

Chronic Illness and Loneliness in Older Adulthood: The Role of Self-Protective Control Strategies

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Objectives: This study examined whether levels of chronic illness predict enhanced feelings of loneliness in older adulthood. In addition, it investigated whether engagement in health-related self-protection (e.g., positive reappraisals), but not in health engagement control strategies (e.g., investment of time and effort), would buffer the adverse effect of chronic illness on older adults' feelings of loneliness. **Method:** Loneliness was examined repeatedly in 2-year intervals over 8 years in a longitudinal study of 121 community-dwelling older adults (Time 1 age = 64 to 83 years). In addition, levels of chronic illness, health-related control strategies, and sociodemographic variables were assessed at baseline. **Results:** Growth-curve models showed that loneliness linearly increased over time and that this effect was observed only among participants who reported high, but not low, baseline levels of chronic illness. In addition, health-related self-protection, but not health engagement control strategies, buffered the adverse effect of chronic illness on increases in loneliness. **Conclusions:** Loneliness increases in older adulthood as a function of chronic illness. Older adults who engage in self-protective strategies to cope with their health threats might be protected from experiencing this adverse effect.

Keywords: chronic illness, loneliness, self-regulation, self-protection, older adulthood

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Research demonstrates a robust directional effect of loneliness on physical health problems across the life span (Caspi et al., 2006; Hawkey et al., 2006; Sorkin, Rook, & Lu, 2002). This association is most pronounced in old age, where loneliness has been implicated in patterns of morbidity and mortality (Hawkey & Cacioppo, 2010). It is surprising, however, that there is a paucity of research examining whether physical health problems could also influence older adults' feelings of loneliness. According to life span development theories, common age-related challenges, such as the experience of chronic illness, can trigger emotional distress and thus could also contribute to loneliness (e.g., Heckhausen, Wrosch, & Schulz, 2010). In addition, these theories postulate that the use of self-protective control strategies (e.g., positive reappraisals) might prevent the emotional distress caused by chronic health threats (Heckhausen, Wrosch, & Schulz, 2013). To investigate these possibilities, we examined the effects of chronic illness on older adults' long-term trajectories of loneliness. It was expected that chronic illness would forecast increasing levels of

loneliness. In addition, it was anticipated that older adults would be protected from the adverse effect of chronic illness on loneliness if they engage in self-protective control strategies.

Loneliness and Physical Health

Loneliness has been conceptualized as perceived social isolation and refers to negative emotions resulting from a discrepancy between an individuals' desired and present quality or quantity of social relationships (Hawkey & Cacioppo, 2010; Peplau & Perlman, 2000). A large body of research has linked loneliness to adverse health outcomes, such as depression, high blood pressure, disrupted sleep, and dysregulation of neuroendocrine and immune responses (Cacioppo et al., 2002a, 2002b; 2006; Hawkey et al., 2006; Steptoe et al., 2004). These consequences of loneliness might accumulate over time and accelerate physical health decline (Hawkey & Cacioppo, 2007, 2010).

Associations between loneliness and health have been shown to be particularly strong in older adulthood. For example, systolic blood pressure was greater in lonely older adults compared with that of lonely young adults and nonlonely individuals (Cacioppo et al., 2002b). Such age effects might occur because older, as compared with younger, adults typically experience higher levels of loneliness (Hacihasanoglu et al., 2012; Demakakos, Nunn, & Nazroo, 2006; Pinquart & Sörensen, 2001) and are more prone to developing a variety of health problems (Centers for Disease Control & Prevention, 2011). Moreover, age effects of loneliness might be due to age-related reductions in social and motivational resources (Heckhausen et al., 2010; Pinquart & Sörensen, 2001), which could make it more difficult for older adults to manage feelings of loneliness.

