

Antecedent–Consequent Relations of Perceived Control to Health and Social Support: Longitudinal Evidence for Between-Domain Associations Across Adulthood

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Objectives. To examine antecedent–consequent relations of perceived control to health and social support across adulthood and old age.

Methods. We applied (multigroup) change score models to two waves of data collected 9 years apart from 6,210 participants of the Midlife in the United States survey (MIDUS, 24–75 years at baseline). We used composite measures of perceived control (personal mastery and constraints), health (chronic conditions, acute conditions, and functional limitations), and social support (support and strain associated with spouse/partner, family, and friends).

Results. Analyses revealed evidence for direct and independent multidirectional accounts. Greater initial control predicted weaker declines in health and stronger increases in support. In turn, increases in control were predicted by better initial health and more support. Changes in control were also accompanied by concurrent changes in the other two domains, and relations involving control were larger in size than those between health and support. We found only small sociodemographic differences across age, gender, and education group.

Discussion. We conclude that perceiving control may serve as both a precursor and an outcome of health and social support across the adult age range and suggest routes for further inquiry.

Key Words: Biopsychosocial factors—Differential aging—Longitudinal—Midlife in the United States Survey—Successful aging.

LIFE-SPAN psychological research has long been interested in structural relations among intraindividual changes within and between domains of functioning (Baltes & Nesselroade, 1979; Magnusson & Cairns, 1996). Our study explores the developmental ordering of three central components of successful aging, namely indicators of perceived control, health, and social support. An extensive body of research has demonstrated that perceived control shows moderately strong cross-sectional relations with levels of health and social support (Krause, 2007; Lachman & Weaver, 1998; Rodin, 1986). Relatively little is known, however, about possible antecedent–consequent relations between levels of functioning and subsequent changes across the three domains. To examine the nature and correlates of such relations, we apply change score (CS) models to 9-year longitudinal data from two occasions of the national Midlife in the United States survey (MIDUS). Specifically, we (a) empirically compare competing unidirectional and multidirectional accounts of across-domain associations and (b) explore if and how changes in one domain are accompanied by changes in another domain and whether the strength of these relations differs with age, gender, and education.

Antecedent–Consequent Relations of Perceived Control to Health and Social Support

Perceptions of control refer to beliefs about one's capability to bring about a given outcome (Lachman & Weaver, 1998; Levenson, 1981; Skinner, 1995). Such feelings of autonomy and self-determination are generally considered to be essential constituents of successful aging and show considerable associations with indicators of adaptation (Baltes & Baltes, 1990; Lachman, Neupert, & Agrigoroaei, in press; Rowe & Kahn, 1997; Ryff & Singer, 1998). For example, it is well established that perceived control shows sizeable cross-sectional associations with various health measures, including better physical and mental health, and a longer life (Krause & Shaw, 2003; Kunzmann, Little, & Smith, 2002; Taylor, Helgeson, Reed, & Skokan, 1991). Similarly, various forms of social support (e.g., caring for and appreciating the other, empathy, providing help) have been linked to perceived control (Antonucci, 2001; Cohen & Wills, 1985). However, the directionality and developmental sequences of such associations are less well understood and have rarely been empirically examined, particularly when developmental changes across the three domains are considered conjointly. We draw from Lachman's (2006) integrative

conceptual model and consider control beliefs to be both an antecedent and an outcome of adaptation in the health and social domains (see also Skaff, 2007; Uchino, 2006).

In this model, preserved control beliefs or a lack thereof are expected to have profound motivational and behavioral consequences (e.g., engagement and persistence in activities, particularly in the face of difficulties) that in the long run either restrain or help to exploit an individual's resources. Perceived control thus acts as an antecedent condition that fosters health or social support. Specifically, individuals who report greater control beliefs are often more inclined to adopt and continue with health maintenance behaviors, such as exercise and preventive care (Rodin, 1986; Seeman, Unger, McAvay, & Mendes de Leon, 1999). Sense of control may also be an important factor in how well people manage to actively seek out, mobilize, and handle the availability of social support (Lang, Featherman, & Nesselroade, 1997). For example, despite plausible expectations that those in need will receive most support, individuals with a strong sense of control are more likely to attract sources of support than those who convey a helpless outlook (Pearlin & Schooler, 1978).

In turn, the Lachman and colleagues (1997) model also posits that control beliefs constitute an outcome of resources in the health and social domains. In particular, people in better health may perceive themselves to have the means for achieving desired outcomes, whereas aspects of poor health such as chronic conditions or functional limitations may destabilize feelings of control (Cairney, Corna, Wade, & Streiner, 2007; Wurm, Tesch-Römer, & Tomasik, 2007). Similarly, supportive social experiences and exchanges have been proposed to constitute major sources for perceptions of control (see also Antonucci & Jackson, 1987; Bandura, 1977; Deci & Ryan, 1995). Features of social support that may foster a sense of control include encouraging mastery attempts, providing supportive performance feedback, and suggesting appropriate coping responses in times of strain. However, the empirical evidence in both domains is rather inconclusive, primarily because many studies are based on cross-sectional data that preclude inferences regarding the temporal sequence (for discussion, see Martire, Stephens, & Townsend, 1998). Longitudinal findings are also mixed, with some studies reporting predictive effects of health or support for perceived control, whereas other studies do not (e.g., Krause, 1987; McAvay, Seeman, & Rodin, 1996; Skaff, Pearlin, & Mullan, 1996). Our conceptual premise in this study is that perceived control serves both antecedent and consequent functions for adaptation in the health and social domains.

