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Perceived Control Across the Second Half of Life: The Role of Physical Health and Social Integration

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Perceived control is a key component of successful aging and may serve as a protective factor against age-related declines in central domains of functioning. However, it is a largely open question whether and how perceived control changes from midadulthood to very old age and how such change is shaped by health and social contexts. To examine these questions, we apply growth models to up to 15-year 4-wave longitudinal data from the German Ageing Survey (DEAS; $N = 10{,}081$; aged 40–85 years at baseline; 49% women). Results revealed that perceived control is relatively stable in midlife, but starts to decline after midlife. Starting at 70, perceived control declines an average of a quarter of a *SD* per 10 years. Suffering from comorbidity and functional limitations were each associated with considerably lower perceived control. Volunteering and less loneliness were each uniquely associated with higher perceived control, over and above the other social factors as well as sociodemographic and health variables. Surprisingly, less social support was associated with stronger perceived control. We also found significant interaction effects suggesting that the combination of functional limitations with older age and loneliness with lower education were each associated with particularly compromised perceived control. Overall we found little evidence for correlates of change in perceived control, with only the loneliness—control association becoming slightly weaker over time. We take our findings to suggest that various different facets of social integration later in life are uniquely relevant for perceived control and suggest routes for further inquiry.

Keywords: perceived control trajectories, longitudinal data, health, social support

Life Span theory has long emphasized that perceptions of control are an integral component of adaptive self-regulation and a key predictor of successful development and aging (Bandura, 1997; Heckhausen & Schulz, 1995; Lachman, 2006). There is mounting evidence that beliefs to actively influence and shape one's life conditions and to cope with challenges are related to central indicators of health, well-being, and cognition (Femia, Zarit, & Johansson, 1997; Kunzmann, Little, & Smith, 2002; Penninx et al., 1997; Rodin, 1986; Skaff, 2007). What is less well understood, however, is whether and how perceived control changes or remains stable in the second half of life. Some studies report that perceived control shows rather minor forms of decline in old age (Gatz & Karel, 1993; Specht, Egloff, & Schmukle, 2013), whereas other studies have found relatively steep rates of decline (Mirowsky & Ross, 2007). Research has also shown that those who perceive more control over their lives are often of higher socioeconomic status, in better health, and socially integrated (Krause, 2007; Roepke & Grant, 2011). However, little is known about the specific physical health and social integration factors that are relevant for late-life control trajectories. To examine these questions, the current study applies growth curve modeling to up to 15-year longitudinal data obtained from 10,081 participants of the German Ageing Survey (DEAS; aged 40–85 years at baseline; 49% women). Specifically, we investigate trajectories of stability and

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change in perceived control from midadulthood to very old age and target the unique and shared roles of multiple key aspects of physical health and social integration.

Control Beliefs Across Adulthood and Old Age

Control beliefs can be defined as people's beliefs about their ability to influence, control, and shape one's life circumstances (Bandura, 1997; Skinner, 1995). Because the pursuit of control is a fundamental human concern, the perceived capacity to influence one's life is often considered to be a crucial constituent of successful aging (Baltes & Baltes, 1990; Heckhausen, Wrosch, & Schulz, 2010). Conceptual models suggest that across adulthood numerous health and social factors profoundly shape perceptions of control (Antonucci, 2001; Bandura, 1997). Because these key sources of perceived control are often declining in old age (Baltes & Smith, 2003), one could expect that older people have increasingly fewer opportunities to exert control in several domains of life, thereby resulting in age-related declines of overall perceived control. At the same time, it has long been argued that older adults change their strategies to exert control (Brandtstädter, 1999; Heckhausen et al., 2010; Lachman, 2006). For example, when being confronted with an increasing number of losses in the health domain, older adults may focus their remaining resources on domains of life that appear more controllable (e.g., social network) and, therefore, maintain their overall sense of control. As a consequence, domain-general perceived control could be relatively stable across adulthood and old age.

Empirical evidence on age-related changes in perceived control is inconclusive, with some studies reporting average declines in perceived control with increasing age (Mirowsky, 1995; Mirowsky & Ross, 2007), whereas others report stability across adulthood (Gatz & Karel, 1993; Specht et al., 2013). A comprehensive overview of studies examining age differences and age-related changes in perceived control is given in the Appendix. To begin with, several lines of empirical research indeed provide initial evidence that perceived control is lower in older ages. For example, using cross-sectional data from the United States, Mirowsky (1995) reported that average levels of perceived control were relatively stable for participants aged 18 through 50, but decreased in older age groups. Again using cross-sectional data, Pearlin, Nguyen, Schieman, and Milkie (2007) reported that levels of perceived control showed modest forms of decline among older adults. Using five-wave 13-year longitudinal data from the Berlin Aging Study, Gerstorf and colleagues (2013) reported that perceived control declined by an average of half a *SD* per decade between age 70 and 100. In contrast, other studies have reported that perceived control remains stable across adulthood and old age (Gatz & Karel, 1993) or even evince increases after age 60 (Specht et al., 2013). Such discrepant findings could be because of study differences in sample size, sampling strategies, longitudinal information available, or measurement (see overview table Appendix). For example, studies reporting relative stability in perceived control are primarily based on measures encompassing domain-specific perceived control (Gatz & Karel, 1993), whereas studies reporting age-related declines in perceived control are primarily based on broad measures of perceived control. Additionally, studies on the topic rarely have sufficiently large sample sizes for very old adults aged 80 and older available so as to draw firm conclusions about stability and change of perceived control in advanced old age. In the present study, we make use of longitudinal within-person change information on perceived control assessed with an 8-item instrument obtained at up to four waves of assessment across up to 15 years to examine stability and change in perceived control from midadulthood into very old age.

The Role of Physical Health

An extensive body of conceptual and empirical work has shown that perceived control is associated with key indicators of health (Krause & Shaw, 2000; McAvay, Seeman, & Rodin, 1996). To begin with, healthier individuals may have more opportunities to achieve desired outcomes, which in the long run might enhance their feeling of control (Bandura, 1994; Lachman & Firth, 2004; Rodin, 1986; Seeman, Unger, McAvay, & Mendes de Leon, 1999; Wurm, Tesch-Römer, & Tomasik, 2007). To illustrate, people in good health are often in a better position to remove themselves from negative situations (e.g., stressful environments; Baltes, 1997) and to exercise regularly (Chodzko-Zajko et al., 2009), both of which in turn contribute to maintaining health. In contrast, being in poor physical health undermines one's perception of control (Cairney, Corna, Wade, & Streiner, 2007; Wurm et al., 2007) because, among other things, people are not able to independently carry out basic activities of daily living (e.g., groceries shopping).

Consistent with these theoretical assumptions, empirical evidence suggests that better health is indeed related to higher levels of perceived control (Caplan & Schooler, 2003; Infurna & Gerstorf, 2014; Paquet et al., 2010; Roepke & Grant, 2011; Surtees et al., 2006). For example, Infurna and Okun (2015) could show that fewer functional limitations were associated with higher levels of and less pronounced declines in perceived control over a 16-year longitudinal period. Because health problems often become more severe and frequent late in life (Aldwin, Spiro, & Park, 2006; Stenholm et al., 2015; Suzman, Manton, & Willis, 1992), health-control associations are probably more pronounced in very old age (Gerstorf et al., 2014; Rodin, 1986). Ultimately, morbidity-related changes may undermine one's capacities to deal with the challenges of everyday living, which in the long run further weakens perceptions of control (Heckhausen, Wrosch, & Schulz, 2013).

