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SUBJECTIVE TRAJECTORIES FOR SELF-RATED HEALTH AS A PREDICTOR OF CHANGE IN PHYSICAL HEALTH OVER TIME: RESULTS FROM AN 18-YEAR LONGITUDINAL STUDY

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Drawing on social-cognitive and lifespan development perspectives, we examined how individuals view their health as unfolding across time, using a three-wave longitudinal study of American adults (n = 2386; M age = 55.47 years; 55.9% female). Self-rated health (SRH) was perceived to be declining across subjective temporal periods (recollected past, current, anticipated future), particularly by older (vs. younger) adults. Such perceived declines were negatively biased compared to actual changes in SRH over time, especially among older (vs. younger) adults. Physical health (chronic conditions, daily limitations, symptom frequency) worsened across time, with steeper declines for older (vs. younger) adults. Consistent with stereotype embodiment, longitudinal modeling revealed that subjective perceptions of declining SRH predicted actual declines in physical health over time. This study extends previous research and theory on the temporally extended self- and age-related stereotypes by demonstrating the value of a subjective temporal perspective to understanding changes in health across time.

Keywords: self-rated health, physical health, age-related stereotypes, longitudinal study

Self-rated health (SRH) refers to individuals' subjective perceptions of their health status and has been shown to predict a variety of health-related behaviors and outcomes, including physical functioning, mortality, and quality of life (De Salvo

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et al., 2006; Idler & Benyamini, 1997; Menec, Lix, Nowicki, & Ekuma, 2007). These predictive effects have been found in longitudinal studies over considerable periods of time and among individuals from across the adult lifespan, even when controlling for objective health status at baseline (Han et al., 2005; Lee, Huang, Lee, Chen, & Lin, 2012; Marcinko, 2015). Such findings suggest that SRH contains important and unique information about one's physical functioning that is not available from objective indicators of health (McCullough & Laurenceau, 2004; Schnittker & Bacak, 2014). In the present study, we expand on previous research on SRH by employing a temporally extended approach based on how individuals perceive their health as unfolding over time.

SRH AND THE TEMPORALLY EXTENDED SELF

Social psychological research has demonstrated the importance of expanding the scope of self-evaluation beyond one temporal period (i.e., the present) to include individuals' memories, beliefs, and expectations concerning their past and future selves (Albert, 1977; Markus & Nurius, 1986; Suls & Mullen, 1984). Indeed, studies suggest that individuals use temporal comparisons in making self-evaluative judgments as often as, if not more often than, social comparisons (Brown & Middendorf, 1996; Summerville & Roese, 2008; Wilson & Ross, 2000). The "temporally extended self" (Peetz & Wilson, 2008) has typically been studied with respect to individuals' self-image and based on comparisons between two subjective temporal periods (e.g., past vs. present, present vs. future; Wilson & Shanahan, 2018). Nonetheless, studies have also demonstrated the unique psychological significance of individuals' beliefs about how their lives are unfolding over time, as revealed in simultaneous self-evaluations of the recollected past, present, and anticipated future (Fleeson & Baltes, 1998; Ryff, 1991; Shmotkin, 2005; Staudinger, Bluck, & Herzberg, 2003).

In general, people believe that life gets better and better over time, for much of the adult lifespan (Ross & Newby-Clark, 1998). For example, individuals' ratings of their overall satisfaction with their recollected, present, and anticipated future lives typically show an inclining pattern (i.e., past < present < future; Busseri, Choma, & Sadava, 2009; Pavot et al., 1998). Notable exceptions include older adults, who generally view their lives and their life satisfaction as deteriorating over time (Lang, Weiss, Gerstorf, & Wagner, 2013; Robinson & Ryff, 1999; Staudinger et al., 2003). Interestingly, rather than consistently improving or declining, life satisfaction tends to remain relatively stable over longer periods of time (Cummins, 2014; Fujita & Diener, 2005), with the exception of very old adults and individuals approaching the end of their lives (Gerstorf et al., 2010). Consequently, most individuals are biased in their beliefs about how their lives are changing over time: Typically, younger adults are overly negative about their past and overly positive about their futures, whereas older adults tend to be overly negative about their futures (Busseri et al., 2009; Lachman, Rocke, Rosnick, & Ryff, 2008; Lang et al., 2013).

Such insights are valuable because beliefs about how one's life is changing over time (from the recollected past into the anticipated future) are linked with a variety of important outcomes. For example, several studies have shown that among younger and middle-aged adults, more steeply inclining subjective trajectories for one's life satisfaction (particularly between the present and anticipated future) predict less positive physical, psychological, and social functioning—both at present and over time (Busseri et al., 2009; Busseri, Malinowski, & Choma 2013; Busseri & Peck, 2016; Lachman et al., 2008; Röcke & Lachman, 2008). Among older adults, more steeply declining (vs. stable) subjective trajectories for life satisfaction have been linked with less adaptive functioning (Busseri, 2013; Röcke & Lachman, 2008). In general, therefore, perceived self-stability with respect to one's overall quality of life, rather than dramatic change, is linked with more positive outcomes (Keyes & Ryff, 2000; Ryff, 1991).

With respect to SRH, therefore, a perspective based on the temporally extended self would suggest that it is important to understand how people view their health as unfolding over time. Health is one of the most important and consistently referenced life domains that individuals draw on when constructing global evaluations of their current lives (Hsiech, 2003; Schimmack & Oishi, 2005), as well as in conceiving their possible future selves (Frazier, Hooker, Johnson, & Kaus, 2000; Hooker & Kaus, 1992; Smith & Freund, 2002). Yet research examining SRH has focused primarily on individuals' evaluations of their current health. Even in longitudinal studies in which individuals are followed over time, at each time point respondents are typically asked about how they currently view their health status (Han et al., 2005; McCullough & Laurenceau, 2004; Sargent-Cox et al., 2010; Schmitz et al., 2013). Some researchers have examined individuals' SRH evaluations based on comparison between their current and past health status (Klauer & Wegener, 1998; Sargent-Cox, Anstey, & Luszcz, 2010). Other studies have assessed individuals' expectations for their future health status. Results from such studies indicate that individuals holding more positive expectations for their future health status engage in more positive health-related behaviors and experience more positive health-related outcomes (Hooker & Kaus, 1992; Sarkisian, Prohaska, Wong, Hirsch, & Mangione, 2005; Tasdemir-Ozdes, Strickland-Hughes, Bluck, & Ebner, 2016), particularly if such expectations are not unrealistically optimistic (Radcliffe & Klein, 2002; Sheppard, Pogge, & Howell, 2017).

