky, & Maselko, 2004). Additionally, evidence is mounting for research to make distinctions between indicators of well-being and ill-being as they are no longer thought to be mirrors of the same construct, but rather distinct aspects of health (Keyes, 2005; Ryff et al., 2006). Applying this logic to SPA is important for understanding the possible differential impact of PVA and NVA on psychological/physiological indicators of well-being/ill-being as well as how the two major lines of SPA research relate to one another.

Beginning in the early 2000s, Levy and colleagues carried out seminal SPA research, finding individuals with a more positive SPA were less likely to die from a respiratory illness (Levy & Myers, 2002) and lived an average of 7.5 years longer (Levy, Slade, Kunkel, & Kasl, 2002) compared to those with less positive SPA over a 23-year period. To measure SPA, this line of research used the ATOA subscale which Liang and Bollen (1983) adapted from the Philadelphia Geriatric Center Morale Scale. The 5-item subscale asks respondents to compare their current assessment of life to when they were younger, with two of five items negatively worded. The scale has been found to load highly onto a single factor (Levy et al., 2002; Liang & Bollen, 1983); however, due to the positive transformation of the scale's negative items, it is not

clear whether that single factor is a general representation of SPA or positive SPA specifically. In terms of the groups created from the scale, it is unclear whether the groups represent positive versus negative views on aging, or more specifically high versus low positive SPA as suggested by the literature. What the groups actually represent is not just a semantic issue but has empirical implications if positive and negative SPA differentially predict various health outcomes. For instance, it is currently unknown whether this line of research has shown the effects of positive SPA or a more general representation of SPA on health. Moreover, assuming negative SPA has additional predictive power beyond positive SPA, the total effect of SPA on health would be underrepresented in the previously cited findings if the ATOA subscale solely measured positive SPA.

Around the same time period as the start of Levy's work with the ATOA subscale, the AgeCog scales were developed to represent the multidimensionality of SPA. Although research had already recognized SPA as a multidimensional construct, consisting of positive and negative views, there was not a scale that measured SPA in specific life domains. Using data from the German Aging Survey, factor analyses revealed three distinct factors related to SPA beliefs, including: aging experiences of Physical Decline, Social Loss, and Ongoing Development (Ditmann-Kohli et al., 1997; Steverink, Westerhof, Bode, & Dittman-Kohli, 2001). A fourth scale was later added to represent aging experiences of increased Self-Knowledge and Control, producing two scales each for PVA and NVA.

Although four scales were developed, the vast majority of research uses the AgeCog scale of Physical Decline, a negative view on *physiological* aging, to measure NVA (Wurm & Benyamini, 2014; Wurm et al., 2007) and the AgeCog scale of Ongoing Development, a positive view on *psychological* aging, for PVA (Wurm, Tomasik, & Tesch-Römer, 2008, 2010; Wurm,

Warner, Ziegelmann, Wolff, & Schüz, 2013). Moreover, even in literature reviews exploring what is known about the effects of SPA, the AgeCog scales of Ongoing Development and Physical Loss are specifically cited as operationalizations of PVA and NVA, respectively, while the other two AgeCog scales are not mentioned (e.g., Wurm et al., 2017). Even though the two constructs represent views on physiological and psychological aging, respectively, researchers have primarily used them to predict both physiological and psychological health outcomes that are of similar valence. For example, researchers have opted to use PVA to predict well-being outcomes like physical activity (Wurm et al., 2010) or life satisfaction (Wurm et al., 2008), and NVA to predict ill-being, such as depression (Wurm & Benyamini, 2014) and the inability to maximize resource allocation after a serious health event (Wurm et al., 2013).

With the current state of SPA research, it is difficult to disentangle how various aspects and operationalizations of SPA (i.e. valence, domain-specific, or domain-general) differentially predict health outcomes. Recent research has begun to examine distinctions between different measures of subjective aging, including SPA. This research found that the AgeCog scales, the ATOA, and subjective age ratings are related, but still distinct (Spuling, Klusmann, Bowen, Kornadt, & Kessler, 2019). Specifically, the measures were found to correlate with each other at varying levels; however, the measures were differentially related to dispositions (optimism and self-efficacy) and certain health outcomes (depressive symptoms, negative affect, and self-rated health). Although their study provides important initial insights into the similarities and differences between operationalizations of subjective aging, a longitudinal approach is warranted to test differences between the scales' predictive validity of various outcomes over time. For instance, in regard to SPA valence, it is not known whether PVA and NVA differentially predict well-being and ill-being. Additionally, whether specific SPA domains better predict domain

matching health outcomes has yet to be examined. Essentially, the question is whether matching domain or valence has a greater impact on maximizing explained variance in health outcomes when using SPA as a predictor.