The Role of Social Integration

Social factors have long been identified as pivotal sources of perceived control (Antonucci, 2001; Bandura, 1997; Skaff, 2007; Uchino, 2006). First, having access to a social network provides people with numerous instrumental resources and expands possible courses of action, both of which are often beneficial for attaining desired outcomes and overcoming challenges, which in turn foster perceived control (Krause, 1987, 2007; Lang, Featherman, & Nesselroade, 1997; McAvay et al., 1996). Second, being engaged with and supporting others by, for example, engaging in volunteer work, might be related to overall higher levels of functioning and additionally foster the internalization of self-related positive feedback and encouragement from others through positive interactions, which in the long run increase perceived control (Fuller-Iglesias, Sellars, & Antonucci, 2008; Shaw, Krause, Chatters, Connell, & Ingersoll-Dayton, 2004; Wahrendorf, von dem Knesebeck, & Siegrist, 2006). Finally, feeling lonely might under-

mine one's perceived control (Cacioppo & Hawkley, 2005; Solano, 1987) when people doubt that they have the capabilities to improve the situation so as to have their socioemotional needs met (Newall et al., 2009). Similarly, feelings of loneliness and social isolation may be attributed to uncontrollable external forces (Perlman, 2004), and lonely people might feel that they lack relationships that offer trust, security, and comfort, which in turn results in internalizing control-related self-evaluations that undermine perceptions of control.

Consistent with these conceptual perspectives, empirical evidence for links between measures of social integration and control has repeatedly been reported (Antonucci & Jackson, 1987). First, social network contact has been found to be linked to higher levels of perceived control (McAvay et al., 1996). Second, volunteering and social participation has been shown to be associated with higher levels of perceived control (Curtis, Huxhold, & Windsor, 2016; Infurna et al., 2011). Third, using 9-year longitudinal data from the Midlife in the United States Study (MIDUS), Gerstorf, Röcke, & Lachman, (2011) showed that perceived emotional support from one's spouse, partner, family, or friends was associated with more positive changes in perceived control. Finally, loneliness has been associated with lower perceptions of control in older adults (Newall et al., 2009). It is important to note that most of these studies also control for health in their analysis.

What is less known, however, is what the unique contribution of each of these social factors vis-à-vis other social factors are and how these various different sources of perceived control operate together. It is possible that, for example, having a large network combined with the perception that support can be acquired if needed, is associated with higher control than each of the two social factors alone. On a broader level, by examining the unique contribution of various indicators of health and social support the current study investigates important notions from life span developmental theory suggesting that late-life development is shaped by a complex interplay of gains and losses in various domains of functioning (e.g., Baltes et al., 2006). The current study aims at corroborating and extending these earlier reports by attempting to disentangle the effects of a diverse set of social resources, encompassing network size, participation (volunteering), social support, and loneliness.

The Present Study

Conceptual perspectives and empirical evidence have long shown that health and social integration are associated with perceived control (Antonucci, 2001; Bandura, 1997; Heckhausen et al., 2010). However, empirical studies have typically examined single selected indicators out of the larger construct space and rarely examined the unique role a given set of health and social factors plays over and above other relevant factors. In the current study, we move one step further and examine the unique role of key indicators of physical health and social integration for stability and change in perceived control and test whether these differ from midlife to very old age. We are in a position to pit not only the relevance of physical health and social variables against one another, but also several different operational definitions within the larger construct space of the health and social domains against one another. To do so, we applied multilevel growth models to up to 15-year longitudinal data from 10,081 participants in the DEAS (age at baseline: $M = 60$ years, $SD = 12.15$). Corroborating and extending earlier empirical reports, we make use of longitudinal data from a large-scale national sample in Germany and expect that perceived control remains relatively stable across midlife and old age, but declines in very old age. We also expect that various different facets of the larger construct space of physical health and social integration are uniquely important for perceived control in the second half of life. To control for known predictors of perceived control, our models covary for mortality, gender, and education (Gerstorf et al., 2013; Lachman & Firth, 2004; Ross & Mirowsky, 2002; Vargas Lascano et al., 2015). For example, having lower level of education is associated with low perceived control, poor health, and less social support (Lachman & Firth, 2004; Ross & Mirowsky, 2002). In addition, we also test the interaction between social support/health and known predictors. For example, it could be that higher education can compensate for an individual's lower social support. Having less social support, on the other hand, may increase the vulnerability for low perceived control of a less educated older adult.

Method

We examined our research questions using longitudinal data from the DEAS (Deutscher Alterssurvey, German Aging Survey). Comprehensive information about the study design, variables, participants, and assessment procedures is reported in Schöllgen, Huxhold, Schüz, and Tesch-Römer (2011). Select details relevant to the present study are presented below.

Participants and Procedure

The DEAS is an ongoing nationally representative longitudinal panel study of people living in private households in Germany aged 40 to 85 years at baseline (Engstler & Schmiade, 2013). Data collection took place in 1996, 2002, 2008, and 2011. In 2002 (T2) and 2008 (T3), additional baseline samples were drawn, stratified by age (40–85 years), gender, and region (East or West Germany). In 2002, 2008, and 2011, people who had already participated in previous waves were also asked to participate again. The response rate corresponds to that in other large-scale surveys in Germany (Schöllgen et al., 2011). As a consequence, at both T2 and T3, the sample assessed consists of newly added participants and those who had already participated in previous waves. Data were collected through self-complete questionnaires and home-based interviews.

In the current study, we included participants who had provided a minimum of one data point on the variables of interest, independent of whether (T1) data were collected in 1996, 2002, or 2008. The current sample of $N = 10{,}081$ participants distributes as follows: $n = 3{,}663$ tested first in 1996, $n = 2{,}909$ tested first in 2002, and $n = 3{,}509$ tested first in 2008. With this set-up, we have 10,081 participants with one or more waves of data, $n = 3{,}521$ participants who had provided two waves of data, $n = 1{,}383$ participants with three waves, and another $n = 876$ with four waves of data. 57% of the sample contributed two or more data points and lend themselves to the examination of within-person change (M observation period = 1.48 years, $SD = 2.30$; range: 0–15 years). The 10,081 DEAS participants contributed a total of 15,733 observations, spread from adulthood to very old age: ages

40 through 49: 2,585 observations; ages 50 through 59: 3,913 observations; ages 60 through 69: 3,967 observations; ages 70 through 79: 3,505 observations; and ages 80+: 889 observations.

To examine the longitudinal selectivity for the measures under consideration, we used an effect-size metric indicating the degree to which individuals who survived and participated longitudinally differed from those who did not (for details, see Lindenberger, Singer, & Baltes, 2002). We compared individuals who only contributed data at Time 1 with those who had two or more waves of data. As expected, the latter had higher levels of perceived control ($d = 0.10$), were younger ($d = 0.64$) and better educated ($d = 0.10$), had fewer chronic health conditions ($d = 0.11$), reported fewer limitations in physical functioning ($d = 0.83$), were more engaged in voluntary work ($d = 0.15$), and perceived more social support ($d = 0.14$). The statistical procedures implemented in this study handle this type of nonrandom attrition (see also Data Preparation and Analyses). However, we acknowledge that participants who provided the most change (i.e., longitudinal) information represent a positively selected subset of the initial sample.