Very little research, however, has examined individuals' SRH based on all three subjective temporal periods. Staudinger and colleagues (2003) included individuals' assessments of their past, current, and anticipated future health status as part of a composite measure of overall well-being, rather than directly examining the correlates and functional significance of the subjective temporal health ratings in their own right. In a recent pair of studies employing such an approach, Bunda and Busseri (2017, 2019) found that young adults generally viewed their SRH as improving from the recollected past to the anticipated future. Further, having an inclining subjective trajectory for SRH (particularly between the past and present) was associated with more frequent health-promoting behavior and stronger intentions to engage in (future) health-promoting behaviors. Such results provide

valuable insights into the significance of how individuals view their health as changing over time. However, the findings reported by Bunda and Busseri (2017, 2019) are limited by the exclusive focus on younger adults, and the lack of a longitudinal design to evaluate individuals' beliefs as predictors of actual changes in physical health-related outcomes across time. At present, therefore, it is unknown how individuals from across the adult lifespan view their health as unfolding over time, and whether such subjective trajectories for SRH are associated with actual changes in health outcomes.

BELIEFS ABOUT LIFESPAN DEVELOPMENT, SOCIAL NORMS, AND STEREOTYPES

According to theories of lifespan development, younger adulthood is characterized by gains and accumulation of resources (e.g., social, educational, financial), whereas older adulthood is characterized by an increasing preponderance of losses over gains in physical, cognitive, and social domains (Baltes, 1997; Carstensen, Isaacowitz, & Charles, 1999; Freund & Baltes, 2000). Such developmental dynamics are reflected in individuals' beliefs about changes in important personal domains across the lifespan (Ebner, Reidiger, & Lindenberger, 2009; Fleeson & Heckhausen, 1997; Heckhausen & Schulz, 1998; Mustafic & Freund, 2012). Further, with increasing age comes a change in salience and prioritization in personal goal orientations (Freund, Nikitin, & Ritter, 2009), typically from a focus on growth and improvement to prevention of and compensation for losses (Ebner, Freund, & Baltes, 2006; Freund, 2006; Smith & Freund, 2002).

Consistent with these developmental processes, research on cultural life script theory indicates that individuals within a culture share a common set of beliefs concerning the types, timing, and valence of key events and transitions that characterize a typical human life (Berntsen & Rubin, 2004). Adolescence and younger adulthood are perceived to be periods during which individuals experience an increasing number of positive life events (e.g., graduation, marriage, career), followed by a decreasing number of positive events and an increasing proportion of negative events during older adulthood (e.g., divorce, illness, death; Bohn, 2010). The life script, therefore, conveys an underlying message that life gets better and better during younger adulthood, and worse and worse during older adulthood (Shanahan & Busseri, 2017, in press). Such beliefs may function as both descriptive and injunctive norms (Cialdini & Trost, 1998), describing not only how individuals perceive that life does change over time, but also how it should unfold (Busseri & Merrick, 2016).

Beliefs about how life is supposed to unfold over time may also be closely tied to stereotypes about and attitudes toward aging. Although individuals' beliefs about aging are diverse and include positive content, stereotypes about aging tend to be negative and suggest that old age is typically characterized by frailty, loneliness, and incompetence (Kornadt & Rothermund, 2011; Lamont, Swift, & Abrams, 2015). Negative age-related stereotypes also specify losses and deterioration in a

variety of life domains, including health and physical functioning (Kornadt & Rothermund, 2011; Wurm, Warner, Ziegelmann, Wolff, & Schüz, 2013). Such stereotypes are partially supported by research tracking objective health outcomes in the aging population, which demonstrates worsening health outcomes over time, including a higher prevalence of chronic illnesses among older (vs. younger) individuals (National Council on Aging, 2016). Similarly, longitudinal research has revealed declines over time in current SRH, particularly among older individuals (Diehr et al., 2001; McCullough & Laurenceau, 2004; Sargent-Cox et al., 2010). The degree to which such normative trends apply to a given individual, however, vary depending on a variety of considerations, including psychological and behavioral (i.e., lifestyle) factors (McDonough & Berglund, 2003; Orfila, Ferrer, Lamarca, & Alonso, 2000).

Critically, age-related stereotypes can contaminate individuals' attitudes toward their own aging through processes of internalization (Kornadt, Meissner, & Rothermund, 2016; Rothermund & Brandstadter, 2003). Further, according to stereotype embodiment theory (Levy, 2009) and related research, age-related stereotypes can negatively impact individuals' motivation, goal-striving, and coping strategies as they age—and ultimately create a self-fulfilling prophecy (Wurm et al., 2013). In the context of health, older individuals who have negative views of aging are at heightened risk of employing less effective self-regulatory and coping strategies in the face of health-related challenges, and are less likely to engage in health-promoting behavior (Beyer, Wolff, Warner, Schüz, & Wurm, 2015; Levy & Meyers, 2004; Meisner & Baker, 2013; Sarkisian et al., 2005; Westerhof & Wurm, 2015; Wurm, Tomasik, & Tesch-Römer, 2010; Wurm et al., 2013). Consequently, individuals with negative aging stereotypes, including negative beliefs about one's own aging, tend to experience more negative health outcomes over time, including mortality (Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorf, & Smith, 2009; Levy, 2009; Levy, Slade, Kunkel, & Kasl, 2002; Wurm, Tesch-Römer, & Tomasik, 2007; Wurm et al., 2017). Importantly, such studies have typically focused on individuals' stereotypic beliefs about aging, either with respect to older adults in general or for themselves. Yet to be determined, however, is whether individuals' beliefs concerning how their own health status is changing over time—from the recollected past, to the present, and into the anticipated future—predict actual changes in their physical health across time.

THE PRESENT STUDY

To address these issues, in the present study we evaluated results from an 18-year, three-wave longitudinal study of American adults. Our first goal was to evaluate how individuals from across the adult lifespan viewed their health as unfolding over time, from the recollected past, to the present, and into the anticipated future. Consistent with previous research on lifespan development, life script theory, and age-related stereotypes, we hypothesized that individuals would generally view their health as declining over time and that such subjective trajectories for

SRH would be more steeply declining among older (vs. younger) adults. We also evaluated the accuracy of such beliefs by comparing individuals' evaluations for their recollected past SRH at Wave 2 to their current SRH at Wave 1, and their anticipated future SRH at Wave 2 to their current SRH at Wave 3. Congruent with previous research on temporal self-evaluations of life satisfaction, we predicted that individuals would overestimate their past SRH and underestimate their future SRH, such that they would be overly negative with respect to the overall degree of decline in the subjective trajectory for SRH. Consistent with research on age-related stereotypes, such negative biases were expected to be stronger among older (vs. younger) adults.