Combining the theoretical questions raised from examining the two main bodies of SPA literature, three overarching research questions drive the current study: RQ1) "How are ATOA scores related to PVA and NVA?" RQ2) "Do PVA and NVA differentially predict psychological and physiological indicators of well-being and ill-being?" RQ3) "Is the ATOA subscale more similar to PVA, NVA, or a combination of the two when predicting various health outcomes?" To better understand the longitudinal and multidimensional effects of SPA, the predictive validity of the three different scales will be assessed with a range of health outcomes that represent physiological and psychological health indicators of well-being and ill-being. Exploring the similarities and differences between the scales' ability to predict such health outcomes will provide insights into the best combination of predictors for each type of health outcome and elucidate whether the ATOA subscale more closely represents PVA, NVA, or a combination of both. Understanding the relationship between SPA scales will help contextualize previous research, and elucidate whether the valence and/or the domain of the SPA measure impacted the observed association between SPA and health. Furthermore, understanding the impact of measurement valence and domain-specificity will bolster our conceptual understanding of SPA as a multidimensional construct and consequently inform best practices for measuring SPA in future research.

Method

Data and Sample

Data came from the German Aging Survey (DEAS), which is an ongoing nationally

representative, cohort-sequential survey of the German population aged 40 and up (Klaus et al., 2017). The DEAS began in 1996, with follow-up surveys occurring every six years (2002, 2008, 2014), and re-interviewing taking place every three years starting after 2008 (2011)—totaling five waves. The current study uses data from the 2008 (Time 1) and 2014 (Time 2) waves and includes participants from each of the panel samples. These waves were chosen because they contain all of the SPA measures, as well as the most theoretically relevant health outcomes. The total sample for 2008 included 8,196 participants (Panel Sample=1,991 and 2008 Baseline sample= 6,205), however, only respondents who participated in both the 2008 and 2014 wave were included in the current study, resulting 3,745 participants. Compared to the 4,451 respondents who participated in 2008 but not 2014, the respondents who participated in both waves were on average younger, more educated, had more positive and less negative SPA, and were physically and mentally healthier (see Table 1).

[INSERT TABLE 1]

Measures

All measures of SPA and the demographics variables were measured at Time 1 (see Table 1). The health outcomes were measured at Time 1 and 2. Each of these health outcomes were chosen because they represent combinations of two major health distinctions: psychological/physiological health and well-being/ill-being. Within this framework, the authors chose health outcomes that have been commonly used in previous SPA research (e.g., Wurm & Benyamini, 2014; Wurm et al., 2007; 2008).

Positive Views on Aging. PVA was assessed with the Ongoing Development scale from the larger set of AgeCog scales (Dittman-Kohli et al., 1997; Steverink et al., 2001). The scale assesses the psychological domain of SPA, measuring participants' view of aging as being a time

of personal growth and development. Participants rate their PVA on a 4-point Likert scale, ranging from 1 (*definitely false*) to 4 (*definitely true*). The four items that make up the subscale include: 'Aging means to me that I continue to make plans', 'my capabilities are increasing', 'I can still learn new things', and 'I can still put my ideas into practice'. The scale was internally reliable in previous research (Steverink et al., 2001; α=.78) and in the current study (α=.64). Although the Cronbach's alpha score was lower in the current study compared to the original validation study, other research has found the reliability of the scale to vary and be lower for longitudinal samples in the DEAS (Wurm et al., 2010).

Negative Views on Aging. NVA was examined with the Physical Loss AgeCog scale (Steverink et al., 2001). The scale measures the physiological domain of aging as it examines perceptions that aging is characterized by physical loss. Participants are asked to rate their negative views on aging with a 4-point Likert scale, ranging from 1 (*definitely false*) to 4 (*definitely true*). The subscale consists of four items, including 'Aging means to me being less energetic and fit,' 'my health declines,' 'I have less physical endurance,' and 'I'm less able to handle physical declines.' Evidence supporting the underlying factor structure and internal reliability has been established (Steverink et al., 2001; α=.79). A similar alpha was found using the current sample at Time 1 (α=.77).

General SPA. The ATOA subscale from the Philadelphia Geriatric Center Morale Scale (Liang & Bollen, 1983) was included in the study to assess a domain-general SPA. The subscale consists of five items: (1) 'I have as much pep as last year,' (2) 'Things keep getting worse as I get older,' (3) 'As I get older, I am less useful,' (4) 'As I get older, things are better than I thought they would be' and (5) 'I am as happy now as when I was younger.' Each item was presented in a 4-point Likert scale format with responses options ranging from 1 (*strongly agree*)

to 4 (*strongly disagree*). As done in prior research, items 1, 4, and 5, were reverse-coded and all items were summed to create a singular measure of SPA with higher scores representing more positive SPA (Levy et al., 2002). In general, the scale has been found to have adequate internal reliability (Beyer et al., 2015; α = .76; Wurm, Wolff, & Schüz, 2014; α = .76). Sufficient reliability was found at Time 1 in the current study (α=.72).