The nature and correlates of multidirectional across-domain associations

A key feature of the Lachman's (2006) model and other models (Skaff, 2007; Uchino, 2006) is the embedded and

interdependent nature of across-domain changes. Though directional inferences cannot be drawn from concurrent changes, highly valuable insights can be gained from examining if change in one domain in the system is accompanied by change in another domain (Seeman & Lewis, 1995). For example, decrements in perceived control might undermine the pursuit of health maintenance behaviors, thereby resulting in declining health, which in the long run may lead to cascades of further reductions in control beliefs. In a similar vein, control beliefs are often considered one mechanism underlying well-known relations between facets of social support and health (Antonucci, 2001; Berkman, Glass, Brissette, & Seeman, 2000; Biscotti & Bergeman, 1999). We thus expect the size of support-health relations to be reduced when all three domains are considered simultaneously.

Conceptual and empirical work alike also suggests that multidomain associations may be moderated by third variables, such as age (Lachman, 2006; Mirowsky, 1995). Health problems typically occur more often and are more serious in old age relative to young and mid adulthood (Aldwin, Spiro, & Park, 2006). Such health decrements in available resources of strength and vitality can be expected to undermine and exert limitations on older adults' control efforts (Rodin, 1986). In a similar vein, a compromised health system may be particularly vulnerable to the detrimental effects of lack of control. Both arguments suggest stronger control-health associations in old age than in earlier phases of life. Also, one of the prime reasons why perceived control typically shows only minor decrements in old age may be because older adults increasingly attempt to derive their sense of control from more controllable and attainable sources, such as one's social network (Heckhausen, Wrosch, & Schulz, 2010). This also suggests more pronounced control-social associations in old age than in earlier phases of life. We will additionally explore if across-domain associations differ by gender and education. Specifically, women typically report more health problems (Moen, 1996) and are often more active in social networks (Antonucci & Akiyama, 1987). It thus appears conceivable that these domains are more tightly connected to perceived control among women relative to men. Finally, cross-sectional reports indicate that perceived control buffers the negative health effects of low socioeconomic status (SES; Lachman & Weaver, 1998). Such across-domain associations may thus be stronger for low-SES in contrast to high-SES groups.

The present study

We extend and qualify earlier insights into the nature and implications of antecedent-consequent relations of perceived control to health and social support across adulthood. We go beyond previous reports by examining all three domains conjointly and by targeting across-domain

relations in a longitudinal context. To do so, we applied CS models to two-wave 9-year MIDUS data ($N = 6,210$; 24–75 years at baseline) to address two sets of questions. First, considering initial level of perceived control as an antecedent, we determined its predictive role for levels and changes in health and social support. Targeting change in perceived control as an outcome, we simultaneously examined the predictive role of previous levels of health and social support. Based on our guiding conceptual framework (Lachman, 2006), we expected multidirectional associations in that perceived control would uniquely predict subsequent changes in health and support and that initial health and support in turn independently would predict changes in control. In a second step, we explored if change in one domain was accompanied by changes in other domains and if differential across-domain associations emerged in age, gender, and education subgroups.

METHODS

We used two-wave 9-year data from the national MIDUS survey conducted in 1995–1996 (T1) and 2004–2006 (T2). Detailed descriptions of the study are published in Brim, Ryff, and Kessler (2004) and Lachman and Weaver (1998). A brief overview is given subsequently.

Participants and Procedure

To recruit MIDUS participants, a national sample of households in the 48 contiguous states with at least one telephone was selected using random digit dialing. The core sample of 7,120 noninstitutionalized adults was stratified by gender and age with the greatest number between 40 and 60 years. Participants were interviewed for 20–30 min by telephone (70% response rate) and then received a questionnaire in the mail containing the measures used in this study. An average of nine years (range of 8–10 years) later, 75% of survivors from the original sample agreed to participate. We included all participants with valid data on the three target domains (control, health, and support) at the first occasion, resulting in a sample of 6,210 participants. Of those, 62% provided data for the second wave. Relative to the remaining participants, those who contributed longitudinal data were older, $M = 47.33$, $SD = 12.41$ vs. $M = 45.24$, $SD = 13.62$; $F(1, 7,018) = 45.24$, included more women, 55% vs. 47%; $\chi^2(1, N = 7,070) = 47.20$, and more people with 3 years of college or more, 48% vs. 36%; $\chi^2(1, N = 7,120) = 100.4$, all p 's < .01. Using T -standardized scores (for details, see below), we also found that longitudinal participants reported at baseline slightly more control, $M = 50.36$, $SD = 9.72$ vs. $M = 49.41$, $SD = 10.42$; $F(1, 6,208) = 13.42$; $R^2 = .002$, better health, $M = 50.47$, $SD = 9.48$ vs. $M = 49.21$, $SD = 10.76$; $F(1, 6,208) = 23.17$; $R^2 = .004$, and more support, $M = 50.48$, $SD = 9.60$ vs. $M = 49.22$, $SD = 10.59$; $F(1, 6,208) = 23.24$; $R^2 = .004$, all p 's < .01.