Our second goal was to evaluate individuals' beliefs about how their health was changing over time in relation to actual changes in their physical health across time. To do so, we tested their subjective trajectory for their SRH as a predictor of longitudinal changes in their physical health (chronic conditions, daily limitations, acute symptom frequency) over an 18-year period. Consistent with previous studies demonstrating normative age-related declines in health outcomes over time, we hypothesized that individuals' physical health would get worse across time and that such declines would be stronger among older (vs. younger) adults. Further, based on stereotype embodiment theory, we predicted that individuals who reported more steeply declining subjective trajectories for their SRH would experience greater actual deterioration in their physical health over time.

METHOD

PARTICIPANTS AND PROCEDURES

The present data was drawn from the Midlife in the United States (MIDUS) study, a large-scale longitudinal survey of American adults (Brim, Ryff, & Kessler, 2004). MIDUS participants were selected using random digit dialing. Telephone interviews and self-report surveys were employed at each of three waves, with adjacent waves separated by roughly nine years: Wave 1 in 1995/96, Wave 2 in 2004/05, and Wave 3 in 2013/14. The Wave 1 sample comprised 7,108 participants. Note that this sample size was determined by the MIDUS administrators, rather than by the present authors. (Results for the present analyses were not examined during the data collection process.)

The present analyses are based on the 2,386 participants (34% of full baseline sample) who completed the relevant study measures at each wave.[1] Note that Wave 2 was used as the reference period for the primary analyses, as described be-

1. The remaining 4,722 participants who were not included in the present analyses comprised 2,145 participants who completed Wave 1 only, 1,670 participants who completed Wave 1 and Wave 2 only, and 907 participants who completed all three waves of the MIDUS study but did not complete the study measures examined in the present work. At Wave 1, the excluded participants had significantly lower SRH (recollected past, current, anticipated future) and physical health compared to the analysis subsample (all ps < .05; η^2s < .01). Together, these variables explained a total of 1% of the between-group variance.

low. At Wave 2, participants in the present study had a mean age of 55.47 years (*SD* = 11.12), 55.9% were female, 93.2% self-identified as White (2.9 % African American, 1.4% Native American, Asian, or other), 72.8% were married, median household income was $63,500 USD, and 70.6% had at least one year of post-secondary education.[2] This analysis sample size was determined based on the available data from the MIDUS study, rather than based on an a priori power analysis. We note, however, that a sample of 2,368 participants has power at 1-β = .8 to detect a correlation of .06 or larger (in absolute value) as statistically significant at alpha = .05 (two-tailed).

MEASURES

Descriptive statistics for the study measures are shown in Table 1. (Item descriptions and variable names as coded in the MIDUS dataset are provided for each analysis variable by wave in Supplemental Table 1.) Note that the MIDUS dataset contains a large number of additional measures and variables, as detailed in the documentation available at http://midus.wisc.edu/. In the present work, we examined only the variables described below (i.e., no other measures were examined for present purposes and not reported).

Self-Rated Health. A three-item self-anchoring scaling approach (Kilpatrick & Cantril, 1960) was utilized to assess participants' evaluations of their recollected past (10 years ago), current, and anticipated future (10 years into the future) health status (Staudinger et al., 2003). Specifically, participants responded to the following items: (1) "Using a scale from 0 to 10 where 0 means "the worst possible health" and 10 means "the best possible health," how would you rate your health these days"; (2) "Looking back ten years ago, how would you rate your health at that time using the same 0 to 10 scale"; and (3) "Looking ahead ten years into the future, what do you expect your health will be like at that time?" Ratings were made using an 11-point response scale, ranging from 0–*worst health possible* to 10–*best health possible*. Higher scores indicated more positive SRH. Note that participants completed all three ratings (i.e., current, past, future) at each wave; however, in the present work we only examined the SRH ratings relevant to present purposes (as detailed below).

Physical Health. Participants' physical health was assessed using multi-item indices for chronic health conditions, daily health-related limitations, and acute health-related symptoms (Brim et al., 2004; Lachman et al., 2008; Röcke & Lachman, 2008).

2. Compared to the analysis subsample, at Wave 1 the excluded participants did not differ significantly in mean age ($p = .40$), but comprised a significantly greater proportions of male (vs. female) and non-White (vs. White) individuals, had lower income and education level, and were less likely to be married (vs. married; all ps < .001; η^2s < .03). Together, these variables explained a total of 4% of the between-group variance.

TABLE 1. Descriptive Statistics and Correlations Among Study Measures

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. W2 age	55.47	11.11	—																	
2. W1 SRH current	7.64	1.43	.05*	—																
3. W2 SRH past	8.28	1.58	.08	.38	—															
4. W2 SRH current	7.57	1.44	.02^	.51	.37	—														
5. W2 SRH future	6.96	1.83	-.17	.39	.16	.68	—													
6. W3 SRH current	7.36	1.57	-.05*	.43	.24	.53	.46	—												
7. W1 chronic cx	2.20	2.23	.14	-.36	-.20	-.27	-.27	-.26	—											
8. W2 chronic cx	2.24	2.28	.18	-.30	-.16	-.38	-.35	-.34	.56	—										
9. W3 chronic cx	2.72	2.51	.19	-.28	-.14	-.34	-.33	-.42	.24	.61	—									
10. W1 daily limits	2.00	2.44	.23	-.42	-.22	-.33	-.34	-.31	.40	.37	.36	—								
11. W2 daily limits	2.94	2.85	.28	-.34	-.16	-.49	-.47	-.42	.37	.46	.45	.59	—							
12. W3 daily limits	3.94	3.14	.36	-.29	-.11	-.36	-.38	-.51	.32	.38	.47	.51	.66	—						
13. W1 acute sx	2.00	0.75	.05*	-.36	-.16	-.28	-.26	-.27	.52	.41	.41	.44	.36	.33	—					
14. W2 acute sx	2.41	0.83	.03^	-.26	-.13	-.37	-.33	-.30	.39	.49	.45	.32	.43	.36	.56	—				
15. W3 acute sx	2.48	0.83	-.07	-.26	-.13	-.31	-.27	-.35	.35	.40	.48	.27	.30	.38	.50	.66	—			
16. W1 health comp	0.26	0.73	-.17	.47	.24	.37	.36	.35	-.81	-.56	-.54	-.76	-.55	-.48	-.82	-.53	-.47	—		
17. W2 health comp	-0.02	0.81	-.20	.37	.19	.52	.48	.44	-.55	-.81	-.63	-.53	-.79	-.58	-.55	-.81	-.57	.68	—	
18. W3 health comp	-0.24	0.85	-.21	.35	.16	.42	.42	.54	-.50	-.58	-.82	-.48	-.60	-.79	-.82	-.61	-.77	.63	.75	—

Note. $N = 2{,}386$. W1 = Wave 1. W2 = Wave 2. W3 = Wave 3. SRH = self-rated health. Chronic cx = chronic health conditions. Daily limits = daily health-related limitations. Acute sx = acute health-related symptoms. Health comp = composite physical health score. All ps < .001 except *$p < .05$ and ^ $p > .05$.