Psychological Well-Being. Psychological well-being was assessed with the Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985). This 5-point Likert scale consists of five items, with responses ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A sample item includes: 'In most ways my life is close to ideal.' Previous studies have found the scale to be valid in both U.S. (Diener et al., 1985; α=.87) and German samples (Glaesmer, Grande, Braehler & Roth, 2011; α=.92). Internal consistency was high at Time 1 (α=.84) and Time 2 (α=.85) in the current study.

Physiological Well-Being. The 10-item physical functioning subscale from the SF-36 health survey (Bullinger & Kirchberger, 1998) was used to operationalize physiological well-being. This subscale measures functional ability in a range of daily physical activities such as lifting or carrying groceries, bending, and running. Each item is rated on a 3-point Likert scale from 1 (*severely limited*) to 3 (*not limited at all*). Following the SF-36 manual, responses were transformed into a standardized score from 0-100. Higher scores indicate better functional health. Prior research has found the scale to have high internal reliability with a German sample (Wurm & Benyamini, 2014; α = .93), as was the case in the current study at Time 1 (α=.90) and Time 2 (α=.91).

Psychological Ill-Being. The German version of the (CES-D) was used to assess depressive symptoms (Hautzinger, 1988) and psychological ill-being. The 4-point Likert scale

prompts participants to rate the extent to which they have experienced a variety of depressive symptoms during the past week on a scale of 1 (*rarely or none of the time – less than one day long*) to 4 (*most or all of the time – five to seven days long*). A few sample items include: 'I felt lonely' and 'I thought my life had been a failure.' The composite variable is a sum score that has been transformed to a range of 0 to 45, with higher values indicating more frequent depressive symptoms. The scale has been found to be reliable in previous research (Radloff, 1977; α=.85). Sufficient reliability was found at Time 1 (α=.85) and Time 2 (α=.85) in the current study.

Physiological Ill-being. Total number of diagnosed physical illnesses was used to represent physiological ill-being (Wurm et al., 2007). Physical illness was assessed by summing the number of diagnosed health issues from a list of 11 chronic health conditions (e.g., cardiovascular diseases, circulatory issues, arthritis). The items were summed, meaning all individuals have a score ranging from 0 to 11.

Demographics. Several covariates that are known to influence health across the lifespan were also included: age, educational attainment, gender, income, and marital status (e.g., Adler & Ostrove, 1999; Cummings & Jackson, 2008; Liu & Umberson, 2008). Educational attainment was assessed with the International Standard Classification of Education which distinguishes between low (incomplete vocational training), medium (complete vocational training and/or high school degree) and high (completion of any higher education; UNESCO, 1997) educational attainment. Gender was represented as a binary variable (Male=0; Female=1). Net monthly household income was used to represent income level. Marital status was a constructed, binary variable, with one representing individuals who were married and living with their spouse and zero representing those who lived in any other condition. All demographic variables were measured at Time 1 (see Table 1). Lastly, we controlled for whether individuals were a part of

the baseline sample in 2008 or were part of the panel that was being re-interviewed (baseline=0; panel=1).

Data Analysis

Data were analyzed with the statistical software R (version 3.5.2). To conduct the path and confirmatory factor analyses (CFAs), the Lavaan package was utilized (Rosseel, 2012). Path analyses and CFAs were conducted with full information maximum likelihood estimation (FIML) to account for incomplete data amongst respondents who participated in both waves. Standard error estimates for the predictor variables were estimated using a bootstrapping procedure with 1,000 resamplings (Bollen & Stine, 1990).

For all path analyses, the corresponding outcome variable (health) from Time 1 was regressed onto the Time 2 variable to serve as a control. In all models, the Time 1 indicator of health and the demographic variables were set to covary. The same criteria were used to assess the model fit of each analysis (e.g., Hu & Bentler, 1999; MacCallum, Browne, & Sugawara, 1996): comparative fit index (CFI) > .90, root mean square error of approximation (RMSEA) < .05, and standardized root mean square residual (SRMR) < .08. Since the two path models contain different exogenous variables, they cannot be directly compared through a chi-square difference test. Instead, the Akaike Information Criteria (AIC) values as well as the explained variance across the health outcomes were used to compare models. AIC values penalize models based on extra parameters and models with lower values are considered to have better model fit (Kuha, 2004).