Measures

Perceived control was measured using a unit-weighted composite of four items assessing personal mastery and eight items assessing perceived constraints (for details, see Lachman & Firth, 2004). Participants were asked to indicate the extent to which they agreed with each of the items (e.g., “What happens to me in the future mostly depends on me.”), using a 7-point scale (1 = “strongly agree” and 7 = “strongly disagree”). Mastery items were reverse coded, so that higher scores reflect perceiving more control ($\alpha \geq .85$ at both occasions).

Health was measured using a composite of chronic health conditions, acute conditions, and the number of functional limitations. Chronic conditions were self-reports of the number of chronic medical conditions from a comprehensive list of 29 health conditions (e.g., asthma, thyroid disease, migraine headaches, ulcer, hay fever, and stroke) participants had experienced or been treated for in the past twelve months. For acute conditions, participants rated how often they experienced each of nine physical symptoms during the past thirty days (e.g., lower backaches, trouble getting to sleep or staying asleep, and sweating a lot). Functional limitations represent the sum across items asking whether respondents had experienced any limitations in carrying out eight (instrumental) activities of daily living (e.g., bathing; climbing; walking). To compute a comprehensive measure of multiple aspects of health, standardized means across the three variables were aggregated and reverse coded, with higher scores reflecting better health ($\alpha \geq .71$ at both occasions; for details, see Röcke & Lachman, 2008).

Social support was assessed with 24 items, 8 of which asked about the social support and social strain (but not dependency) associated with each of three sources, spouse/partner, family, and friends. Participants were asked to answer each item (e.g., “How much does your partner appreciate you?”, “How often does your partner criticize you?”) using a 4-point scale (1 = “a lot” and 4 = “not at all”). Support items were reverse coded, so that higher scores reflect stronger support ($\alpha \geq .85$ at both occasions; for details, see Walen & Lachman, 2000).

To examine whether the strengths of across-domain associations differed by sociodemographic strata of age, gender, and education, we opted for a statistically thorough, yet straightforward and parsimonious multigroup approach. To ensure sufficiently large group sizes, we used cutoffs at age 60 at the first occasion (young and middle aged: $N = 4,967$ vs. old age: $N = 1,243$) and 3 or more years of college (less education: $N = 3,464$ vs. more education: $N = 2,746$), respectively, to contrast groups of different age and education. We note that determining the cutoff points for dividing the adult life span into distinct age periods is always somewhat arbitrary. Because of continuous demographic shifts in work life and general life expectancies in industrialized countries, precise transition ages are difficult to define. In

Table 1. Descriptive Statistics and Intercorrelations for the Variables Under Study

Variables	<i>N</i>	<i>M</i>	<i>SD</i>	Intercorrelation									
				T1			9 years later						
				1	2	3	4	5	6				
Level													
1. Perceived control T1	6,210	50.00	10.00	.37	.38	.59	.30	.31					
2. Health T1	6,210	50.00	10.00		.23	.30	.70	.19					
3. Social support T1	6,210	50.00	10.00			.30	.16	.61					
Nine years later													
4. Perceived control T2	3,852	50.28	9.76				.36	.41					
5. Health T2	3,875	46.42	10.44					.18					
6. Social support T2	3,863	52.03	9.67										
Correlates													
<i>n</i> (%) aged 60+	1,243	(20)											
<i>n</i> (%) women	3,261	(53)											
<i>n</i> (%) highly educated	2,746	(44)											

Notes: Means and standard deviations in *T* scores. Highly educated persons had 3 or more years of college. All correlations significant at $p < .001$.

our analyses, we follow earlier approaches using age 60 years as approximating the end of midlife and the start of young old age (for discussion, see Lachman & Firth, 2004). The approach also provided the benefit of obtaining two subsamples with reasonably large size. We also carried out follow-up analyses that used different split ups of the groups (i.e., ages 55, 65, and 70 years as the cutoff) and found the same substantive pattern of results as reported in the text.