Chronic Health Conditions. A checklist was used to assess chronic health conditions (e.g., asthma, high blood pressure, and ulcers). Participants indicated whether or not they had experienced or been treated for each condition over the past 12 months. The number of conditions assessed varied by wave, but 29 conditions were assessed at all three waves. The number of endorsed conditions was summed (range = 0 to 29). Higher scores indicated a greater number of chronic health conditions.

Daily Health-Related Limitations. A nine-item scale was used to assess health-related limitations in daily living (e.g., lifting or carrying groceries, walking several blocks). Participants indicated the extent to which they experienced each limitation. Ratings were made using a four-point scale, ranging from 1–*a lot* to 4–*not at all*. The number of endorsed limitations was summed (range = 0 to 9). Higher scores indicated a greater number of daily health-related limitations.

Acute Health-Related Symptoms. A nine-item scale was used to assess the frequency of health-related symptoms (e.g., headaches, backaches) experienced over the past 30 days. Participants indicated the frequency with which they experienced each symptom. Ratings were made using a six-point scale, ranging from 1–*almost every day* to 6–*not at all*. Rating were averaged at each wave (αs = .72, .71, and .71, respectively, at Wave 1, Wave 2, and Wave 3) and then reverse-scored. Higher scores indicated more frequent acute health-related symptoms.

As shown in Table 1, the three physical health indicators were moderately and positively intercorrelated at each wave. Further, each indicator loaded strongly onto a single component at each wave, as indicated by principal component analysis. Therefore, at each wave these three indicators were averaged to form a composite measure of physical health. To do so, each indicator was standardized using the corresponding across-wave grand mean and *SD*, and averaged at each wave (αs = .72, .72, and .70, respectively, at Wave 1, Wave 2, and Wave 3). The resulting scores were then reversed, such that higher scores indicated better physical health.

RESULTS

SUBJECTIVE TRAJECTORY FOR SRH

To examine participants' beliefs about how their health status was changing over time at Wave 2, we estimated a latent growth curve model comprising two correlated latent factors: a latent intercept factor and a latent slope factor. Loadings on the latent intercept were fixed to 1 for the Wave 2 ratings of recollected past, current, and anticipated future health status. Loadings on the latent slope factor were fixed to 0 and 1, respectively, for the ratings of current and anticipated future subjective health status; the loading was freely estimated for the rating of recollected past subjective health status. This approach allowed for a non-linear subjective trajectory for SRH, consistent with the means reported in Table 1. Means and variances were estimated for each latent factor along with the correlation between factors. Residual variances in each of the subjective health status ratings were freely

estimated. This model was just-identified (i.e., $df = 0$), and thus provided perfect model fit. Parameter estimates are shown in Table 2. (Note that all parameters, including confidence intervals and p values, reported for each model presented below were based on bias-corrected estimates derived from 1,000 bootstrap samples). The latent intercept mean indicated a moderately high level of current SRH. The latent slope mean was significant and negative, consistent with a declining subjective trajectory in which SRH was perceived to be getting worse and worse over time.

To determine whether the subjective trajectory for SRH was related to participant age, we added Wave 2 age to the latent growth curve model by estimating correlations between age and both of the latent factors. Model fit indices indicated a significant positive residual correlation between age and the residual variance in the Wave 2 rating of current SRH. This covariance was added to the model (post hoc), resulting in a just-identified model (i.e., $df = 0$). As shown in Table 2, age had significant and negative correlations with the latent intercept and latent slope factors, indicating that older participants were characterized by lower current SRH and more steeply declining subjective trajectories than younger participants.

ACTUAL TRAJECTORY FOR SRH

To assess how participants' subjective health status actually changed over time, we estimated a latent growth curve model using the same specifications as the model described above (without participant age), but using the Wave 1, Wave 2, and Wave 3 ratings of current SRH as the indicators. This model was just-identified (i.e., $df = 0$) and thus provided perfect model fit. Parameter estimates are shown in Table 2. The latent intercept mean indicated a moderately high level of current SRH at Wave 2. The latent slope mean was significant and negative, consistent with a declining trajectory in which current SRH worsened over time.

To determine whether the trajectory was related to participant age, we added Wave 2 age to the latent growth curve model by estimating correlations between age and both of the latent factors. The model provided excellent fit: $\chi^2 = 0.14$ ($df = 1$), $p = .001$; CFI > .999; RMSEA < .001. (Unlike the subjective trajectory model for SRH described above, there was no significant residual correlation between age and the Wave 2 rating of current SRH, and thus no need to modify the model post hoc.) As shown in Table 2, age had a significant and negative correlation with the latent slope factor (but not the intercept factor), indicating that older participants were characterized by more steeply declining trajectories in current SRH over time than were younger participants.

ACCURACY AND BIAS IN BELIEFS ABOUT SRH

We then evaluated the accuracy of individuals' beliefs about how their SRH was changing over time. To do so, we computed the degree of bias in participants'

TABLE 2. Results from Univariate Latent Growth Curve Models and Correlations with Age

	Subjective trajectory, SRH			Actual trajectory, current SRH			Actual trajectory, health composite		
	parameter	**95% CI**	***p***	**parameter**	**95% CI**	***p***	**parameter**	**95% CI**	***p***
Model parameters									
Free loading	-1.15	-1.30,-1.01	.002	-0.31	-0.69,-0.06	.002	-1.32	-1.58,-1.13	.002
Intercept mean	7.57	7.52,7.63	.002	7.57	7.52,7.63	.002	-0.02	-0.06,0.01	.156
Intercept variance	1.36	1.25,1.50	.001	1.08	0.98,1.19	.002	0.47	0.43,0.51	.002
Slope mean	-0.62	-0.67,-0.56	.002	-0.22	-0.27,-0.16	.002	-0.22	-0.24,-0.19	.002
Slope variance	0.74	0.59,0.92	.001	0.62	0.24,3.29	.002	0.05	0.03,0.06	.001
Intercept/slope correlation	0.44	.38,.51	.002	0.14	.05,.26	.004	0.33	.25.,42	.002
Correlations with age									
Latent intercept	-.10	-.14,-.05	.002	.03	-.01,.08	.152	-.23	-.27,-.19	.003
Latent slope	-.24	-.29,-.19	.002	-.15	-.27,-.08	.001	-.11	-.17,-.05	.003

Note. *N* = 2,386. SRH = self-rated health. Free loading = Wave 2 rating of recollected past subjective health status (for subjective trajectory model) or Wave 1 indicator (for actual trajectory models).