Measures

Perceived control. This dataset did not include a complete perceived control scale. However, because several items of the Dispositional Hope Scale (Snyder et al., 1991) represent perceptions of control we combined them as a measure of perceived control ("*I can think of many ways to get out of a jam.*"; "*I energetically peruse my goals.*"; "*There are lots of ways around any problems.*"; "*My past experiences have prepared me well for my future.*"; "*Even when others get discouraged, I know I can find a way to solve the problem.*"; "*I have been pretty successful in life.*"; "*I can think of many ways to get the things in life that are most important to me.*"; "*I meet the goals I set for myself.*", Cronbach's $\alpha = .83$). Participants were asked to indicate the extent to which they agreed with each of the statements, using an 8-point Likert-scale with 1 labeled as "*definitely false*" and 8 labeled as "*definitely true.*" Because of our interest in perceived control, we did not consider items from the Adult Hope Scale that tap into aspects of vitality and neuroticism for our analysis. Previous research has shown the validity of the Dispositional Hope Scale as an indicator for perceived control (Schöllgen et al., 2011; Wiest, Schüz, & Wurm, 2013).

Physical health. Physical health was assessed using two comprehensive measures. *Comorbidity* was measured using a checklist of 11 health problems (heart and circulatory complaints, perfusion problems, back or joint diseases, diabetes, cancer, gastro-intestinal diseases, respiratory diseases, bladder complaints, liver or kidney diseases, eye problems, and ear complaints). For each person, we computed a sum score based on the total number of self-reported diseases. Global scores on self-reported illness have been shown to be a better indicator for physical health than self-reports on single illnesses (Katz, Chang, Sangha, Fossel, & Bates, 1996; Olomu, Corser, Stommel, Xie, & Holmes-Rovner, 2012) and represent valid predictors for mortality (Idler & Benyamini, 1997). *Functional health* was assessed using limitation in 10 Activities of Daily Living (e.g., taking a bath, climbing stairs, carrying shopping bags). Based on the frequency distribution of functional limitations in the sample, we contrasted those participants with and without limitations. We used data for the health characteristics as collected at baseline assessment.

Social integration. We used four indicators to assess social integration. *Social network* size was assessed by asking participants to report the number of people (up to eight) with whom they had contact with regularly or whom they considered as being important. *Volunteering* was measured with a single item asking participants whether or not they were socially engaged in voluntary work. *Social support* was measured with a single item asking participants to name up to six people they could ask for advice. The total number of people named was used as a measure of receiving emotional support. *Loneliness* was measured using the 6-item short version of the De Jong Gierveld Scale for emotional and social loneliness (DeJong Gierveld & Van Tilburg, 2010). The scale assesses several components of emotional and social loneliness, such as feelings of isolation or being alone. Participants were asked to indicate the extent to which they agreed with each of the statements, using a 4-point Likert-scale with 1 labeled as "*does not apply to me at all*" and 4 labeled as "*applies very well to me.*" Higher scores indicate more loneliness (Cronbach's $\alpha = .82$). We used data for the social integration characteristics as collected at baseline assessment.

Time and age. Time in study was used as a proxy for within-person change in perceived control across up to 15 years ($M = 1.48$ years, $SD = 2.30$; range = 0–15). Chronological age was used as the number of years since birth at baseline assessment and included as a between-person predictor in our model ($M = 60.23$, $SD = 12.15$; range: 40–85).

Covariates. We included mortality, gender, and education, occupational status, relationship status and number of children as covariates in our models. As part of the first wave, participants were asked whether they were willing to be interviewed at a later point in time. Because of German data protection legislation, the mortality status could only be obtained for those participants who agreed to be contacted again. *Mortality status* was obtained from public registries and has been used in earlier publications (Wiest, Schüz, Webster, & Wurm, 2011). Information about causes of death was not available. *Gender* was also used as a dichotomous variable with 49% of our sample being women. Levels of *education* were assessed as a three-categorical variable based on the German schooling system (1 = less than 10 years school education; 2 = 10 or 11 years of school education; 3 = at least 12 years of school education; centered at the sample mean). *Occupational status* was assessed as a two-categorical variable (0 = no occupation; 1 = occupation). *Relationship status* was used as a dichotomous variable (0 = single; 1 = in relationship). *Number of children* was assessed by asking participants to report the number of children they have.

Data Preparation and Data Analysis

We standardized scores for perceived control to the *T* metric score ($M = 50$, $SD = 10$) using the baseline DEAS sample ($N = 10{,}081$) as the reference. Intercorrelations and descriptive information for our measures are presented in Table 1. For example, from the age correlations can be obtained that older age was associated with differences in physical health (e.g., comorbidity and limitations in physical functioning), social integration (e.g., less likely to be in a relationship, less social support), and reporting

Table 1
Descriptive Statistics and Intercorrelations of Study Measures at T1

Variable	*M*	*SD*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Construct																
(1) Age (40–85)	60.23	12.15	1													
(2) Deceased	.09	.28	.25*	1												
(3) Men	.51	.50	.04*	.10*	1											
(4) Education (1–3)	2.04	.64	−.17*	−.05*	.19*	1										
(5) Occupational status (0–1)	.40	.49	−.69*	−.21*	.09*	−.69*	1									
(6) Relationship status (0–1)	.80	.40	−.18*	−.08*	.03*	−.18*	.16*	1								
(7) Number of children (0–8)	1.89	1.24	.06*	.18*	.01	.06*	−.09*	.11*	1							
(8) Perceived control (1–4)	3.07	.49	−.08*	−.01	.06*	.13*	.11*	.12*	.03*	1						
Physical health																
(9) Comorbidity (0–11)	2.32	1.87	.39*	.15*	.01	−.13*	−.30*	−.11*	.07*	−.20	1					
(10) Functional health (0–1)	.75	.43	.27*	.14*	−.04*	−.12*	−.24*	−.08*	.04*	−.12	.32	1				
Social integration																
(11) Social network size (1–8)	4.50	2.69	−.13*	−.08*	−.04*	.09*	.09*	.11*	.13*	.07	−.02	−.03*	1			
(12) Volunteering (0–1)	.14	.35	−.08*	−.05*	.09*	.14*	.07*	.07*	.01	.08	−.03	−.04*	.10*	1		
(13) Social support (1–6)	2.09	1.43	−.08*	−.04*	−.08*	.07*	.05*	.04*	.11*	.03*	−.01	.01*	.35*	.06*	1	
(14) Loneliness (1–4)	1.75	.57	−.02	.03*	.04*	−.06*	.01	−.17*	−.09*	−.40*	.17	.07*	−.15*	−.04*	−.15*	1

Note. $N = 10{,}081$. M = mean. Mortality: 0 = alive; 1 = deceased. Gender: 1 = men, 0 = women. Education was divided into three categories: 1 = basic school degree or no degree; 2 = advanced school degree; 3 = college degree or more. Occupational status: 0 = no occupation; 1 = occupation. Relationship Status: 0 = single; 1 = in a relationship. Comorbidity: Number of diseases (11 Symptom Health Checklist). ADL = activities of daily living was divided into two categories: 0 = no limitations; 1 = limitations. Volunteering: 0 = no volunteering; 1 = volunteering.
* $p < .05$.

lower perceived control. We also observed gender differences, suggesting that being a woman was associated with differences in physical health (more limitations in physical functioning, $d = 0.08$), social integration (e.g., more likely to be in a relationship, $d = 0.35$, and to engage in volunteering, $d = 0.17$), and reporting slightly higher perceived control ($d = 0.12$). These descriptive analyses underscore our approach to include age and gender into our models.

To examine our research questions, we estimated growth curve models (McArdle & Nesselroade, 2003; Ram & Grimm, 2007; Raudenbush & Bryk, 2002) based on data for perceived control over up to four assessments across up to 15 years (1996–2011). Importantly, the observation period was relatively brief compared with the broad age range across the adult life span that our model parameters generalize to (40 to 85+ years). As a consequence, we used an accelerated longitudinal study design to model perceived control trajectories over time (in study) and examine age-related differences therein (for detailed discussion of the approach, see Sliwinski, Hoffman, & Hofer, 2010). Using this approach provides us with more statistical power to test the research questions we are after and also allows us to test age convergence, that is whether the change in perceived control of younger individuals aligns with levels and change trajectories of older individuals in the sample (for further applications, see Morack et al., 2013; Wagner et al., 2015, 2016).