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Although health effects of older adults' loneliness are well established, there is a lack of longitudinal research examining the reversed directional association; that is, the influence of health problems on older adults' loneliness. In the context of aging, it has been suggested that, in particular, chronic illness could trigger emotional distress including loneliness (Heckhausen et al., 2010; Pinquart & Sörensen, 2001). For example, cardiovascular disease, cancer, or osteoarthritis might lead to functional disability (Verbrugge & Jette, 1994) and could prevent older adults from actual or perceived engagement with their social environment. Alternatively, such effects might occur because chronic illness could undermine older adults' emotion regulation capacities. In this regard, it has been argued that effective emotion regulation requires individuals to draw on personal resources, which can be compromised in old age by the experience of uncontrollable threats, such as chronic illness (Charles, 2010). Given the different pathways that could link chronic disease with loneliness, it seems important to examine whether levels of chronic illness might forecast increases in loneliness over time. The experience of chronic illness could trigger a downward spiral associated with detrimental effects of chronic illness on older adults' loneliness, and vice versa.

Self-Regulation of Chronic Illness in Old Age

A corollary of the previous discussion is that it would be important to identify psychological mechanisms that prevent older adults from experiencing the adverse effect of chronic illness on feelings of loneliness. To this end, the motivational theory of life span development provides a useful theoretical framework (Heckhausen et al., 2010). This theory suggests that individuals who encounter stressful life circumstances can effectively cope with the stressor by engaging in one of two broader categories of control strategies. The first category consists of *goal engagement strategies*, which relate to investing time and effort in goal attainment (selective primary control), finding new ways to overcome problems (compensatory primary control), and enhancing the motivational focus on goal attainment (selective secondary control; Heckhausen et al., 2010). Because the primary function of goal engagement strategies is to facilitate the attainment of feasible goals, they should be adaptive particularly if individuals have sufficient opportunities to overcome a stressor. The second category consists, in part, of *self-protective strategies*, which represents an umbrella term associated with individuals' engagement in different emotionally beneficial cognitive processes, such as positive reappraisals of problematic situations or self-protective attributions (compensatory secondary control). In the context of failure and stress, self-protective strategies can contribute to adaptive outcomes by reducing emotional distress and facilitating disengagement from unattainable goals. Therefore, they should be adaptive if individuals' opportunities for goal attainment are sharply reduced or it is impossible to overcome a stressor (Heckhausen et al., 2010).

In support of these assumptions, studies examining the management of stressors across a variety of life domains have demonstrated that an opportunity-adjusted use of control strategies contributes to subjective well-being (e.g., childbearing, finances, or separation; Heckhausen et al., 2010). In addition, research on the management of physical health problems consistently shows that

goal engagement strategies can improve well-being and health among older adults who confront manageable acute physical symptoms, but not among their counterparts who experience chronic disease (Hall et al., 2010; Wrosch et al., 2002, 2008). Research on the effects of self-protective strategies for dealing with chronic illness, however, is mixed. Whereas some studies showed that self-protective strategies benefit well-being and health in the context of chronic illness (Castonguay, Wrosch, & Sabiston, 2014; Wrosch, Heckhausen, & Lachman, 2000), other research did not document such effects (Hall et al., 2010).

In sum, the reported theoretical and empirical work points to the possibility that an opportunity-adjusted use of control strategies could prevent older adults from experiencing the adverse effect of chronic illness on feelings of loneliness. Given that chronic illness is often relatively intractable and difficult to overcome through active engagement in health-related goals (Hall et al., 2010), the use of self-protective control strategies could buffer the negative impact of chronic illness on older adults' feelings of loneliness. For example, positive reappraisals of health-related circumstances might facilitate an individual's perception of his or her own health as adequate to participate in social activities and might also result in the perception of new ways to effectively organize the social environment. In addition, avoiding self-blame for chronic illness could prevent depressive symptoms (Bombardier, D'Amico, & Jordan, 1990) and support the continued involvement in social activities. The use of goal engagement strategies, by contrast, might not ameliorate loneliness in the context of chronic illness, as these strategies keep a person engaged in overcoming health problems and thus might not promote effective psychological accommodation to the illness.