Wave 2 ratings of their recollected past subjective health status (bias = rating of Wave 2 recollected past minus Wave 1 current subjective health status; M = 0.64 [95% CI = 0.57,0.71], SD = 1.68, $p < .001$) and their Wave 2 ratings of their anticipated future subjective health status (bias = Wave 2 anticipated future minus Wave 3 current subjective health status; M = -0.40 [-0.47, -0.33], SD = 1.79, $p < .001$). On average, participants *overestimated* their past subjective health status and *underestimated* their future subjective health status. We also computed the degree of bias across the entire subjective trajectory by comparing the overall slope of the Wave 2 subjective trajectory for SRH (slope = rating of Wave 2 anticipated future minus Wave 2 recollected past; M = -1.32 [-1.41, -1.23], SD = 2.23) with the slope of the actual trajectory for current SRH (slope = rating of Wave 3 current minus Wave 1 current; M = -0.28 [-0.34, -.22], SD = 1.60). This bias was negative, on average (M = -1.03 [-1.13, -0.93], SD = 2.53), indicating that participants *overestimated the amount of decline* they would experience in their SRH over time.

To determine whether these biases were linked to participant age, we examined the correlation between age and the degree of bias in participants' Wave 2 ratings of their recollected past subjective health status. This correlation was small and not statistically significant (r = .03 [95% CI = -.01, .07], p = .20). We also examined the correlation between age and the degree of bias in participants' Wave 2 ratings of their anticipated future subjective health status. This correlation was negative and statistically significant (r = -.13 [-.17, -.09], $p > .001$). In addition, we examined the correlation between age and the degree of bias in the slope of participants' Wave 2 subjective trajectory for their SRH. This correlation was negative and statistically significant (r = -.11 [-.15, -.07], $p > .001$). That is, whereas the tendency to overestimate one's past subjective health status was not systematically linked with participant age, the tendencies to underestimate one's future subjective health status and overestimate the amount of decline in one's SRH over time were stronger in older (vs. younger) participants.

CHANGES IN PHYSICAL HEALTH

To evaluate how participants' physical health changed over time, we estimated a univariate latent growth curve model using the composite physical health scores. Loadings on the latent intercept factor were fixed to 1 for the Wave 1, Wave 2, and Wave 3 scores. Loadings on the latent slope factor were fixed to 0 and 1, respectively, for the Wave 2 and Wave 3 indicators, and freely estimated for the Wave 1 indicator to allow for a non-linear trajectory. This model was just-identified (i.e., df = 0) and thus provided perfect model fit. Parameter estimates are shown in Table 2. The latent intercept mean did not differ significantly from 0, consistent with the standardized/grand mean-centered metric. The latent slope mean was significant and negative, consistent with a declining trajectory in which physical health worsened over time.

To determine whether the physical health trajectory was related to participant age, we added Wave 2 age to the latent growth curve model by estimating corre-

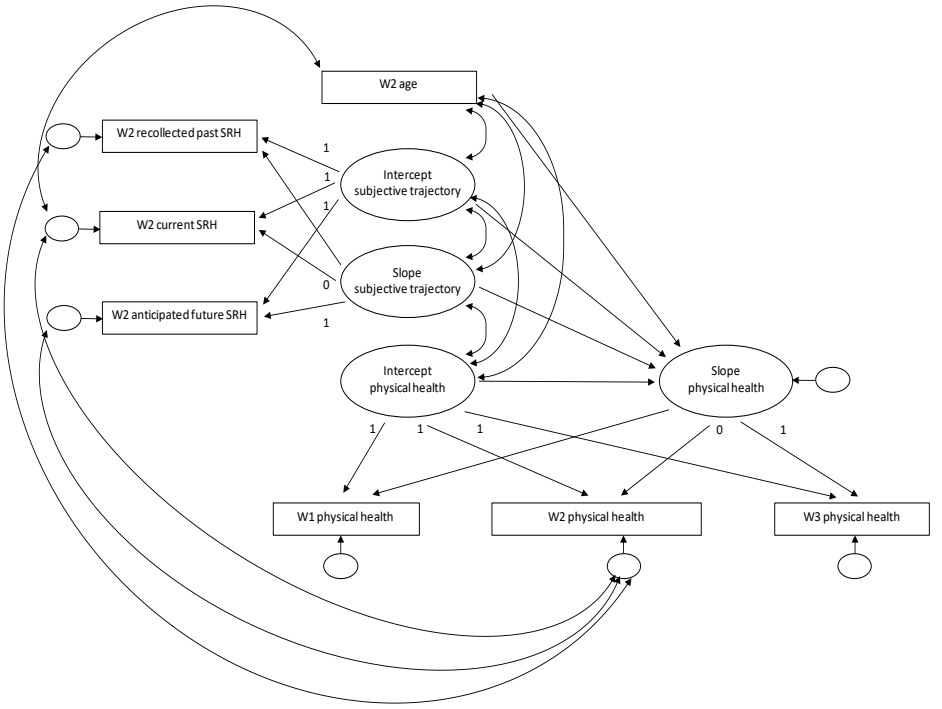

FIGURE 1. Latent growth curve model predicting change in physical health over time from Wave 2 subjective trajectory for SRH and age. Rectangles are measured variables. Large ovals are latent factors. Small ovals are residual variances.

lations between age and both of the latent factors. The model provided excellent fit: $\chi^2 = 0.13$ ($df = 1$), $p = .72$; CFI > .999; RMSEA < .001. (No post hoc modifications were made to this model.) As shown in Table 2, age had significant and negative correlations with the latent intercept and latent slope factors, indicating that older participants were characterized by worse physical health at Wave 2 and more steeply declining trajectories (i.e., worsening health) over time than younger participants.