Data Preparation and Statistical Procedure

To ensure a common metric across variables, measures were standardized to a *T* metric ($M = 50$; $SD = 10$ at baseline). Intercorrelations and descriptive information for our measures are presented in Table 1. For example, across-domain correlations were sizeable both between baseline levels (e.g., $r_{\text{control.T1} - \text{health.T1}} = .37$) and between levels at baseline and nine years later (e.g., $r_{\text{control.T1} - \text{health.T2}} = .30$). We also note mean-level changes, which we corroborated by separate analyses of variance with two repeated measures (T1 and T2). Largely consistent with extant reports (Aldwin et al., 2006; Mirowsky, 1995; Shaw, Krause, Liang, & Bennett, 2007), our analyses revealed average stability in perceived control ($p > .10$) as well as average declines in health, $F(1, 3,847) = 1,027.97$, $p < .01$, partial $\eta^2 = .211$, and average increases in social support, $F(1, 3,847) = 122.90$, $p < .01$, partial $\eta^2 = .031$. Our focus, however, was not on these prototypical two-wave changes over a 9-year period but on examining between-person differences in across-domain associations. We targeted this objective using a contemporary technique in developmental inquiry, CS models (see McArdle, 2009; McArdle & Nesselroade, 1994).

In CS models, the effect of variable *X* at T1 (X_{T1}) on variable *X* at T2 (X_{T2}) is constrained to a value of 1. As a consequence, some part of X_{T2} is exactly identical to X_{T1} , and the residual portion ΔX is explicitly parameterized and directly

interpretable as the raw change score. Importantly, this change score is unobserved but as a latent variable directly related to the observation (Bollen, 2002). We generated a change score independent of initial level by regressing latent change ΔX on initial level X_{T1} . To address our research questions, we estimate a conjoint change score model of the three domains and inspect the direction and size of two sets of parameters. For the first question, we consider the simultaneously estimated regression weights that each factor at T1 has on the latent changes. These signify the predictive and reciprocal associations between control beliefs, health, and social support at baseline and two-wave change. For the second question, the change scores are allowed to correlate so as to represent across-domain correlations between concurrent changes. We also used statistically nested model comparisons and the resulting loss in overall model fit (as indexed by the χ^2 difference per *df*) to evaluate whether or not the size of a given parameter estimate differs between sociodemographic groups. Models were fit to the data using *Mplus* (Muthén & Muthén, 1998–2006). We applied full information maximum likelihood estimation algorithms to all data points available, which allowed treating incomplete data as missing at random (Little & Rubin, 1987).

RESULTS

Antecedent–Consequent Relations of Perceived Control to Health and Social Support

Results are presented in Figure 1. To begin with baseline levels, there was a positive manifold of considerable size between perceiving greater control, better initial health, and more social support (e.g., $\sigma_{\text{control.T1} - \text{health.T1}} = .37$; $\sigma_{\text{health.T1} - \text{social.T1}} = .23$). Most important for our question is the prediction of two-wave change. Greater perceived control at baseline was predictive of less pronounced declines in health ($\beta = .12$) and stronger increases in social support ($\beta = .10$). To illustrate, Figure 2 graphs a scatterplot of perceived control and subsequent health changes and shows that participants who reported a strong sense of control at baseline, on average, were more likely to maintain health or to decline less.

In addition, between-person differences in perceived control changes were uniquely predicted by baseline levels of both health and support. Specifically, increasing perceived control over time was independently predicted by both better initial health ($\beta = .12$) and more initial support ($\beta = .09$). In contrast, there were no across-domain associations between initial levels and subsequent changes in health and support. Results from the CS model thus provide evidence for reciprocal antecedent–consequent relations of perceived control to health and social support. Sense of control was directly and independently predictive of subsequent changes in health and support, and in turn, change in control was predicted by previous levels of health and support. The

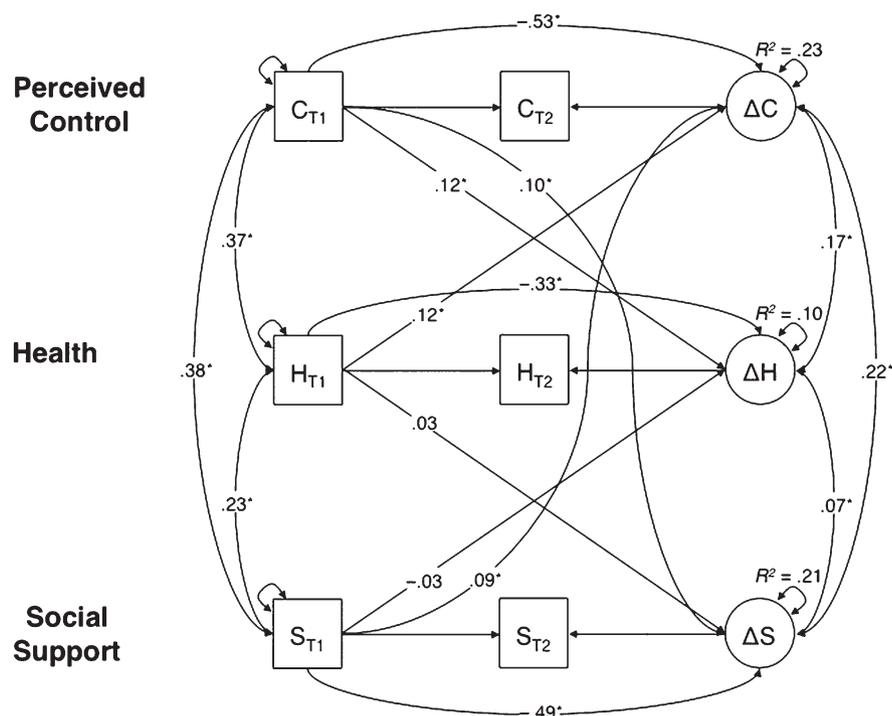


Figure 1. Results from a change score (CS) model as applied to two-wave 9-year longitudinal Midlife in the United States survey data of control beliefs, health, and social support. Means, intercepts, and variances were omitted for clarity. Unlabelled unidirectional paths set to 1.

magnitude of the standardized path coefficients, however, was in the range of small effect sizes.