Results

Factor Structures of PVA, NVA, and ATOA

To address RQ1, a CFA was conducted to assess the factor structures of the three SPA

predictor variables. The CFA model specified correlations between the three SPA latent factors (see Figure 1). Overall, the model adequately fit the data: CFI= .94, RMSEA= .06, 90% CI [.05, .06], and SRMR= .04. All items loaded significantly on their respective latent factor, providing further evidence of the scales' reliability. The two AgeCog scales (PVA/NVA) were moderately and negatively correlated with each other (r = -.45, p<.001), suggesting that the two scales represent two, distinct, and opposite views of aging. The ATOA subscale had a strong, positive correlation with PVA (r = .72, p<.001) and a similarly strong, but negative correlation with NVA (r = -.67, p<.001). Based on z-score transformations of the correlations, the association between the AgeCog scales and the ATOA were significantly higher than the correlation between the AgeCog scales (p<.001). Taken together, there is initial evidence that ATOA is a general representation of SPA and is not more similar to PVA (vs. NVA), even though the scale is positively valenced once recoded.

[INSERT FIGURE 1]

The Relationships Between Health Outcomes and SPA Scales

To address the remaining research questions, two path analyses were conducted to determine whether PVA, NVA, and the ATOA scales differentially predict a variety of health outcomes across time**.** Model 1 was specified to regress PVA and NVA onto each of the four health outcomes to determine whether they differentially predict psychological and physiological indicators of well-being and ill-being (see Figure 2 and Table 2). The model was found to have adequate fit: CFI= .97, RMSEA= .07, 90% CI [.06, .08], and SRMR= .02. Controlling for NVA, PVA was found to significantly predict increases in life satisfaction (β = .09, p<.001) and decreases in depressive symptoms (β = -.07, p =. 002), but it did not predict functional health (β = .02, p=.175) nor number of physical illnesses (β = .00, p =. 938). Controlling for PVA, NVA

was significantly related to decreases in life satisfaction (β = -.05, p=.005) and functional health (β = -.12, p<.001), as well as increases in depressive symptoms (β= .16, p<.001) and number of physical illnesses (β = .13, p<.001). In other words, PVA and NVA were both significantly related to life satisfaction and depression. However, NVA was additionally related to functional health and number of physical illnesses. To reiterate in terms of the research questions, PVA and NVA were found to significantly predict psychological functioning, and NVA additionally predicted physiological well-being and ill-being.

[INSERT FIGURE 2]

Next, a path analysis (Model 2) was conducted to assess the predictive nature of the ATOA subscale. The path analysis used the same covariates as the previous model, but only the ATOA scores were used to represent the longitudinal effects of SPA on the four health outcomes (see Figure 2). This model adequately fit the data: CFI= .97, RMSEA= .07, 90% CI [.06, .08], and SRMR= .02. The ATOA subscale was significantly related to increases in life satisfaction (β = .15, p<.001) and functional health (β= .11, p<.001), as well as decreases in depressive symptoms (β = -.24, p<.001) and number of physical illnesses (β = -.13, p<.001; see Table 2). In other words, ATOA significantly predicted each health outcome. Models 1 (PVA and NVA) and 2 (ATOA only) explained a similar amount of variance in each dependent variable (see Table 2). The ATOA model had a higher AIC value, indicating better model fit (Kline, 2016). Thus, evidence suggests the ATOA subscale has the predictive power of using PVA and NVA, with the direction of effects similar to PVA.

[INSERT TABLE 2]

Discussion

The first goal of the current study was to explore the relationship between the AgeCog

scales and the ATOA subscale (RQ1). The ATOA had a strong positive and negative correlation with the AgeCog scales of Ongoing Development (PVA) and Physical Loss (NVA), respectively. Next, the study assessed whether PVA and NVA differentially predict psychological and physiological indicators of well-being and ill-being (RQ2). PVA was found to predict indicators of psychological well-being and ill-being, while NVA predicted all health outcomes. Lastly, the question of whether the ATOA subscale was more similar to PVA, NVA, or a combination of the two in terms of predicting health outcomes was explored (RQ3). The ATOA subscale had a similar predictive power of using both PVA and NVA.

Confirmatory factor analysis revealed a high, positive correlation between ATOA and PVA, and an almost equally high, negative relationship with NVA (RQ1). This finding provides initial evidence that the ATOA subscale reflects both PVA and NVA. Thus, the single factor underlying the ATOA subscale found in previous research (Liang & Bollen, 1983) is indeed a general representation of SPA. The AgeCog scales were found to be moderately correlated with each other, yet strongly correlated with the ATOA. The significantly smaller correlation between the AgeCog scales may stem from the specific domains of aging beliefs they assess beyond their different valences.