SUBJECTIVE TRAJECTORY FOR SRH PREDICTING CHANGES IN PHYSICAL HEALTH

In a final analysis we evaluated whether participants' beliefs about how their health status was changing over time was predictive of actual changes in their physical health over time. To do so, we estimated a latent growth curve model in which the Wave 2 subjective trajectory for SRH was treated as a predictor of the physical health trajectory (both trajectories were specified as in the univariate growth curve models presented above). As shown in Figure 1, the latent intercept and latent slope factors from the subjective trajectory were treated as predictors of the latent slope factor for the physical health trajectory, as was Wave 2 age and the latent intercept factor for physical health. Correlations were specified among the

TABLE 3. Results from Latent Growth Curve Model Predicting Change in Physical Health over Time

Predictors	β	95% CI	*p*	*r*	95% CI	*p*
Age	.01	-.06,.07	.865	-.11	-.17,-.05	.003
Intercept, health comp	.33	.23,.45	.002	.33	.24,.42	.002
Intercept, subjective trajectory	-.12	-.23,-.02	.022	.16	.09,.24	.002
Slope, subjective trajectory	.21	.11,.33	.001	.25	.17,.34	.001

Note. N = 2,386. Standardized path coefficients (β) are shown for predictive effects on slope for health composite trajectory. Pairwise correlations (r) with slope for health composite trajectory are also shown.

predictors (i.e., among age, subjective trajectory latent intercept and latent slope factors, and physical health latent intercept, as well as between age and the residual variance in Wave 2 current SRH, consistent with the results described above). Correlations were also specified between the residual variances in the Wave 2 physical health score and all three of the subjective health status ratings in order to account for residual covariation among these Wave 2 measures that was not explained by the model.[3] The model provided excellent fit: $\chi^2 = 24.65$ ($df = 3$), $p = .055$; CFI = .997; RMSEA = .055. Parameter estimates are shown in Table 3.

Significant predictive effects were found for the physical health intercept, the subjective trajectory intercept, and the slope of the subjective trajectory (but not age). Specifically, a more steeply declining slope for physical health was uniquely predicted by worse physical health at Wave 2, higher SRH at Wave 2, and more a steeply declining subjective trajectory for SRH at Wave 2. Stated differently, greater deterioration in physical health over time was predicted by worse physical health at Wave 2, higher subjective health status at Wave 2, and the belief at Wave 2 that one's health was getting (increasingly) worse and worse over time.[4]

DISCUSSION

SUBJECTIVE TRAJECTORIES FOR SRH

Our first goal was to identify how individuals viewed their health as unfolding over time, from the recollected past, to the present, and into the anticipated future. In support of our prediction based on previous research on age-related

3. We did not have specific predictions concerning the subjective trajectory in relation to the other demographic variables (i.e., participant gender, race, income, marital status, education level). Consequently, we did not include these variables in the predictive model. Note, however, that the results were unchanged when the additional demographic variables were included as covariates in the predictive model (model $\chi^2 = 45.64$, $df = 13$, $p < .001$; CFI = .995; RMSEA = .032). Parameter estimates are shown in Supplemental Table 2.

4. In this predictive model, more positive subjective health status at Wave 2 (i.e., higher subjective trajectory intercepts) predicted greater declines in physical health across time. We note, however, that whereas this negative predictive effect was observed when controlling for the Wave 2 physical health intercept, it was in the opposite direction of the (positive) correlation between the subjective trajectory intercept and the slope of the actual physical health trajectory (see Table 2). Such patterns suggest a possible suppressor effect. However, given that the suppressor pattern was not anticipated a priori, future work is needed to evaluate the reliability of this finding and to directly assess possible explanatory mechanisms.

stereotypes, which has found that beliefs about deteriorating physical health are common (e.g., Kornadt et al., 2016; Kornadt & Rothermund, 2011; Wurm et al., 2013), the mean slope for the subjective trajectory was negative in direction, and this downward trend was systematically related to age. That is, in this sample of middle-aged American adults there was a general perception that one's subjective health status was getting worse and worse over time, particularly among older (vs. younger) individuals.[5]

Given that normative age-related stereotypes about physical health are typically negative, along with the increasing salience of anticipated losses in physical resources and abilities during older adulthood (Baltes, 1997; Berntsen & Rubin, 2004; Ross & Newby-Clark, 1998), we speculate that normative beliefs about declines are likely to be both accessible and influential on perceptions concerning how one's own health status is changing over time.

ACCURACY AND BIAS

The three-wave 18-year span of the MIDUS study examined in the present work provided a unique opportunity to evaluate the accuracy of individuals' beliefs (at Wave 2) concerning how their health status was changing over time, from 10 years in the past to 10 years into the future. Overall, participants' current subjective health status declined slightly over time, from Wave 1 to Wave 3. Thus, the mean Wave 2 subjective trajectory was accurate with respect to the overall direction of change (i.e., perceived decline). On average, however, as predicted, individuals' recollected past SRH was overly positive and their anticipated future SRH was overly negative. Consequently, the magnitude of the mean decline in the actual trajectory for SRH was considerably smaller than the perceived decline implied by the subjective trajectories.

Although the reason for this difference in slopes was not a focus in the present work, it is possible that current evaluations of one's health may be less influenced by norms and stereotypes about changes in health than are evaluations of recollected past and anticipated future health. Instead, at each time point, current SRH may be influenced by factors such as health-related social comparisons to similar others (Buunk, Gibbons, & Buunk, 2013); consistency in how these comparisons are made over time may lead to consistency in evaluations of SRH. More generally, the greater stability in mean levels of current SRH over time (relative to the subjective trajectory) may reflect the overall stability in the self-concept (Anusic & Schimmack, 2016). In contrast, as discussed above, the steeper slope for the subjective trajectory may reflect greater reliance on norms and aging stereotypes when

5. Although the focus in the present work was on the overall slope of the subjective trajectories for SRH, age-related differences also applied to both pieces of the subjective trajectory (i.e., past-current and current-future). That is, younger adults tended to view the change from past to present SRH as larger than the change from present to anticipated future SRH, whereas the opposite pattern was observed among older adults. In future research, therefore, it may be informative to examine individuals' beliefs about how their health is unfolding over time based both on the overall slope and the different pieces of the subjective trajectory.

evaluating changes in one's health over time, based on one's recollected past and anticipated future SRH. Future research is needed to test these various notions.

Also noteworthy, as predicted, is that older individuals were more negative in their beliefs than were younger individuals, particularly with respect to their anticipated future SRH and the overall amount of decline in their SRH over time. These age-related findings are consistent with previous research suggesting that individuals tend to be inaccurate when evaluating their recollected past and anticipated future life satisfaction, and that the inaccuracies with respect to the anticipated future are more negative among older versus younger individuals (Lachman et al., 2008; Robinson & Ryff, 1999). The present findings extend this previous work by demonstrating such biases with respect to age-related differences in how individual view their health (as opposed to their lives overall) as unfolding over time.