The Nature and Correlates of Multidirectional Across-Domain Associations

Our second objective was to inspect the correlated changes and examine whether the strengths of associations differed between the sets of domains considered and across sociodemographic groups. To begin with the size of correlated changes reported in Figure 1, one can see positive and sizeable associations of between-person differences in rates of change across domains. Reports of increasing control over time were accompanied by less pronounced declines in health ($\rho = .17$) and stronger increases in support ($\rho = .22$). To illustrate, Figure 3 shows a scatterplot of concurrent changes in perceived control and social support, indicating that participants who experienced increased support over time were, on average, more likely to report more perceived control as well. Both Figures 2 and 3 highlight the tremendous amount of between-person heterogeneity. A small and significant correlation was also found between changes in health and changes in support ($\rho = .07$).

In a final step, we examined if and how across-domain relations differed by age, gender, and education. To do so, we compared a baseline model (estimating all parameters freely in all age, gender, and education groups) in a hierarchical fashion with models that constrained all variances to be equal

across groups, set all covariances and regressions invariant, and estimated all fixed effects to be invariant. Results of these analyses are reported in Table 2. Age comparative analyses revealed highly significant losses of model fit when we fixed the average levels of functioning to be of equal size between young and middle-aged adults versus older adults (Row 5). As one would expect, follow-up analyses indicated that, for example, older adults were on average in poorer health relative to young and middle-aged adults. Most important for our question, setting the size of across-domain associations to be invariant across age groups revealed a small but statistically reliable difference (Row 4). We note, however, that the loss in χ^2 per *df* was considerably weaker than for setting either means or variances to be age invariant. As it turned out, the magnitude of age differences in across-domain associations was indeed relatively small, amounting to less than a 0.1 difference (e.g., $\beta_{\text{control.T1} - \text{social}.\Delta} = .09$ vs. $.07$). Our model comparisons by gender (Rows 6 through 10) revealed gender differences in average levels (e.g., poorer health for women) and variances (e.g., more variability in health among women) but most importantly, no significant loss in model fit when setting across-domain relations invariant across men and women. Analyses of education differences indicated reliable differences in across-domain associations (Rows 11 through 15), but their absolute size was rather minimal, and no single group difference exceeded a 0.1 difference (e.g., $\beta_{\text{control.T1} - \text{social}.\Delta} = .06$ vs. $.11$ in the less well and well-educated groups, respectively).