Time was centered at the middle of each person's mean (Hülür, Hertzog, Pearman, Ram, & Gerstorf, 2014; Wagner et al., 2015). We also estimated quadratic rates of change, but as might be expected given the scarcity of repeated assessments, both fixed and random effects for the quadratic rate of change were not reliably different from zero and were not included in the final models. Additionally, we examined whether and how the between-person variance in individuals' level and change over time in study was associated with the covariates, and the health and social factors. All person-level predictors were grand-mean centered so that the regression parameters indicated the average trajectory (across all individuals). We also tested interaction terms of age, mortality status, and education with each of the health and social variables. Only those interaction terms that were significantly different from zero were included in the final model. Models were estimated in SAS 9.2 using PROC MIXED (Littell et al., 2006) with full information maximum likelihood estimation, thereby treating incomplete data as missing at random (Little & Rubin, 2002) and adjusting for unbalanced data (Singer & Willett, 2003).

Results

We present the analyses testing our research questions in two steps. In a first step, we examined stability and change in perceived control from midadulthood to old age. In a second step, we examined the unique and shared roles of physical health and social integration factors.

Control Beliefs Across Adulthood and Old Age

In a preliminary step, we estimated an unconditional intercept-only model of perceived control to examine the distribution of between-person variation and within-person variation. Analyses revealed that the intraclass correlation was .50, suggesting that 50% of the total variation in perceived control was located at the between-person level with the remainder of 50% being located at the within-person level. With this indication of having observed substantial variation in perceived control between persons and within persons, we proceeded to test our research questions.

Results from growth curve models of perceived control over time in study are presented in Table 2. Perceived control declined an average of a quarter of a *SD* per 10 years ($\gamma = -0.26$, $p < .01$). With age being centered at age 70, trajectories of stability and

Table 2
Growth Models of Perceived Control Over Time in Study Including Age and Mortality as Between-Person Predictors

Effects	Estimates	(*SE*)
Fixed effects estimates		
Intercept	49.21**	(.12)
Time	−.26**	(.03)
Age	−.07**	(.01)
Deceased	−.27	(.34)
Time × Age	−.01**	(.00)
Time × Deceased	.03	(.09)
Random effects estimates		
Variance of intercept	54.80**	(1.40)
Variance linear slope	.12**	(.02)
Covariance intercept, linear slope	−.94**	(.16)
Residual variance	36.60**	(.93)
Goodness-of-fit indices		
AIC	113,337	

Note. Unstandardized estimates are presented, with *SE*s in parentheses. n = 10,081 participants who provided 15,733 observations. Perceived control is *T* score standardized to the cross-sectional DEAS sample at T1 (N = 10,081, M = 50, SD = 10). Time centered at the middle of the individual time series, with an average of 1.48 years. Age centered at 70 years. AIC = Akaike information criterion, a relative model fit statistic; DEAS = German Ageing Survey.
* $p < .05$. ** $p < .01$.

change in perceived control were significantly related to age, such that older age was associated with both lower levels of perceived control ($\gamma = -0.07$, $p < .01$) and steeper rates of decline ($\gamma = -0.01$, $p < .01$). In this model without further covariates, we found no evidence for moderation effects of mortality. Figure 1 provides a graphical illustration of our findings. There are at least three important information included: First, the general outline of the average curve indicates that perceived control is relatively stable in midlife, but starts to decline thereafter. Second, the figure nicely illustrates the increasingly lower levels and more pronouncing decrease in perceived control later in life as indicated by the negative and significant interaction of age with slope (see also Table 3). Finally, a relative convergence of age-related differences across slices of 5-year change is apparent at younger ages by mostly overlapping 5-year trajectories. With increasing age, however, the trajectories become more and more nonconvergent and are mainly nonoverlapping. In particular, intercepts gradually are higher in older ages, with older adults in the sample appearing to have started at higher levels of perceived control at baseline. These increasing nonoverlapping trajectories of change indicate that the older participants have higher levels of perceived control than would be expected based on how their younger peers were changing. Such patterns suggest a positive selection of our sample in later life. We will get back to that point in the Discussion.

The Role of Physical Health and Social Integration

In a second step, we added physical health and social integration factors into our models. Results are presented in Table 3. To begin with, analyses revealed that under the consideration of all covariates perceived control was lower among participants who had died over the up to 15-year observation period ($\gamma = -1.14$), women ($\gamma = 0.78$), and the lower educated ($\gamma = 0.94$). Similar to the model without further covariates, older participants reported lower perceived control ($\gamma = -0.07$) and experienced more pronounced declines ($\gamma = -0.01$; all ps $< .01$). We also found a significant quadratic effect of age with perceived control ($\gamma = -0.001$; $p < .01$).

Most important for the questions under study, we also found evidence that several physical health and social integration factors were associated with perceived control in the second half of life. Of the physical health factors, suffering from comorbidity ($\gamma = -0.50$) and functional limitations ($\gamma = -1.92$; both ps $< .01$) were each associated with considerably lower levels of perceived control.[1] Of the social integration factors, volunteering ($\gamma = 0.92$), and less loneliness ($\gamma = -5.71$) were each uniquely associated with higher perceived control, over and above the other social factors as well as sociodemographic and health variables. Additionally, lower social support ($\gamma = -0.18$; all ps $< .01$) was associated with higher perceived control. Overall, we found little evidence for correlates of change in perceived control. The only significant effect was that control declines were less pronounced among participants who reported high levels of loneliness ($\gamma = 0.33$; $p < .01$), probably because their control had already been compromised at study inception. The age interaction of occupational status was statistically significant ($\gamma = -0.07$; $p < .01$), suggesting that the difference in perceived control between those with versus without an occupation is more pronounced the older participants are. Finally, the age interaction of functional limitations was statistically significant ($\gamma = -0.06$; $p < .01$), suggesting that the difference in perceived control between those high versus low in functional limitations is more pronounced the older participants are. Thus, the combination of suffering from functional limitations and being older was associated with particularly compromised perceived control. Finally, we found a significant interaction effect between education and loneliness ($\gamma = 0.63$; $p < .01$), indicating a buffering effect of education in that the lower levels of perceived control typically associated with loneliness are less pronounced among the high educated.

Figures 2 through 4 selectively illustrate our major findings. Figure 2 contrasts stability and change in perceived control for people high versus low on loneliness. It can be obtained that relative to German Ageing Survey participants who felt less lonely (−1 *SD*), those who reported more loneliness (1 *SD*) also reported considerably lower control beliefs and this association became slightly smaller with increasing age. Figure 3 graphically illustrates the age by functional limitations interaction, indicating that the difference in perceived control between those high (vs. low) in functional limitations is more pronounced among those aged 70 and older than among those aged 69 and younger. Figure 4 shows the education by loneliness interaction, suggesting that perceived control was particularly compromised for those who felt lonely combined with being less educated.

Quantifying the effect size as the reduction in unexplained variance in the parameters of interest (Snijders & Bosker, 1999), we found that all predictors together accounted for 27% of between-person variance in levels of perceived control and 11% in

[1] In follow-up analyses, we additionally included interactions of mortality status with comorbidity and functional limitations. Results were not significant and, therefore, not included in our main model.