The Present Study

This 8-year longitudinal study examined the effect of chronic illness and health-related control strategies on long-term trajectories of loneliness in older adulthood. It was hypothesized that, above and beyond sociodemographic variation, feelings of loneliness would increase over time and that higher levels of chronic illness would be associated with increases in loneliness. In addition, it was hypothesized that the use of health-related self-protection would buffer the adverse effect of chronic illness on increasing levels of loneliness. Because the outlined theoretical rationale would not expect goal engagement strategies to ameliorate loneliness in the context of chronic illness, these strategies were included into the analysis to provide evidence for discriminant validity. Finally, the present study considered that other variables could be functionally associated with loneliness (e.g., depressive symptoms), chronic disease (e.g., functional disability), or health-related control strategies (e.g., underlying personality traits such as optimism, self-esteem, or neuroticism). To explore the latter possibilities, supplemental analyses examined the independence of the hypothesized effects from these constructs.

Method

Participants

The present study analyzed longitudinal data collected from a heterogeneous sample of community-dwelling older adults called

the Montreal Aging and Health Study (MAHS). The MAHS began in 2004 by assessing 215 participants. Subsequent waves were conducted at approximately 2 years ($M = 1.88$, $SD = .08$, range = 1.73–2.13, $n = 184$), 4 years ($M = 3.78$, $SD = .24$, range = 3.28–4.77, $n = 163$), 6 years ($M = 6.05$, $SD = .20$, range = 5.52–6.40, $n = 136$), and 8 years ($M = 7.78$, $SD = .19$, range = 7.39–8.28, $n = 125$) after baseline. Study attrition from baseline to 8-year follow up was attributable to death ($n = 36$), refusal to participate in the study ($n = 22$), loss of contact ($n = 19$), withdrawal for personal reasons ($n = 10$), or inability to follow study directions ($n = 4$). Participants who did not provide data on loneliness at three or more assessments over the course of the study ($n = 4$) were further excluded from the analysis.¹ The final analytic sample consisted of 121 participants. Participants who dropped out of the study were significantly older at baseline ($M = 74.17$, $SD = 6.90$) than were those who remained in the study ($M = 71.15$, $SD = 4.72$; $t(213) = 3.80$, $p < .01$). Study attrition was not attributable to baseline levels of any other variable used in this study.²

Procedure

Participants were recruited through newspaper advertisements in the greater Montreal area. Because the study was conducted to obtain a normative sample of community-dwelling older adults, the only inclusion criterion was an age requirement of 60 years or older. Participants completed a questionnaire at each study assessment either in the laboratory or at home if they were unable to visit the laboratory. The questionnaire included measures of health-related control strategies, chronic illness, and other variables. At each wave, participants were further asked to respond to daily questionnaires that included an assessment of loneliness. They were instructed to complete the daily questionnaires over the course of one week at home toward the end of 3 nonconsecutive typical days (days during which they did not expect an unusual doctor's appointments or extraordinary circumstances). After completion of study measures, all materials were collected. Participants were compensated \$50 for their participation in each of the first three waves and \$70 for the participation in each of the final two waves. Informed consent was obtained from all participants prior to participation. All procedures and methods were approved by the Concordia University Research Ethics Board.

Materials

Loneliness was assessed on 3 days at each wave by using a previously validated two-item measure (Pressman et al., 2005). Participants were asked at the end of each day to what extent they felt "lonely" or "isolated". Participants responded using 5-point Likert-type scales, ranging from 0 (*very slightly or not at all*) to 4 (*extremely*). For each wave, loneliness was indexed by computing a sum score of participants' responses across the 3 days ($\alpha = .68-.91$; interclass correlations [ICCs] = .67–.92).

Chronic illness was assessed at baseline. Participants responded to a checklist that asked them to report whether they had been diagnosed with 17 different chronic illnesses (e.g., high blood pressure, cardiovascular problems, arthritis, asthma, cancer, or diabetes). Level of chronic illness was indexed by counting the number of chronic illnesses reported.