We also observed independent effects of PVA and NVA on various health outcomes (RQ2). NVA was found to significantly predict both psychological (satisfaction with life and depression) and physiological (functional health and physical illnesses) health outcomes, whereas PVA was just related to the psychological outcomes. In terms whether the domain or the valence of the SPA measure effects how it predicts health outcomes in the same domain or of the same valence, the results are ambiguous. It appears that PVA and NVA can predict both well-being and ill-being outcomes, and only PVA is domain dependent. These findings may be

partially explained by the content of positive and negative stereotypes and how much these stereotypes are represented by the domains of both AgeCog scales. Negative aging stereotypes are found across domains of psychological and physical health, while positive stereotypes are primarily centered around increases in emotion regulation abilities and wisdom (e.g., Hummert, 2011; Kite, Stockdale, Whitley, & Johnson, 2005). Moreover, it may be difficult for individuals to distinguish between physical loss, the specific domain represented by NVA in this study, and psychological loss (e.g., the bidirectional relationship between functional health and self-esteem; Reitzes & Mutran, 2006) when assessing the content of aging stereotypes. In other words, although NVA primarily measures beliefs of physical loss in the current study, psychological decline may be inherently intertwined. Evidence for this comes from the commonly found "severely impaired" stereotype grouping that encompasses stereotypical traits like senile, feeble, and incompetent (Hummert et al., 1994; Schmidt & Boland, 1986). With such stereotypes becoming internalized across the lifespan (Levy, 2009), it is understandable that NVA was found to impact both psychological and physiological health outcomes, while PVA primarily influenced indicators of psychological and emotional health. Thus, even though the AgeCog scales used in the current study are domain specific, these domains seem to encapsulate the majority of positive and negative aging stereotypes. This provides some credibility to the many research studies that have opted to use only the AgeCog scales of Physical Loss and Ongoing Development, instead of all four scales, to represent positive and negative aging beliefs, respectively (e.g., Wolff, Beyer, Wurm, Nowossadeck, Oec, & Wiest, 2018; Wurm & Benyamini, 2014; Wurm et al., 2007, 2008, 2010, 2013).

Models containing either the ATOA subscale or PVA and NVA explained a similar amount of variance across the four health outcomes (RQ3). With few studies using both AgeCog

scales as independent predictors (e.g., Wurm et al., 2007), there exists a likelihood that studies using only one of the two AgeCog scales underestimate the total effect of SPA on the health outcome under investigation. Specifically, studies that investigate physiological outcomes may not reveal a significant relationship with SPA if only PVA is used as a predictor. Moreover, previous studies that only use NVA as a predictor are likely to show similar relationships to those that use the ATOA subscale, but in the opposite direction. However, only using NVA may exaggerate the negative impact of SPA on the health outcome. To ameliorate this divide and increase compatibility between studies, it is again recommended that future research use either both AgeCog scales or the ATOA subscale. Using either will provide a similar amount of explained variance, however, it may be preferable to use the AgeCog scales to investigate views of aging in different domains.

The current findings also have implications for both future meta-analytic research on SPA and practitioners interested in creating interventions to enhance SPA. Due to the observed differences in the health outcomes predicted by PVA, NVA, and the ATOA, meta-analyses and systematic reviews on SPA need to be cautious in how they operationalize the construct. Effect sizes of the SPA-health relationship are likely to be different across studies based on how they operationalize SPA. The scale adopted by studies should therefore be considered as a potential moderator that influences the strength of the SPA-health relationship. Similarly, differences between the three scales leave practitioners with some questions that will affect the efficacy of designing interventions. Practitioners wanting to boost positive SPA must decide whether they want to use a generalized approach (i.e., aging is a wholly positive experience) or a more domain-specific approach. Practitioners must also choose whether they want to boost PVA, reduce NVA, or attempt to do both. Such considerations will depend upon the available

resources, however, if there are no limitations the current findings suggest that a domain specific approach that focuses on both aspects of SPA will be most beneficial. If resources are limited, practitioners may opt to focus on either SPA as a general construct or reducing NVA.

Limitations and Future Directions

Although the current study compared the impact of the three SPA scales on a variety of health outcomes, each combination of well-being/ill-being and psychological/physiological health was limited to one operationalization. Even though the chosen dependent measures are the most widely used in previous SPA research (Wurm & Benyamini, 2014; Wurm et al., 2007, 2008), it is possible that other health indicators (e.g., perceived life expectancy, loneliness) representing the various combinations of outcomes may have produced different findings. Future research should investigate the differences in the effects of the PVA, NVA, and ATOA scales across additional outcome variables. Similarly, only the two most commonly used AgeCog scales were used in the current study. The inclusion of AgeCog scales of Self Knowledge and Control, and Social Loss would help elucidate the extent to which the domain specificity of the AgeCog scales impact their ability to predict psychological/physiological well-being/ill-being. Additionally, the reliability for the AgeCog scale of Ongoing Development was low for the sample which may have produced some issues in its ability to predict physiological health outcomes. A replication of this study using a different sample, more waves of data, and the other AgeCog scales would provide further support for the current findings.

Future research should also compare other measures under the umbrella of AoA (Diehl et al., 2014) to assess the relationship amongst like constructs. It would be particularly interesting to see whether emerging constructs like attitudes toward aging (Laidlaw, Power, & Schmidt, 2007) or awareness of age-related change differentially predict health outcomes or explain

differences in health above and beyond SPA constructs. Such research is important for unifying the AoA literature and creating a coherent understanding of how similar variables differentially impact health.