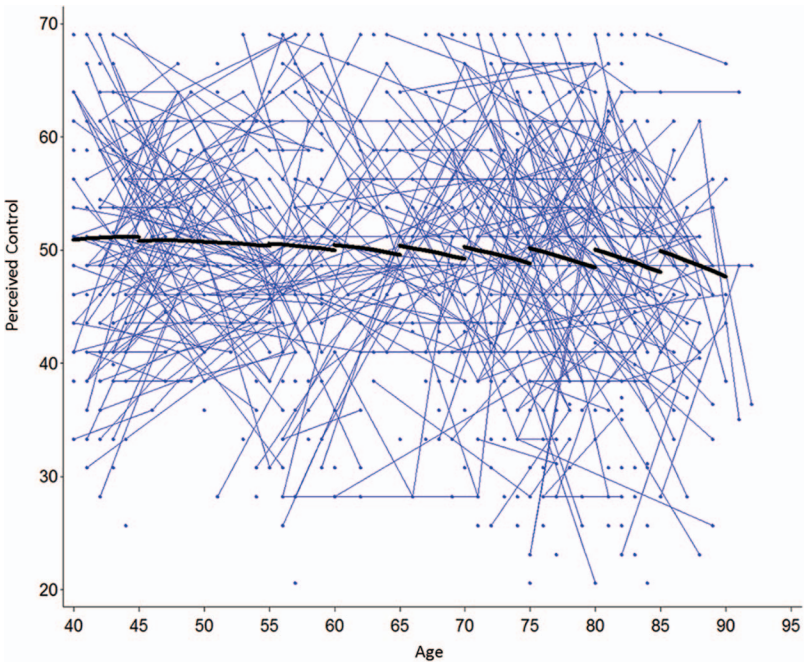

Figure 1. Individual (thin lines) and average (thick lines) trajectories of perceived control (for 5-year slices of age) from midadulthood to very old age, as obtained from participants in the German Aging Survey. Relative convergence of age-related differences across slices of 5-year change is apparent at younger ages by mostly overlapping 5-year trajectories. With increasing age, however, the trajectories become more and more nonconvergent and are mainly nonoverlapping. In particular, intercepts gradually are higher in older ages, with older adults in the sample appearing to have started at higher levels of perceived control at baseline. It can be obtained that control beliefs are relatively stable in midlife, but start to decline thereafter. Among 70-year olds, perceived control declined an average of about a quarter of a *SD* per 10 years. See the online article for the color version of this figure.

the rate of change of perceived control. Of these, the unique effects of the physical health and social factors together over and above the covariates amounted to 22.6% in level and 11.2% in change of perceived control. Loneliness emerged as the strongest predictor, accounting for 17.3% of the variance in levels and 11% in change of perceived control over and above all other variables examined in our study. The two physical health variables accounted for a comparable share of the variance (e.g., 2.1% in levels of perceived control each). The model fit comparison also indicates that nominally the full model in Table 3 provides better model fit than the baseline model in Table 2 and is thus preferable.

Discussion

The major objective of our study was to examine whether and how perceived control changes from midadulthood to very old age and to investigate the unique and shared roles of particular health and social factors. To do so, we applied growth curve models to up to 15-year, four-wave longitudinal data obtained from participants in the German Aging Survey (N = 10,081; aged 40–85 years at baseline; 49% women). Results revealed that perceived control is relatively stable in midlife, but starts to decline thereafter. Among 70-year olds, perceived control declined an average of a quarter of a *SD* per 10 years.

Of the health variables, suffering from comorbidity and functional limitations were each associated with considerably lower control. Of the social variables, volunteering, and less loneliness were each uniquely associated with higher control, over and above the other social factors as well as sociodemographic and health variables. In addition, lower social support was associated with higher perceived control. Associations of perceived control with functional limitations became stronger in older ages. Overall, we found little evidence for prime predictors of change in perceived control, with only the loneliness—control association becoming slightly weaker with age. Associations were independent of gender and mortality. We take our findings to suggest that various different facets of social integration later in life are uniquely relevant for perceived control and suggest routes for further inquiry.

Perceived Control Across Adulthood and Old Age

One central question of our study was to examine whether perceived control remains on average relatively stable across the second half of life or evince precipitous declines. Earlier research has provided an inconsistent picture, with some studies reporting average decline (e.g., Mirowsky & Ross, 2007), whereas others reported that perceived control is typically stable (e.g., Gatz & Karel, 1993).

Our findings of relative stability in midlife and rather minor forms of decline with advancing age are consistent with theoretical notions that emphasize the adaptive capabilities of older adults when being confronted with increasingly frequent and

Table 3
Growth Models of Perceived Control Over Time in Study: The Role of Physical Health and Social Integration Factors

Effects	Estimates	(*SE*)
Fixed effects estimates		
Intercept	49.94**	(.20)
Time	−.26**	(.03)
Age	−.07**	(.02)
Deceased	−1.14**	(.31)
Men	.78**	(.17)
Education	.94**	(.14)
Occupational status	.39	(.55)
Relationship status	.33	(.22)
Number of children	.10	(.07)
Comorbidity	−.50**	(.05)
Functional limitations	−1.92**	(.34)
Network size	.00	(.03)
Volunteering	.92**	(.23)
Social support	−.18**	(.06)
Loneliness	−5.71**	(.15)
Time × Age	−.01**	(.00)
Time × Deceased	−.05	(.09)
Time × Men	−.03	(.04)
Time × Education	.01	(.03)
Time × Occupational Status	−.02	(.05)
Time × Relationship Status	.06	(.05)
Time × Number of Children	−.02	(.02)
Time × Comorbidity	.01	(.01)
Time × Functional Limitations	.03	(.05)
Time × Network Size	.01	(.01)
Time × Volunteering	.04	(.04)
Time × Social Support	.02	(.01)
Time × Loneliness	.33**	(.03)
Age × Age	.001**	(.00)
Age × Occupational Status	−.07*	(.03)
Age × Functional Limitations	−.06**	(.02)
Education × Loneliness	.63**	(.23)
Random effects estimates		
Variance of intercept	39.30**	(1.16)
Variance linear slope	.11**	(.02)
Covariance intercept, linear slope	−.33*	(.13)
Residual variance	35.86**	(.89)
Goodness-of-fit indices		
AIC	108,663	

Note. Unstandardized estimates are presented, with standard errors in parentheses. n = 10,081 participants who provided 15,733 observations. Perceived control is T score standardized to the cross-sectional DEAS sample at T1 (N = 10,081, M = 50, SD = 10). Time centered at the middle of the individual time series, with an average of 1.48 years. Age centered at 70 years. AIC = Akaike information criterion, a relative model fit statistic; DEAS = German Ageing Survey.
* $p < .05$. ** $p < .01$.

severe loss experiences (Baltes & Smith, 2003; Brandtstädter & Rothermund, 2002; Carstensen et al., 2000; Charles et al., 2001; Freund & Smith, 1999; Haase, Heckhausen, & Wrosch, 2013; Heckhausen et al., 2010). To illustrate, theories of developmental self-regulation and self-plasticity suggest that individuals adjust to changing life conditions in older age by, for example, changing their standards of comparison (e.g., Baltes & Smith, 2003); therefore, maintaining their overall sense of control. Our findings are in line with this reasoning, showing that despite normative changes in older age (e.g., poorer health), perceived control only shows small forms of decline over a 15-year period and by illustrating the differential role of health and social resources. Putting our findings in larger perspective, it seems as if it is not before very late in life when many regulatory and supporting structures break down that beliefs in one's control are compromised (Gerstorf et al., 2013; Heckhausen et al., 2013)—a pattern that is also consistent with our finding that those who had died over the observation period reported lower control.