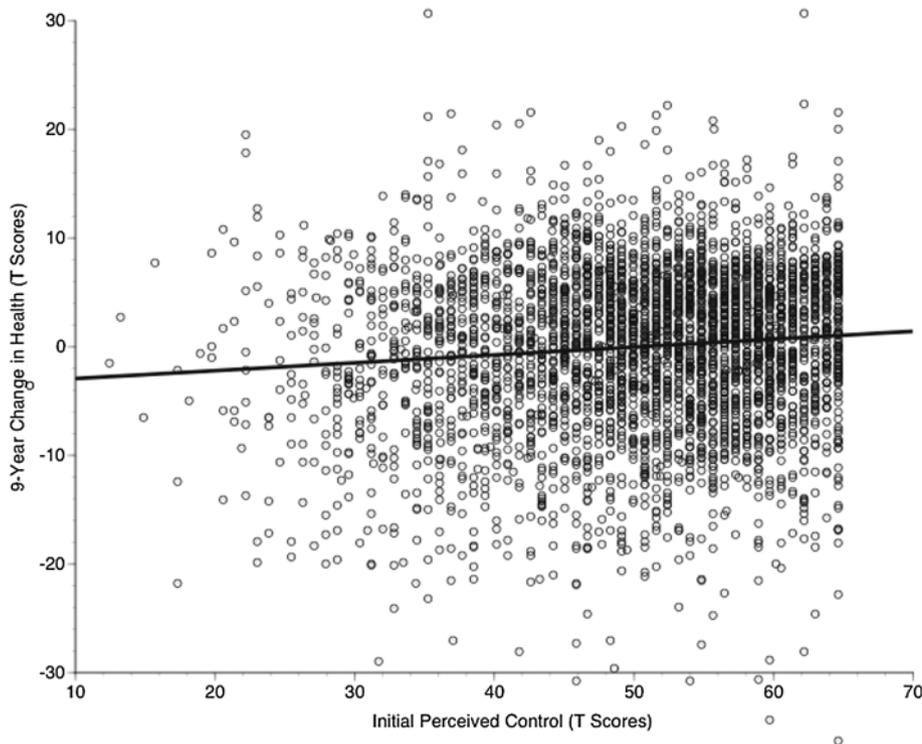


Figure 2. Illustrating associations between initial levels of perceived control and subsequent 9-year changes in health in the two-wave longitudinal Midlife in the United States survey data. The scatterplot illustrates that participants who reported high levels of perceived control at baseline, on average, were more likely to maintain health or to decline less. The figure also highlights the tremendous amount of between-person heterogeneity. Data presented in T scores ($M = 50$ and $SD = 10$).

In sum, we found that changes in control beliefs were accompanied by concurrent changes in the other two domains, and associations involving control were somewhat larger in size than those between health and support. Analyses targeting sociodemographic characteristics indicated statistically significant differences for age and education, but the size of these differences was relatively small, suggesting that change relationships were relatively consistent across subgroups.

DISCUSSION

Our objective was to examine antecedent–consequent relations of perceived control to health and social support across the adult age range. Applying CS models to two-occasion data over 9 years of 6,210 MIDUS participants revealed evidence in line with our guiding conceptual framework that unique and independent multidirectional relations exist (Lachman, 2006). Consistent with the view of an antecedent role of control beliefs, we found that greater initial perceived control independently predicted weaker declines in health and stronger increases in social support. In turn, consistent with the view of a consequent role of control, our analyses revealed that subsequent increases in perceived control were predicted by better initial health and more initial support. Addressing the nature and correlates of

such multidomain associations, we found that changes in control were accompanied by concurrent changes in the other two domains. The strength of these relations differed by age and education, but differences were small in size. We take our results to suggest that perceived control serves as both a precursor and a consequence of health and social support across adulthood and old age, and we highlight routes for further inquiry to thoroughly address questions about developmental ordering.

Antecedent–Consequent Relations of Perceived Control to Health and Social Support

In line with conceptual and empirical work, the present study reports sizeable associations and a positive manifold across domains of perceived control, health, and social support (Antonucci, 2001; Krause & Shaw, 2003). We corroborate and provide empirical evidence for our guiding framework (Lachman, 2006), suggesting that perceived control serves both antecedent and consequent functions. Our findings add to the literature by examining all three domains conjointly and demonstrating that such relations extend beyond the typically reported mean-level associations and generalize to longitudinal change.

To begin with, our results illustrate that perceived control represents an important predictor for key indicators of

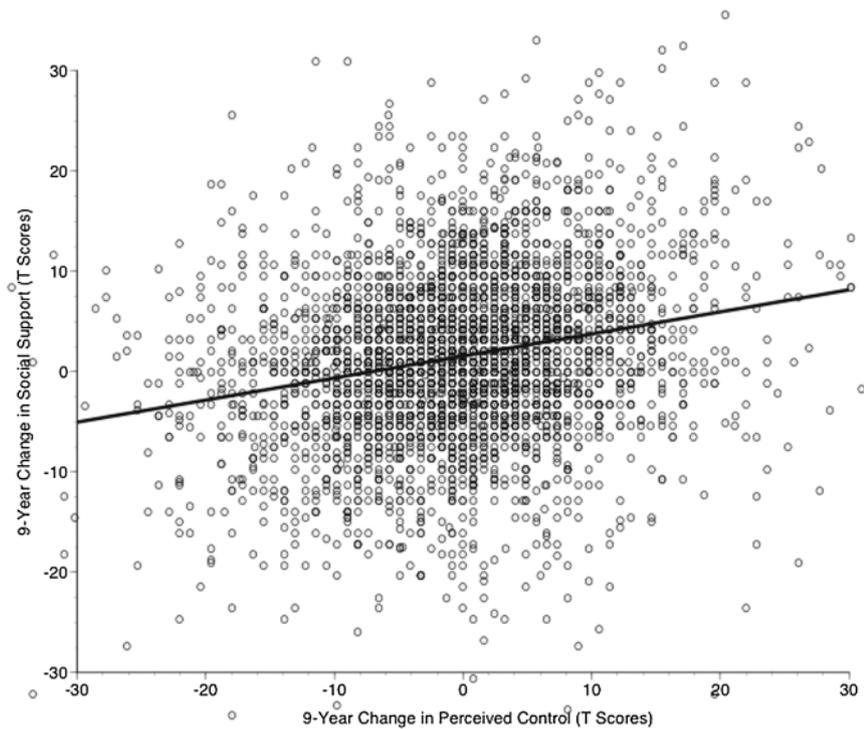


Figure 3. Illustrating associations between 9-year changes in perceived control and social support in the two-wave longitudinal Midlife in the United States survey data. The scatterplot illustrates that participants who experienced more social support over time were, on average, more likely to report increased perceived control as well. The figure also highlights the tremendous amount of between-person heterogeneity. Data presented in *T* scores ($M = 50$ and $SD = 10$).