Taken together, the findings from the current study shed light on how PVA and NVA differentially impact health. By and large, PVA and NVA are not just opposites of the same construct and have independent effects across various health outcomes. Although PVA only predicted domain-matching health outcomes, NVA was related to both psychological and physiological health outcomes, evidencing the deleterious effects of negative aging beliefs. Moreover, it was found that the ATOA subscale represents both PVA and NVA. Future research should emphasize the multidimensionality of SPA when predicting health as it is what the construct contributes beyond older, more global constructs related to subjective age.

Funding

The German Ageing Survey was funded by the German Federal Ministry for Family, Senior Citizens, Women and Youth.

Acknowledgements

All data comes from the German Aging Study. Due to contractual obligations, the data cannot be released by the authors. However, all syntax for analyses can be made available and will be sent upon request. The data from this study was not preregistered due to the dataset being owned by the German Government. Research questions were not pre-registered due to no direct hypotheses being made.

Conflict of Interest

There are no conflicts of interest.

References

Adler, N. E., & Ostrove, J. M. (1999). Socioeconomic status and health: What we know and what we don't. *Annals of the New York Academy of Sciences, 896,* 3-15. doi: 10.1111/j.1749-6632.1999.tb08101.x

Ardelt, M. (2000). Antecedents and effects of wisdom in old age: A longitudinal perspective on aging well. *Research on Aging, 22,* 360-394. doi.org/10.1177/0164027500224003

Baltes, P. B. (1987). Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline. *Developmental Psychology, 23,* 611–626. doi: 10.1037/0012-1649.23.5.611

Baltes, P. B. (1997). On the incomplete architecture of human ontogeny: Selection, optimization, and compensation as foundation of developmental theory. *American Psychologist, 52,* 366-380. doi: 10.1037//0003-066x.52.4.366

Baltes, P. B., Lindenberger, U., & Staudinger, U. M. (2006). Life span theory in developmental psychology. In R. M. Lerner & W. Damon (Eds.), *Handbook of child psychology: Theoretical models of human development* (pp. 569-664). Hoboken, NJ, US: John Wiley & Sons Inc.

Benyamini, Y. (2005). Can high optimism and high pessimism co-exist? Findings from arthritis patients coping with pain. *Personality and Individual Differences, 38*(6), 1463-1473. doi: 10.1016/j.paid.2004.09.020

Bollen, K. A., & Stine, R. (1990). Direct and indirect effects: Classical and bootstrap estimates of variability. *Sociological Methodology, 20,* 115-140. doi: 10.2307/271084

Bullinger, M., & Kirchberger, I. (1998). SF-36 health questionnaire [SF-36 Scale on health]. Göttingen, Germany: Hogrefe.

Cummings, J. L., & Braboy Jackson, P. (2008). Race, gender, and SES disparities in self-assessed health, 1974-2004. *Research on Aging*, *30*, 137-167. doi: 10.1177/0164027507311835

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

Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment*, *49*, 71-75. doi: 10.1207/s15327752jpa4901_13

Dittmann-Kohli, F., Kohli, M., Kunemund, H., Motel, A., Steinleitner, C., & Westerhof, G., with the infas Sozialforschung (1997). *Lebenszunge, Selbst- und Lebenskonzeptionen [Life contexts, conceptions of self and life]*. Berlin, Germany: Free University.

Hautzinger, M. (1988). The CES-D scale: a depression-rating scale for research in the general population. *Diagnostica*, *34*, 167-173.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*, 1-55. doi: 10.1080/10705519909540118

Hummert, M. L., Garstka, T. A., Shaner, J. L., & Strahm, S. (1994). Stereotypes of the elderly held by young, middle-aged, and elderly adults. *Journal of Gerontology*, *49*(5), P240-P249. doi: 10.1093/geronj/49.5.P240

Hummert, M. L. (2011). Age stereotypes and aging. In K. W. Schaie & S. L. Willis (Eds.), *Handbook of the psychology of aging* (7th ed., pp. 249-262). San Diego, CA, US: Elsevier Academic Press.