Over and above the typical trajectories of stability and change, we found considerable between-person differences in perceived control, with some people reporting low perceived control and experiencing steep decrements, whereas others reported high levels of perceived control and maintained these high levels across a long period of lifetime (see also Figure 1). Our results are in line with previous research demonstrating that perceived control differs by sociodemographic strata (Lachman, 2006; Mirowsky, 1995). To begin with, our gender finding that being a woman was associated with lower perceived control is in line with previous research, suggesting that women believe to have less control over their lives than men (Gatz & Karel, 1993). Differences in education and economic conditions are known to contribute to the gender gap (Ross & Mirowsky, 2002), and it will be intriguing to examine in the future whether other factors, such as taking over certain social roles after retirement, will also share some of the variance. For example, in light of traditional role allocations viewing men as the primary breadwinner, men's perceived control could be more strongly affected by the transition from work to retirement. Our findings are also consistent with previous research demonstrating that education and occupational status relate to perceived control (Caplan & Schooler, 2003; Lewis, Ross, & Mirowsky, 1999; Lachman & Weaver, 1998; Vargas Lascano et al., 2015), probably because better educated people often have more opportunities and capacities to indeed exert control over their lives particularly in time of strain (Lewis et al., 1999; Mirowsky & Ross, 2007). However, because of changes in role allocation and gender normative roles one could suggest that such gender gaps will be smaller in younger cohorts. It would be highly informative to additionally elucidate the role of further SES

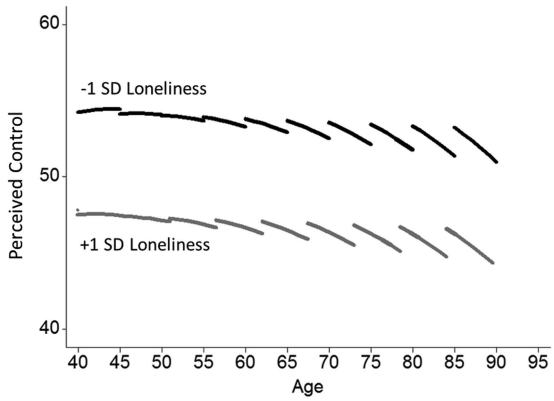

Figure 2. Associations between individual differences in levels of loneliness and perceived control (for 5-year slices of age). Relative to German Ageing Survey participants who felt less lonely (−1 *SD*), those who reported more loneliness (1 *SD*) also reported considerably lower perceived control and this association became slightly weaker with increasing age.

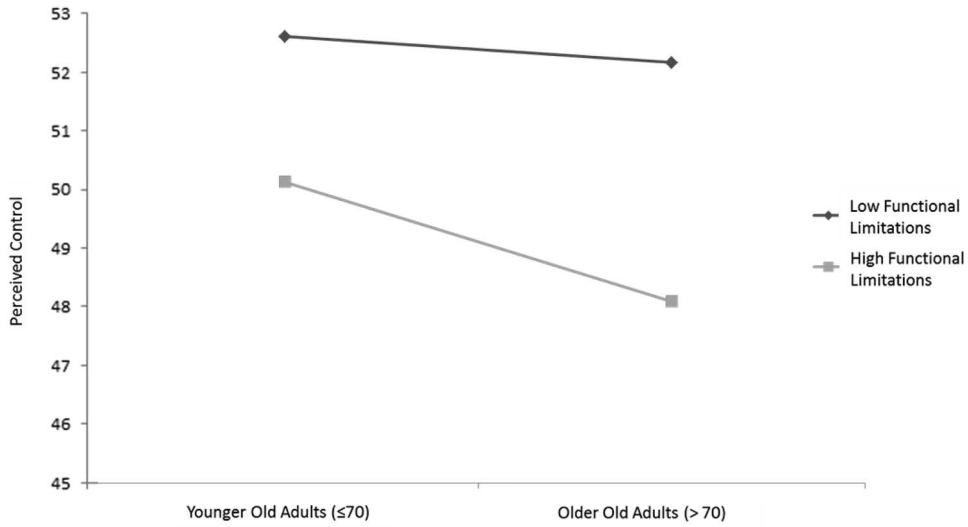

Figure 3. Illustration of the age by functional limitations interaction in predicting perceived control. The difference in perceived control between those high versus low in functional limitations (median-split) is more among those aged 71 and older than among those aged 70 and younger.

indicators such as income or wealth.[2] To illustrate, with respect to the above example regarding the transition into retirement, the loss of financial resources can be considered a crucial factor that is associated with changes in perceived control. Such changes would presumably be relatively independent of one's level of education, but might, however, be buffered by higher wealth accumulated across the life course. An interesting find was that neither being in a relationship nor having children was associated with perceptions of control. We can only speculate about reasons for this. One reason would be that individuals who do not have their own family develop social networks of friends that take on the social support functions other individuals received from their family members. Another reason for the lack of effect of having a spouse or child could be that these two variables represent more descriptive indicators of social embedding and do not allow making conclusions about the quality of those relationships. To illustrate, one could be in a relationship and have children, but still feel a lack of social support, which in turn might undermine perceptions of control. It is upon future research to empirically address this post hoc speculation.

The Role of Physical Health

In the current study, we have been in the rare position to compare the shared and unique associations of a multitude of physical health and social integration factors. To begin with, health problems are known to become more frequent as people get older (Baltes & Smith, 2003), thereby reducing the opportunities people may have to exercise control. In line with this argument, our results that self-reported comorbidity and functional limitations in activities of daily living were both found to be associated with substantially lower perceived control highlight the relevance of health (Lachman & Firth, 2004; Rodin, 1986; Seeman et al., 1999). Being in poor health and suffering from functional limitations may both undermine control-relevant resources (Bandura, 1997; Cairney et al., 2007; Wurm et al., 2007). Functional limitations compromise an individual's ability to successfully interact with his or her environment, leading to long-term decreases in perceived control. In addition to these functional aspects, being diagnosed with one or more chronic conditions might alter an individual's self-concept in a way that undermines perceived control. Specifically, seeing oneself as a "sick person" might be associated with decreases in control that are relatively independent of the actual physical limitations resulting from a specific disease.

The Role of Social Integration

In line with conceptual notions (Antonucci, 2001; Bandura, 1997; Rook, 2015) and empirical support (Fiori, Smith, & Antonucci, 2007; Lang & Carstensen, 2002) our results suggest that various different aspects of social integration, including being engaged in voluntary work, and feeling less lonely are each uniquely associated with perceived control. To begin with, volunteering has been shown to be a form of interpersonal exchange (Siegrist, von dem Knesebeck, & Pollack, 2004) that is relevant for outcomes of successful and healthy aging (Carlson, Seeman, & Fried, 2000), such as well-being (Wahrendorf et al., 2006). Being engaged in voluntary work might affect perceived control through similar routes. In addition and most importantly, voluntary work might enhance someone's control beliefs by providing the opportunity to exert control and positively influence one's (social) environment.

Loneliness emerged as one of the strongest predictors of lower levels of perceived control. This is in line with theoretical conceptions of loneliness in which the experience of loneliness is defined as the extent to which an individual can exercise control over social relationships to achieve a desired level of support and contact (Perlman & Peplau, 1981). Associations

[2] In follow-up analyses, we additionally covaried for household income as an indicator for socioeconomic status. The effects of household income were substantively identical to those reported in the main text.