adaptation, namely both levels of and long-term changes in health and social support. Our longitudinal findings extend the time frame over which buffering effects of control beliefs against health declines have been reported from 1.5 years in the EPESE (Mendes de Leon, Seeman, Baker, Richardson, & Tinetti, 1996) and 2.5 years in the MacArthur Successful Aging studies (Seeman et al., 1999) to an average of 9 years. Conjointly, these findings are consistent with notions suggesting that a strong sense of control may help people to engage in and maintain health-promoting behaviors (e.g., exercise, preventive care; Rodin, 1986). Our results also endorse and illustrate theories of control (e.g., Heckhausen & Schulz, 1995) according to which control beliefs allow people to mobilize social support, particularly in times of strain.

Considering perceptions of control as a consequence, one important finding was that preserved physical health indeed constitutes a unique source for between-person differences in control. Individuals in good health were not only more likely to feel in control initially but also to report a gain in their sense of control over time. It is conceivable that better health provides more opportunities to experience self-related mastery and thus not only helps maintaining but also building one's sense of personal mastery and control. Similarly important, we found supportive relationships with one's family to have long-term beneficial effects for feelings of control and an increase therein. These findings offer empirical evidence for theoretical accounts proposing that

various forms of social support represent prime sources for feelings of control across the adult age range (Antonucci & Jackson, 1987). For example, support may convey the sense that people can count on someone if needed, which likely nurtures a sense of efficacy and control. Similarly, observing a close network member enacting a certain workout regimen may enhance one's own sense of efficacy to carry out and persist with the regimen (Bandura, 1997). It was beyond the scope and possibilities of our study to explore these and other possible mechanisms, so future studies addressing such pathways are warranted.

The Nature and Correlates of Multidirectional Cross-Domain Associations

Our results about the nature and correlates of multidomain relations correspond with notions that control beliefs are indeed embedded in a complex and pervasive system of reciprocal influences and may play a central role in this context. Of course, a comprehensive empirical test was not possible with two waves of data, but our findings nevertheless provide useful initial insights on which future more mechanism-oriented studies may capitalize and elaborate.

As a first result, we found that changes in feelings of control were accompanied by functionally meaningful changes in the social and health domains. This finding is important in and of itself. It illustrates that a positive cross-domain

Table 2. Statistically Nested Model Comparisons Between Alternative Change Score Models Across Groups of Age, Gender, and Education

Model	Goodness of fit indices				
	χ^2	<i>df</i>	$\Delta\chi^2$ (<i>df</i>)	CFI	RMSEA
Age groups					
Baseline model	0	0	—	1.000	.000
Variances invariant	64.5	6	64.5 (6) ^a	.991	.056
Covariances and regressions invariant	98.9	21	34.4 (15) ^a	.988	.035
Means invariant	747.4	27	648.5 (6) ^a	.891	.093
Gender					
Baseline model	0	0	—	1.000	.000
Variances invariant	135.0	6	135.0 (6) ^a	.980	.083
Covariances and regressions invariant	162.5	21	27.5 (15)	.978	.047
Means invariant	385.2	27	222.7 (6) ^a	.946	.065
Education groups					
Baseline model	0	0	—	1.000	.000
Variances invariant	232.5	6	232.5 (6) ^a	.965	.110
Covariances and regressions invariant	297.4	21	64.9 (15) ^a	.958	.065
Means invariant	652.4	27	355.0 (6) ^a	.904	.086

Notes: In the age group model, young and middle-aged adults (aged 24–59 years at T1; $N = 4,967$) were compared with older adults (aged 60–75 years at T1; $N = 1,243$). In the gender model, men ($N = 2,949$) were compared with women ($N = 3,261$). In the education groups model, persons with lower educational achievement (less than 3 years of college; $N = 3,464$) were compared with persons with higher educational achievement (3 or more years of college; $N = 2,746$). CFI = Comparative Fit Index, RMSEA = Root Mean Square Error of Approximation.

^a Statistically nested model comparisons significant at $p < .01$.

manifold not only exists between levels of functioning but also between age-related changes in those domains. Generally speaking, our results point to the importance of opting for a dynamic and systemic perspective when attempting to better understand level and change in perceptions of control across adulthood. One may argue, for example, that a lack of or declines in perceived availability of social support may threaten personal belief systems about control (e.g., Antonucci & Jackson, 1987; Lang et al., 1997), which in turn may have negative consequences for well-being and health (House, Landis, & Umberson, 1988). A major point implicated in our findings is exactly the apparent need for more research addressing such questions about the developmental ordering and reciprocal dynamics among the various domains involved.

Second, our findings can also be taken to indicate the substantial role the variables included play for determining between-person differences in the three-variable system under consideration. At the same time, we found that associations involving perceived control were reliably different from zero, whereas those between health and social support were not. This result needs replication and extension, but we take this pattern to highlight that a sense of control may play a key role in the well-documented relations between social support and health (for overview, see Berkman et al.,

2000; Rook, 1995). One pivotal next step to illuminate this role would be to extend cross-sectional reports (Bisconti & Bergeman, 1999) and examine if perceived control indeed mediates (fully or partially) longitudinal relations among social support and health. Establishing such effects also has major implications for the refinement of health prevention and intervention programs (e.g., attempting to boost perceptions of control).