Kastenbaum, R., Derbin, V., Sabatini, P., & Am, S. (1972). "The ages of me": Toward personal

and interpersonal definitions of functional age. International Journal of Aging and Human Development, 3, 197- 212

Katz, I. R. (1996). On the inseparability of mental and physical health in aged persons: Lessons from depression and medical comorbidity. *The American Journal of Geriatric Psychiatry*, *4*, 1-16. doi: 10.1097/00019442-199624410-00001

Keyes, C. L. M. (2005). Mental illness and/or mental health? Investigating axioms of the complete state model of health. *Journal of Consulting and Clinical Psychology*, *73*, 539–548. doi: 10.1037/0022-006X.73.3.539

Kite, M. E., Stockdale, G. D., Whitley, B. E., & Johnson, B. T. (2005). Attitudes toward younger and older adults: An updated meta-analytic review. *Journal of Social Issues*, *61*, 241-266. doi: 10.1111/j.1540-4560.2005.00404.x

Klaus, D., Engstler, H., Mahne, K., Wolff, J. K., Simonson, J., Wurm, S., & Tesch-Römer, C. (2017). Cohort profile: The German Ageing Survey (DEAS). *International Journal of Epidemiology*, *46*, 1105–1113. doi: 10.1093/ije/dyw326

Kline, R. B. (2016). *Methodology in the social sciences. Principles and practice of structural equation modeling (4th ed.).* New York, NY, US: Guilford Press.

Kubzansky, L. D., Kubzansky, P. E., & Maselko, J. (2004). Optimism and pessimism in the context of health: bipolar opposites or separate constructs?. *Personality and social psychology bulletin*, *30*(8), 943-956. doi: 10.1177/0146167203262086

Kuha, J. (2004). AIC and BIC: Comparisons of assumptions and performance. *Sociological Methods & Research*, *33*(2), 188-229. doi: 10.1177/0049124103262065

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

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

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*, 409-417. doi: 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*, 261-270. doi: 10.1037//0022-3514.83.2.261

Liang, J., & Bollen, K. A. (1983). The structure of the Philadelphia Geriatric Center Morale scale: A reinterpretation. *Journal of Gerontology*, *38*, 181-189. doi: 10.1093/geronj/38.2.181

Liu, H., & Umberson, D. J. (2008). The times they are a changin': Marital status and health differentials from 1972 to 2003. *Journal of Health and Social Behavior*, *49*, 239-253. doi: 10.1177/002214650804900301

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, *1*, 130-149. doi: 10.1037/1082-989X.1.2.130

Palgi, Y., Shrira, A., Ben-Ezra, M., Cohen-Fridel, S., & Bodner, E. (2011). The relationships between daily optimism, daily pessimism, and affect differ in young and old

age. *Personality and Individual Differences, 50*(8), 1294-1299. doi: 10.1016/j.paid.2011.02.030

Reitzes, D. C., & Mutran, E. J. (2006). Self and health: Factors that encourage self-esteem and functional health. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 61*(1), S44-S51. doi: 10.1093/geronb/61.1.S44

Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling and more. Version 0.5–12 (BETA). *Journal of Statistical Software, 48,* 1-36.

Ryff, C. D., Love, G. D., Urry, H. L., Muller, D., Rosenkranz, M. A., Friedman, E. M., ... & Singer, B. (2006). Psychological well-being and ill-being: Do they have distinct or mirrored biological correlates?. *Psychotherapy and Psychosomatics, 75*(2), 85-95. doi: 10.1159/000090892

Schaie, K.W. (1994). The course of adult intellectual development. *American Psychologist, 49,* 304-313. doi: 10.1037/0003-066X.49.4.304

Schmidt, D. F., & Boland, S. M. (1986). Structure of perceptions of older adults: Evidence for multiple stereotypes. *Psychology and Aging, 1*(3), 255-260. doi: 10.1037/0882-7974.1.3.255

Scott, K. M., Von Korff, M., Alonso, J., Angermeyer, M. C., Bromet, E., Fayyad, J., ... & Haro, J. M. (2009). Mental–physical co-morbidity and its relationship with disability: Results from the World Mental Health Surveys. *Psychological Medicine, 39*, 33-43. doi: 10.1017/S0033291708003188

Spuling, S. M., Klusmann, V., Bowen, C. E., Kornadt, A. E., & Kessler, E. M. (2019). The uniqueness of subjective ageing: Convergent and discriminant validity. *European Journal of Ageing*, 1-11. doi: 10.1007/s10433-019-00529-7 (in press)

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*, 364-373. doi: 10.1093/geronb/56.6.P364

Tsang, A., Von Korff, M., Lee, S., Alonso, J., Karam, E., Angermeyer, M. C., ... & Gureje, O. (2008). Common chronic pain conditions in developed and developing countries: gender and age differences and comorbidity with depression-anxiety disorders. *The Journal of Pain*, *9*, 883-891. doi: 10.1016/j.jpain.2008.05.005

UNESCO. (1997). *International standard classification of education: ISCED 1997*. Paris, France: Author.