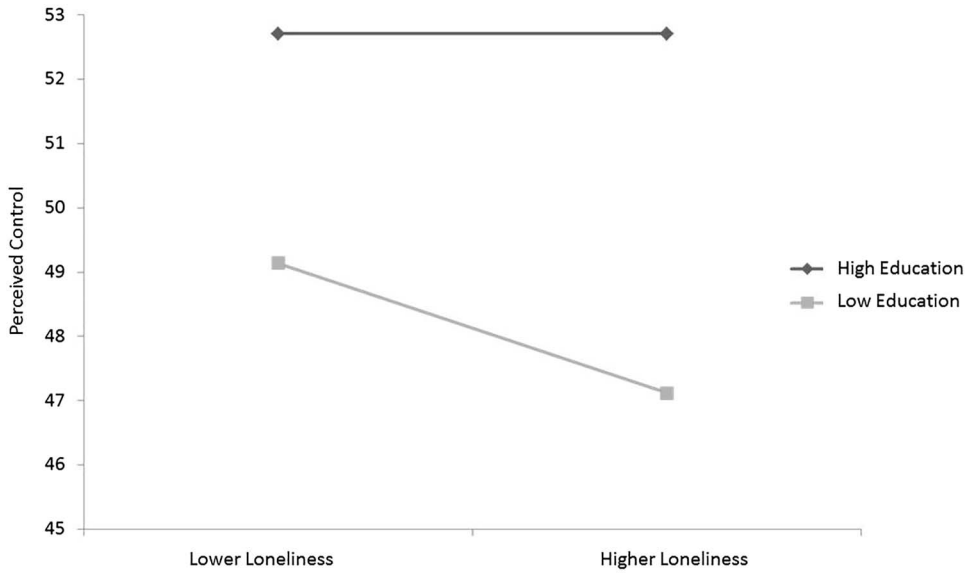

Figure 4. Illustration of the education by loneliness interaction in predicting perceived control. Perceived control was particularly compromised for those who felt lonely combined with being less educate (each based on median-splits).

between perceived control and loneliness became weaker with higher education, which is in line with previous research suggestion that education functions as a resource buffering the effect of loneliness on numerous psychosocial and physical outcomes (Masi et al., 2011). It was a bit of a surprise to see that associations between loneliness and perceived control became weaker over time. Conceptual work suggests that when being confronted with health losses, older adults increasingly focus on more controllable sources such as social integration (Heckhausen et al., 2010). As a consequence, we had expected that associations between perceived control and social factors become stronger in older age. We can only speculate about potential reasons. It is possible that older adults expect to be more likely to experience loneliness because of age-normative changes in the network and support structures and, therefore, show weaker associations between loneliness and perceived control. Additionally, with increasing age social networks become smaller (Wrzus, Hänel, Wagner, & Neyer, 2013). Thus, there might simply be less social contact available. As a consequence it could be functional to disentangle association between loneliness and perceived control.

In contrast to our expectations, perceiving more social support was associated with lower levels of perceived control. Follow-up analyses that did not include any of the other social predictors revealed that the sign of the parameter estimate for social support was in the expected direction, suggesting that perceiving more support was—at the zero-order level—associated with more perceived control. It was only after all other health and social predictors were taken into account that the negative association emerged. We thus need to be careful when interpreting the effect. However, this seemingly counterintuitive finding is in line with research on social support and perceived control (Krause, 1987), indicating that social support operates as a resource at moderate levels, but at high levels social support indicate a high state of need and thus erode perceptions of control. Additionally, it is also possible that perceiving more social support also translates to providing more social support to network members who provide support to the respondent. It is plausible that these exchanges of support may also undermine respondents own perceived control. The finding is also in line with research on social control, according to which interpersonal interactions that involve influencing and constraining the behaviors of another person through strategies like verbal persuasion and social pressure as well as unwanted help may undermine people's perceived control (Lewis & Butterfield, 2007; Newsom et al., 2005; Uchino, 2009). For example, providing support by exercising control over another person's behavior (e.g., eating habits) does not necessarily need to be perceived as positive (e.g., encouraging; Warner et al., 2011). Independent corroboration of this finding is warranted before more firm conclusion can be drawn.

Research linking perceived control and social support has demonstrated that emotional support and social integration rather than instrumental forms of support are associated with maintaining a sense of control and self-efficacy (Krause, 1987; McAvay et al., 1996). Our findings add to this picture by showing that various aspects of social support are differentially associated with perceived control. This has several conceptual and practical consequences. For example, interventions aimed at increasing perceived control by targeting social support need to consider that not only the sheer size of one's social network, but especially the individual perception of social embeddedness is of great importance. Thus, increasing network size alone will not necessarily lead to greater perceived social support and reduced loneliness and, as a result, be related to greater perceived control. Instead, interventions should also aim at improving people's awareness for and use of social resources.

Limitation and Outlook

Among the strengths of our study is that perceived control was tracked over an up to 15-year period in a nation sample covering large parts of adulthood from midlife to very old age. At the same time, several limitations with respect to measures, design and sample of our study are noteworthy.

First, with respect to measures, we note that our measure of perceived control is not the most widely used measure of this construct. However, the Hope scale has been operationalized and validated as a measure of perceived control in numerous previous studies (e.g., Schöllgen et al., 2011; Wurm et al., 2007) and shows sufficient overlap with other related measures of perceived control (e.g., Curtis et al., 2016). Second, as with most large sample studies all measurements were based on self-report. For perceived control, a subjective evaluation of one's perceived control, self-reports seemed to be the measurement of choice. However, even though self-report measures have been shown to be highly reliable (Katz et al., 1996), it would be instrumental to make use of more objective measures of social support and health. To illustrate, self-report measures of health (e.g., functional limitations) could be biased by systematically different standards of health or different reference groups (Dowd & Todd, 2011). With only moderate overlap among subjective and objective indices (Steinhagen-Thiessen & Borchelt, 1999), objective measures (e.g., number of medical diagnoses, biomarker of health) could provide further insights. Likewise, our selection of social support indicators does not allow covering all aspects of social integration. For instance, our measure of social support reflects a number of people one can ask for advice. Even though this question encompasses an evaluation of the quality of the support giver, it does not capture an evaluative component of the quality of the actual support received. Furthermore, our measure of network size represents only one of many possible measures of network size. To illustrate, children as well as household members were listed under separate headers as network size and are therefore not necessarily included into our measure of network size. Thus, network size might represent a lower limit of the actual number of personally important network member. Therefore, future studies should further disentangle the role of subdomains of social integration. Additionally, it would be informative to examine other factors that may be expected to shape perceived control in the second half of life. We note that our selection of indicators was restricted by the availability of measurement included in the DEAS. Including further and more detailed and objective indicators of social support (e.g., geographic proximity of network partners, number of positive interactions) and health (e.g., physician ratings of health status) would have provided additional insights. Furthermore, we used all-cause mortality status as a proxy for mortality-related changes. However, it has been shown that causes of death shape trajectories at the end of life (Lunney et al., 2003). For example, dying of a chronic severe disease (e.g., cancer, neurodegenerative, or respiratory diseases) might be associated with control beliefs differently than dying a sudden and rather unexpected death (e.g., stroke, heart attack; MacDonald, Hultsch, & Dixon, 2011). Thus, we advise future research to further explore the differential role of causes of death in perceived control trajectories. In a similar vein, because of the sample restrictions, we were only able to include mortality status as a correlate in our model. We note, however, that it would be informative to model control trajectories over a different time metric (time-to-death) to further investigate if perceived control in late life are more or less prone to be shaped by mortality related mechanisms.

Second, with respect to the design of our study, independent from the longitudinal character of our data, we cannot draw causal inferences about association between prime predictors and perceived control. The main goal of our study was to describe perceived control trajectories in the second half of life and to elucidate the distinct role of different predictors that contribute to those changes. However, further studies investigating causal, process-oriented mechanisms of time-, mortality-, and age-related changes in perceived control are needed to further address pathways of how control, health, or social support mediate the effects noted here. It would have also been highly instructive to examine the role of stability and change in physical health and social integration. For example, it is possible that people who become more and more lonely also experience declines in perceived control, regardless of whether the size of their social network is indeed small or diminishing. However, when we attempted to take into account changes in physical health and social support in the data at hand, the stability and robustness of our models were compromised, presumably because we have too few data points for estimating multiple within-person changes simultaneously.