Beyond explanations based on norms and age-related stereotypes, such age-related biases may reflect developmental changes in self-evaluation motives (Sedikides & Strube, 1997) from self-enhancement and self-improvement during younger adulthood, to self-verification or self-assessment during older adulthood. Alternatively, even among older adults, a motive such as self-enhancement may be served by viewing one's current health as better than the anticipated future, as a means of justifying a change in prioritization in personal goals from gains and growth (typically of younger adults) to optimization, consolidation, and prevention of future losses (Ebner et al., 2006). In light of these speculations, an important next step for future research would be to evaluate whether individuals' age-related stereotypes, perceived social norms, and developmental goals and priorities do indeed predict their subjective trajectories for SRH, and whether these associations are moderated by participants' age. Although testing such notions was beyond the scope of the present work, such research could be based on additional variables available in the MIDUS dataset (e.g., health-related social comparisons, age-related stereotypes).

PREDICTING CHANGES IN PHYSICAL HEALTH

Our second goal was to evaluate whether individuals' beliefs about how their health status was changing over time predicted actual longitudinal changes in their physical health. To do so, we first evaluated how physical health (i.e., a composite of chronic conditions, daily limitations, and acute symptoms) changed across time. As predicted based on previous research (e.g., National Council on Aging, 2016), physical health declined across time and this deterioration was stronger among older (vs. younger) participants. Critically, results also indicated that the belief at Wave 2 that one's health status was getting (increasingly) worse and worse uniquely predicted greater deterioration in physical health across time. This predictive effect was found even independent of physical health and current subjective health status at Wave 2. As we hypothesized, therefore, subjective perceptions of declining health from the recollected past into the anticipated future

were predictive of actual declines in physical health across time. Such findings extend previous studies indicating that individuals' subjective trajectories for their overall life satisfaction predict important outcomes over time (e.g., Busseri et al., 2009; Busseri & Peck, 2015; Lachman et al., 2008) by demonstrating that such predictive links also extend to individuals' evaluation of their health. The present results also expand on previous research showing the value of SRH in predicting changes in physical health (e.g., De Salvo et al., 2006; Idler & Benyamin, 1997) by revealing the unique predictive significance of individuals' beliefs about their how health is changing over time, from the recollected past to the anticipated future.

The predictive effect of the slope of the subjective trajectory for SRH on the slope of the physical health trajectory is consistent with our hypothesis based on stereotype embodiment theory (Lamont et al., 2015; Levy, 2009). From this perspective, normative and negative beliefs about aging that are internalized into one's personal belief system can impact motivation and behavior, creating a self-fulfilling prophecy (Levy, 2009; Wurm et al., 2013). In the present context, the belief that one's health is getting worse and worse over time may lead individuals to invest less in their physical health, for example by engaging in fewer health-promoting behaviors. Such negative internalized beliefs may also lead individuals to employ more avoidant coping strategies in the face of challenges to their physical functioning. In contrast, the belief that one's health will be relatively stable over time (i.e., less declining) may motivate individuals to work harder at maintaining that stability and to respond actively to challenges (and losses) to physical functioning. Such efforts may include engaging in preventative health behavior and problem-focused coping strategies in the face of real or anticipated health-related challenges. Over time, the accumulation of such choices and efforts can play an important role in determining individuals' success (or failure) in maintaining their physical health. Testing such speculations concerning mechanisms explaining the link between subjective trajectories for SRH and actual changes in physical health over time was beyond the scope of the present work. We note, however, that such notions could be evaluated (in part) using additional variables available in the MIDUS dataset, including control beliefs, coping strategies, and engagement in health-related behaviors.

LIMITATIONS AND FUTURE DIRECTIONS

We employed a composite measure of physical health based on self-reported chronic conditions, daily limitations, and symptom frequency. Although such self-reports are related to objective indicators, people often make mistakes or inaccurately recall information (Johnston, Propper, & Shields, 2007). Thus, the present findings may not generalize to objective indicators of physical health (e.g., BMI, body fat percentage, blood pressure, cholesterol levels). Future research examining individuals' beliefs about how their health status is changing over time in relation to both subjective and objective measures of physical health is needed. Such

analyses can be conducted using additional information available from the MIDUS dataset (e.g., height, weight, diseases).

Further, although the full MIDUS sample was representative of the American middle-aged population at baseline, the longitudinal participants examined in the present work were a subset of the full baseline sample.[6] Thus, the present findings may not generalize to the American population as a whole. Related, our results may not apply to subpopulations of individuals characterized by specific physical health-related limitations or particular diseases (e.g., diabetes, hypertension, asthma, cancer). Because the focus of the present work was on individuals' beliefs about their health status in general, such beliefs were not specific to particular medical conditions or diseases. Further research is thus needed to evaluate the relationship between individuals' subjective trajectories and actual changes in physical health over time with regard to, and among individuals diagnosed with, specific illnesses. Such analyses could be undertaken in future research using the MIDUS dataset, given its large and diverse sample size. Ultimately, such work could lead to improved screening protocols for individuals who are at heightened risk for future declines, as well as improved patient–provider communication.

In addition, although the MIDUS survey included several additional variables that may be relevant to future research examining mechanisms (as discussed above, e.g., motivation, coping, health-related behavior), it did not include a measure of physical health-related stereotype endorsement. Thus, although we have proposed that negative aging stereotypes play a central role in explaining the link between subjective trajectories for SRH and changes in physical health across time, this proposal was not directly assessed in the present work. Future research examining this issue should include a measure of aging-related stereotypes, particularly stereotypes concerning physical health, in order to directly evaluate whether endorsing negative aging-related stereotypes predicts both how individuals view their health as unfolding over time and longitudinal changes in their physical health over time.

Finally, although the longitudinal models tested in the present work permitted temporal separation between the Wave 2 predictors and changes in physical health over time, no manipulation was employed. Thus, inferences and conclusions concerning causality are not warranted.

CONCLUSION

Individuals viewed their health status as declining over time, from 10 years in the past, to the present, and 10 years into the anticipated future. Across a corresponding 18-year period, subjective health status did indeed deteriorate, but to a smaller degree than individuals perceived. Such perceived and actual declines in SRH were larger among older (vs. younger) individuals, as was the degree of negative

6. In a post-hoc analysis, we evaluated the longitudinal predictive model using the full baseline sample (n = 7,108) and FIML estimation in the presence of missing values. Results were consistent with those presented in the main text (see Supplemental Table 3 for details).

bias in individuals' beliefs about changes to their health status. Physical health also deteriorated over the 18-year period, particularly among older individuals. Such declines were predicted not only by poorer levels of current physical health, but also by more steeply declining subjective trajectories in individuals' health status. Simply stated, greater deterioration in physical health was predicted by greater perceived declines in subjective health status. These findings support aging-related perspectives on stereotype embodiment by demonstrating the potential negative long-term impact of believing that one's health is getting worse and worse over time. The present work also extends previous research and theory on the temporally extended self by illustrating the unique psychological significance of a subjective temporal perspective to understanding changes in health over time.