Finally, the strength of across-domain relations was found to differ by age and education, but differences were small in size. In essence, the general pattern was very similar with some associations being slightly more pronounced in one group or another. These findings suggest that cross-domain linkages between levels and changes in perceived control, health, and support are largely independent of and pervasive across a broad range of sociodemographic strata. From an intervention perspective, these are promising findings because they highlight that boosting one variable (e.g., control) may also have enhancing implications for the other two variables (e.g., health, support), irrespective of the preceding functional level. In contrast, however, declines in control appear to be foreshadowed by losses in health and support. More work is needed to better understand the possible role of mediating events (e.g., disability, widowhood) and if and how control beliefs can be guarded against the effects of such age-related declines. At the same time, we note several factors in our study that may have contributed to the relative lack of differential associations. To start with, previous work on the importance of sociodemographics has primarily been cross-sectional and focused on level, whereas our study was longitudinal in nature and focused on long-term changes. Similarly, including more process-oriented variables such as social relations as additional predictors in our analyses may have left relatively little variance to be explained by more macro sociodemographic characteristics. We also acknowledge that further in-depth studies targeting potentially important nuances may provide useful qualifications to our results. For example, it appears conceivable that control–health relations are mediated by adopting health-promoting behaviors (Mirowsky & Ross, 1998) that may reveal larger health-beneficial effects among low-SES groups.

Limitations and Outlook

Applying CS models to two-wave data obtained from a national sample across the adult age range provided for a direct operational definition of our research questions and revealed initial insights into reciprocal across-domain associations. However, we note several limitations of our study. With only two waves of data (and modeling manifest variables), CS models are not distinguishable from and reveal the same set of findings as more traditional autoregressive models, which can produce biased results if the variables under scrutiny are differentially reliable and (or) stable over

time (Rogosa, 1980). It is thus imperative to replicate and extend any directional interpretations with more rigorous methodologies (e.g., dynamic modeling tools; McArdle & Hamagami, 2001). We note that these methods typically require data being collected over three or more waves to fully remedy the weaknesses inherent in other approaches (McArdle & Nesselroade, 1994, see Gerstorf, Lövdén, Röcke, Smith, & Lindenberger, 2007).

Another set of limitations revolves around the specificity of our findings. To begin with, we note that the aging individual is not fully described by three variables. Including additional factors (e.g., cognitive functioning, well-being; Lachman, 2006) may thus help to better understand how across-domain associations observed in this study are embedded in other complex systems of influence. In addition, our social support measure assessed aspects of support rather than dependency (e.g., emotional or financial) and also did not distinguish if the support received was indeed asked for and appreciated. This aspect is important given previous reports that receiving more help than wanted or needed may result in reduced feelings of control and well-being (Newsom & Schulz, 1998; Rook, 1995). We tapped this concern by replicating our pattern of findings when we used an inverse of social strain (Follow-up analyses using various alternative indicators of our measures yielded substantively the same pattern of results as reported in the text. Specifically, we have targeted (a) separate measures for social support and social strain rather than a combined variable as the social support indicator as well as separate measures for the three sources of support and strain (spouse/partner, family, and friends), (b) separate measures of acute health conditions, chronic health conditions, and number of functional limitations rather than the unit-weighted composite across the three variables, and (c) income rather than education as the socioeconomic indicator. We additionally carried out follow-up analyses (d) including linear interaction variables of the three T1 indicators with either age or education in the prediction of two-wave 9-year changes, but a more detailed examination of this possibility is warranted. Also, it would be instructive to explore the extent to which between-person associations revealed by two-wave data over 9 years are similar to within-person associations revealed by data collected over many more, relatively closely spaced occasions (e.g., Röcke, Li, & Smith, 2009). It is also an open question whether or not the associations observed generalize to an age-based time metric, can be found over much shorter time frames, such as weeks or months, and if domain-specific control (e.g., feeling capable of eliciting desirable social or health outcomes) would have generated stronger effects in the respective domain (see Lang et al., 1997). A similarly promising route for future inquiry is whether across-domain dynamics different from those found in this primarily midlife and old age sample may emerge very late in life when individuals often approach

critically low levels of health (see Gerstorf, Ram, Röcke, Lindenberger, & Smith, 2008).

Our study represents an initial effort to conjointly examine antecedent–consequent relations between level and longitudinal change across perceived control, health, and social support. We have shown that perceived control facilitates adaptive functioning and helps to sustain and enrich one's multidomain resources. At the same time, physical and interpersonal resources such as good health and social support are linked to the availability as well as gains in psychological resources, such as perceived control. Our study thus provides further impetus to thoroughly examine processes involved in antecedent–consequent relations of control beliefs to health and social support.

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