Third, with respect to the sample of the study, we examined linear patterns of change in perceived control in the second half of life over up to15 years with four assessments. Contrary to other empirical studies, we did not find stability of perceived control with age. These results could indicate that perceived control declines over time and that the available time metric was suited to examine time -related changes in perceived control (Gerstorf et al., 2013). However, more closely spaced assessments might allow for a wider variety of change models (e.g., nonlinear trajectories) and better opportunity to examine the interplay between control, social support and health, to identify time-varying predictors and to examine time-varying effects (Gerstorf, Hoppmann, & Ram, 2014; Nesselroade, 1991). For example, it is possible that a 1-month spacing of measurement occasions over a longer timeframe would have revealed different results. Additionally, linking short-term fluctuations of perceived control with long term trajectories could provide further insights. Future research should investigate how short term fluctuations and long term trajectories of perceived control are linked to each other. Finally, we acknowledge that our results may not generalize to less positively selected population segments of older adults. For example, examining a positively select subgroup such as the current sample probably underestimates the true amount of decline in the general population. It is upon future research to empirically test if such differences in mean-levels are also accompanied by differences in the covariance structure. To illustrate, it is possible that the more physical health is compromised, the stronger its undermining effects on perceived control.

Conclusions

In summary, our study revealed further insight into trajectories of perceived control in the second half of life. We have illustrated that perceived control shows moderate decline over a course of 15 years. At the same time, our results highlight the importance of

age, mortality, educational, health, and psychosocial resources for the stability of perceived control. However, intraindividual change and interindividual differences were accounted for by the various domain indicators examined only to some moderate extent, with much variability remaining to be explained. Therefore, to better understand developmental processes in late life functioning, future research needs to further explore factors that could contribute to trajectories of perceived control in the second half of life.

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Appendix

Examples of Studies Investigating Age-Related Changes in Perceived Control

Study	Journal	Waves	*N*	Age range	Measure of control	Control variables	Category
			Cross-sectional studies				
Mirowsky, 1995 (U.S. Survey of Work, Family, and Well-Being)	*Social Psychology Quarterly*	1	2,831	18–90	Sense of control scale (Mirowsky & Ross, 1991)	Gender, education; household income; physical impairment	−
Pearlin, Nguyen, Schieman, and Milkie (2007)	*Journal of Health and Social Behavior*	1	1,162	64–100	Mastery scale (Pearlin & Schooler, 1978)	Age; gender; education; ethnicity; occupational prestige; wealth; stressors at earlier points of the life course	−
(Lachman, 1986)	*Psychology and Aging*	1	126 99 85	64–91 60–87 60–89	Domain-generalized and domain-specific locus of control scale (Levenson, 1974)	Health; intelligence	+
Shaw and Krause (2001; Americans' Changing Lives Study)	*The Journal of Gerontology*	1	3,617	25–96	Locus of control scale (Rotter, 1966)	Education; income; ethnicity; chronic conditions; cognitive impairment; social support; religiosity	−
Agrigoroaei, Neupert, and Lachman (2013)	*The Journal of Gerontopsychology and Geriatric Psychiatry*	1	56	18–88	Locus of control scale (Rotter, 1966)	Working memory; anxiety; distraction	+
Schieman (2001; General Social Survey)	*Research on Aging*	1	1,421	18–89	Sense of control scale (Mirowsky & Ross, 1991)	Demographic variables; personal and social characteristics	+
Turiano et al. (2014; Midlife in the United States)	*Journal of Health Psychology*	1	6,135	25–75	Mastery scale (Pearlin & Schooler, 1978)	Demographic variables; parental education; participants' education; general health measures; healthy related behaviors; depressed affect; mortality	+
			Longitudinal studies				
Infurna, Gerstorf, and Zarit (2013; Caregiver Stress and Coping Study)	*The Journal of Gerontology*	6	271	30–88	Mastery scale (Pearlin & Schooler, 1978)	Gender; education; ethnicity; functional limitations; depression; emotional support; family tension; years of caregiving, care recipient characteristics	−
Gatz and Karel (1993; Longitudinal Study of Generations)	*International Journal of Behavioral Development*	4	1,827	54–90 31–53 15–30	Locus of control scale (Rotter, 1966)	Gender; education; self-rated health; role ideology	+
Specht, Egloff, and Schmukle (2013; German Socioecomonic Panel)	*Developmental Psychology*	2	9,484	16–76	SOEP Measure	Gender; education; income; health	−

(*Appendix continues*)

Appendix (*continued*)

Study	Journal	Waves	*N*	Age range	Measure of control	Control variables	Category
Infurna, Ram, and Gerstorf (2012; Americans' Changing Lives Study)	*Developmental Psychology*	4	2,840	28–99	Mastery scale (Pearlin & Schooler, 1978)	Age; gender; education, ethnicity; life satisfaction; depression; physical activity; emotional support; self-rated health; functional limitations; health conditions	−
Mirowsky and Ross (2007; Aging, Status, and the Sense of Control)	*American Journal of Sociology*	3	2,592	18–59	Sense of control scale (Mirowsky & Ross, 1991)	Age; gender; education; parental education	−
Wolinsky et al. (2003; Longitudinal Study of Health-related Quality of Life)	*The Journal of Gerontology*	7	1,662	45–85	Sense of control scale (Mirowsky & Ross, 1991)	Gender; education; socioeconomic status; employment status; income; race; health; stress; social support; religion	−
Eizenman, Nesselroade, Featherman, and Rowe (1997; The MacArthur Successful Aging Studies)	*Psychology and Aging*	25	57	N/A	Mastery scale (Pearlin & Schooler, 1978); desired control scale (Reid & Ziegler, 1981)	N/A	+ −
Ross and Mirowsky (2002; Aging, Status and the Sense of Control)	*Social Psychology Quarterly*	2	2,592	18–95	Sense of control scale (Mirowsky & Ross, 1991)	Education, employment (history), fulfilling work; household income, fairness of division of household labor; living alone; economic headship, self-rated health; functional limitations	−
McAvay, Seeman, and Rodin (1996)	*The Journal of Gerontology*	9	264	62–90	Domain specific self-efficacy	Age; gender; education; baseline and change in medical conditions, emotional, and instrumental social support	+ −
Vargas Lascano, Galambos, Krahn, and Lachman (2015; Edmonton Transitions Study)	*Developmental Psychology*	7	971	16	Mastery scale (Pearlin & Schooler, 1978)	Gender; education; parents' education	+
Lachman, Rosnick, and Röcke (2009; Midlife in the United States)	*Aging and Cognition*	2	7,120	24–75	Mastery scale (Pearlin & Schooler, 1978)	Number of chronic conditions; frequency of physical problems; social support; cognition; personality	+ −
Gerstorf, Ram, Lindenberger, and Smith (2013; Berlin Aging Study)	*Developmental Psychology*	7	439	70–103	Locus of control scale (Levenson, 1974)	Age at death; gender; socioeconomic status comorbidities; disability; suspected dementia	+ −

Note. Categories are: − = lower perceived control among older adults relative to younger adults and/or age-related decline; + = higher perceived control among older adults relative to younger adults and/or age-related increase; + − = curvilinear pattern of initial age-related increase in perceived control followed by later age-related decline; N/A = not available.

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