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TABLE S1. Analysis Variable Descriptions and MIDUS Variable Names by Wave

	MIDUS variable name		
Variable type/item	**Wave 1**	**Wave 2**	**Wave 3**
Self-rated health			
Recollected past	A1SA2	B1SA2	C1SA2
Current	A1SA1	B1SA1	C1SA1
Anticipated future	A1SA3	B1SA3	C1SA3
Chronic conditions			
Asthma, bronchitis, or emphysema	A1SA9A	B1SA11A	C1SA11A
Tuberculosis	A1SA9B	B1SA11B	C1SA11B
Other lung problems	A1SA9C	B1SA11C	C1SA11C
Bone or joint diseases	A1SA9D	B1SA11D	C1SA11D
Sciatica, lumbago, recur backache	A1SA9E	B1SA11E	C1SA11E
Persistent skin trouble	A1SA9F	B1SA11F	C1SA11F
Thyroid disease	A1SA9G	B1SA11G	C1SA11G
Hay fever	A1SA9H	B1SA11H	C1SA11H
Recurring stomach trouble	A1SA9I	B1SA11I	C1SA11I
Urinary or bladder problems	A1SA9J	B1SA11J	C1SA11J
Being constipated	A1SA9K	B1SA11K	C1SA11K
Gall bladder trouble	A1SA9L	B1SA11L	C1SA11L
Persistent foot trouble	A1SA9M	B1SA11M	C1SA11M
Varicose veins requiring treatment	A1SA9N	B1SA11N	C1SA11N
AIDS or HIV infection	A1SA9O	B1SA11O	C1SA11O
Autoimmune disorders	A1SA9P	B1SA11P	C1SA11P
Trouble with gums or mouth	A1SA9Q	B1SA11Q	C1SA11Q
Persistent trouble with teeth	A1SA9R	B1SA11R	C1SA11R
High blood pressure	A1SA9S	B1SA11S	C1SA11S
Emotional disorder	A1SA9T	B1SA11T	C1SA11T
Alcohol or drug problems	A1SA9U	B1SA11U	C1SA11U
Migraine headaches	A1SA9V	B1SA11V	C1SA11V
Chronic sleeping problems	A1SA9W	B1SA11W	C1SA11W
Diabetes or high blood sugar	A1SA9X	B1SA11X	C1SA11X
Neurological disorders	A1SA9Y	B1SA11Y	C1SA11Y
Stroke	A1SA9Z	B1SA11Z	C1SA11Z
Ulcer	A1SA9AA	B1SA11AA	C1SA11AA
Hernia or rupture	A1SA9BB	B1SA11BB	C1SA11BB
Daily limitations			
Lifting or carrying groceries	A1SA17A	B1SA28A	C1SA24A
Bathing or dressing yourself	A1SA17B	B1SA28B	C1SA24B
Climbing stairs	A1SA17C	B1SA28C	C1SA24C
Bending, kneeling, stooping	A1SA17D	B1SA28E	C1SA24E
Walking more than a mile	A1SA17E	B1SA28F	C1SA24F
Walking several blocks	A1SA17F	B1SA28G	C1SA24G
Walking one block	A1SA17G	B1SA28H	C1SA24H
Vigorous physical activity	A1SA17H	B1SA28I	C1SA24I
Moderate physical activity	A1SA17I	B1SA28J	C1SA24J
Acute symptoms			
Headaches	A1SA12A	B1SA10A	C1SA10A
Lower back aches	A1SA12B	B1SA10B	C1SA10B
Sweating a lot	A1SA12C	B1SA10C	C1SA10C

TABLE S1. (continued) Analysis Variable Descriptions and MIDUS Variable Names by Wave

Irritability	A1SA12D	B1SA10D	C1SA10D
Hot flushes or flashes	A1SA12E	B1SA10E	C1SA10E
Aches or stiffness in joints	A1SA12F	B1SA10F	C1SA10F
Trouble sleeping	A1SA12G	B1SA10G	C1SA10G
Leaking urine	A1SA12H	B1SA10H	C1SA10H
Discomfort during intercourse	A1SA12I	B1SA10I	C1SA10I

TABLE S2. Results from Latent Growth Curve Model Predicting Change in Physical Health over Time with All Demographic Covariates

Predictors	β	**95% CI**	***p***	***r***	**95% CI**	***p***
Gender	.02	-.04, .08	.570	.09	.03, .15	.003
Race	-.02	-.09, .05	.591	.01	-.07, .07	.969
Income	.01	-.06, .07	.981	-.02	-.09, .04	.496
Marital Status	-.10	-.16, -.04	.002	-.06	-.13, -.01	.046
Education level	.02	-.04, .09	.494	.12	.06, .19	.003
Age	.01	-.06, .08	.902	-.11	-.17, -.05	.003
Intercept, health comp	.34	.23, .46	.002	.33	.24, .42	.002
Intercept, subjective trajectory	-.12	-.24, -.01	.020	.16	.09, .24	.002
Slope, subjective trajectory	.21	.11, .33	.001	.25	.17, .34	.001

Note. $N = 2{,}386$. Standardized path coefficients (β) are shown for predictive effects on slope for health composite trajectory. Pairwise correlations (*r*) with slope for health composite trajectory are also shown.

TABLE S3. Results from Latent Growth Curve Model Predicting Change in Physical Health over Time Using All Covariates and Full Baseline Sample

Predictors	β	***p***	***r***	***p***
Gender	-.01	.795	.05	<.001
Race	-.01	.804	.01	.399
Income	-.01	.825	-.03	.011
Marital status	-.07	.011	-.03	.011
Education level	.05	.074	.14	<.001
Age	-.05	.064	-.19	<.001
Intercept, health comp	.33	<.001	.32	<.001
Intercept, subjective trajectory	-.15	<.001	.16	<.001
Slope, subjective trajectory	.23	<.001	.27	<.001

Note. $N = 7{,}108$. Results shown are based on FIML estimation used in the presence of missing values. Standardized path coefficients (β) are shown for predictive effects on slope for health composite trajectory. Pairwise correlations (*r*) with slope for health composite trajectory are also shown.