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

Wolff, J. K., Beyer, A. K., Wurm, S., Nowossadeck, S., & Wiest, M. (2017). Regional impact of population aging on changes in individual self-perceptions of aging: Findings from the German ageing survey. *The Gerontologist*, *58*, 47-56. doi: 10.1093/geront/gnx127

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. doi: 10.1016/j.dr.2017.08.002

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

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,* 156-64. doi: 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 aging. *European Journal of Ageing*, *5*, 117–127. doi: 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 and Health*, *25*, 25–42. doi: 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*, 1088-1098. doi: 10.1037/a0032845

Table 1. *Attrition Characteristics: Percentages or Means and Standard Deviations (in brackets).*

Variables	Participation Sample (*N*=3,745)	Dropout Sample (*N*=4,451)
Age (years)	61.02 (10.83)	63.84 (12.65)
Gender (Male)	48.68%	52.12%
Monthly Income (EUR)	2,783.22 (2,808.52)	2,205.51 (1,499.35)
Marital Status (Married, Living Together)	73.54%	68.26%
Education (High)	42.62%	28.33%
PVA	2.97 (0.55)	2.78 (0.65)
NVA	2.75 (0.54)	2.85 (0.57)
ATOA	14.96 (2.63)	14.16 (3.16)
Life Satisfaction	3.81 (0.72)	3.74 (0.79)
Functional Health	86.92 (18.96)	80.28 (26.10)
Depressive Symptoms	6.01 (5.70)	6.87 (6.56)
Number of Physical Illnesses	2.25 (1.71)	2.37 (1.96)

Note. All data refer to variables from the 2008 wave. See section 'Measures' for details on the construction of each scale. All variables are significantly different across the two samples at $p<.01$.
PVA=Positive Views on Aging; NVA=Negative Views on Aging; ATOA=Attitudes Towards Own Aging.

Table 2. Unstandardized and Standardized Coefficients of the Structural Equation Models.

		Life Satisfaction			Depressive Symptoms			Functional Health			Number of Physical Illnesses		
Model	AIC	*B(SE)*	*β*	R^2	*B(SE)*	*β*	R^2	*B(SE)*	*β*	R^2	*B(SE)*	*β*	R^2
Model 1	21583			0.39			0.18			0.46			0.44
PVA		0.11(.02)	0.09**		-0.68(.22)	-0.07**		0.92(.68)	0.02		0.00(.06)	0.00	
NVA		-0.06(.02)	-0.05*		1.72(.21)	0.16***		-5.26(.68)	-0.12***		0.43(.05)	0.13***	
DV T1		0.53(.02)	0.55***		0.30(.02)	0.29***		0.61(.02)	0.50***		0.56(.02)	0.53***	
Age		0.00(.00)	-0.05**		0.00(.01)	0.00		-0.46(.03)	-0.21***		0.03(.00)	0.17***	
Gender		0.05(.02)	0.04**		0.37(.18)	0.03*		-1.77(.57)	-0.04***		-0.09(.05)	-0.02	
Income		0.01(.00)	0.03		-0.10(.04)	-0.05**		0.37(.14)	0.045**		-0.01(.01)	-0.02	
Education		0.03(.02)	0.02		-0.71(.16)	-0.07***		3.52(.55)	0.09***		-0.06(.05)	-0.02	
Marital Status		-0.04(.02)	-0.02		0.01(.20)	0.00		-0.32(.68)	-0.01		0.19(.07)	0.05**	
Sample		-0.02(.02)	-0.01		-0.06(.18)	-0.01		0.71(.62)	0.01		0.15(.06)	0.04**	
Model 2	22020			0.40			0.20			0.46			0.43
ATOA		0.04(.01)	0.15***		-0.51(.04)	-.024***		0.94(.14)	0.11***		-0.09(.01)	-0.13***	
DV T1		0.51(.02)	.53***		0.27(.02)	.027***		0.62(.02)	0.51***		0.56(.02)	0.53***	
Age		0.00(.00)	0.02		0.01(.01)	0.02		-0.47(.03)	-0.22***		0.03(.00)	0.17***	
Gender		0.05(.02)	0.04*		0.40(.17)	0.04*		-1.66(.58)	-0.04*		-0.08(.05)	-0.02	
Income		0.01(.00)	0.02		-0.09(.03)	-0.04**		0.36(.16)	0.04*		-0.01(.01)	-0.01	
Education		0.02(.02)	0.02		-0.58(.17)	-0.06**		3.21(.53)	0.08***		-0.03(.05)	-0.01	
Marital Status		-0.02(.02)	-0.01		-0.22(.21)	-0.02		0.10(.69)	0.00		0.16(.06)	0.04*	
Sample		-0.02(.02)	-0.01		-0.15(.91)	-0.01		0.92(.64)	0.02		0.14(.06)	0.04*	

Note. N = 3,745. Model 1= path containing PVA and NVA as predictors of all four health outcome variables. Model 2= path containing Attitudes Towards Own Aging subscale predicting all four health outcome variables.
PVA =Positive Views on Aging. NVA = Negative Views on Aging. ATOA= Attitudes Towards Own Aging. DV T1= Dependent Variable from 2008. Sample = Baseline (0) or Panel (1).