Health-related control strategies were measured at baseline with a previously validated 12-item self-report instrument (Wrosch et

al., 2002, 2009). These strategies fall into two categories: health engagement control strategies (9 items) and health-related self-protection (3 items). Participants rated each item on a 5-point Likert-type scale, ranging from 0 (*almost never true*) to 4 (*almost always true*). *Health engagement control strategies* (hereafter called *health engagement strategies*) were indexed by computing a mean score of the nine items ($\alpha = .87$), incorporating selective primary, selective secondary, and compensatory primary control strategies. Sample items included, "I invest as much time and energy as possible to improve my health;" "When I decide to do something about a health problem, I am confident that I will achieve it;" and "When a treatment doesn't work for a health problem I have, I try hard to find out about other treatments." *Health-related self-protection* represented different psychological processes that are theoretically expected to ameliorate emotional well-being in the context of health threats, such as positive reappraisals and avoidance of self-blame (for a more comprehensive discussion, see Heckhausen et al., 2010). It was indexed by computing a mean score of the three items measuring self-protective secondary control strategies ($\alpha = .78$). The specific items were as follows: "Even if my health is in very difficult condition, I can find something positive in life," "When I am faced with a bad health problem, I try to look at the bright side of things," and "When I find it impossible to overcome a health problem, I try not to blame myself."

Sociodemographic variables. Self-reports of participants' age, sex, socioeconomic status (SES), and partnership status were measured at baseline. Participants were differentiated by whether they were married or cohabiting (coded as 1; $n = 63$) or single, divorced, or widowed (coded as 2; $n = 58$). SES was measured by asking participants to report their highest levels of education, where 0 (*no education*), 1 (*high school*), 2 (*college or trade school*), 3 (*bachelor's degree*), and 4 (*master's or doctorate*); annual family income, where 0 (*less than \$17,000*), 1 (*up to \$34,000*), 2 (*up to \$51,000*), 3 (*up to \$68,000*), 4 (*up to \$85,000*), and 5 (*more than \$85,000*) and perceived social status (Adler et al., 2000). These three indicators of SES were correlated ($r_s = .35$ to $.50$, $p_s < .01$, $\alpha = .66$), and their standardized scores were averaged to obtain a reliable measure of SES.

Other constructs. To examine the independence of the hypothesized effects in supplemental analyses, commonly used scales of dispositional optimism (Scheier et al., 1994; $M = 16.78$, $SD = 3.59$, $\alpha = .72$), self-esteem (Rosenberg, 1965; $M = 22.76$, $SD = 4.10$, $\alpha = .76$), neuroticism (Costa & McCrae, 1992; $M = 2.14$, $SD = .54$, $\alpha = .75$), and functional disability (Lawton & Brody, 1969; $M = .21$, $SD = .56$) were measured at baseline (except for optimism, which was first assessed at Time 2). In addition, measures of depressive symptoms were obtained across

¹ There were no missing data for the scale scores of predictor variables used in the main analysis. Missing data of single items were replaced during scale computation by the mean of available scores. Missing loneliness scores ($n = 1$ to $n = 5$ across waves) were not replaced because HLM can estimate the associated coefficients based on available data points.

² Data from the MAHS have been published previously, including measures of control strategies or loneliness (e.g., Wrosch & Schulz, 2008; Rueggeberg et al., 2012). None of these studies reported data from all five waves of the MAHS or predicted loneliness as an outcome.

waves (Andresen et al., 1994; $M_s = 5.64$ to 7.34 , $SD_s = 4.14$ – 6.12 , $\alpha_s = .71$ – $.86$).

Data Analyses

Preliminary analyses were conducted to describe the sample and examine zero-order correlations between variables. The study’s main hypotheses were subsequently tested in growth-curve analyses by using hierarchical linear modeling (HLM 6.0). In a first step, a Level-1 model was estimated to examine longitudinal changes in loneliness ratings by testing whether years since study entry and a residual term would predict within-person variability in loneliness across waves.³ In this model, the intercept indicated baseline levels of loneliness, and the slope represented yearly change in loneliness. In a second step, a Level-2 model was estimated to investigate the between-person main effects of sociodemographic variables, chronic illness, health-related self-protection, and health engagement strategies on the variability in participants’ intercept (baseline levels of loneliness), and slope values (yearly change in loneliness). Finally, the significance of interaction effects between chronic illness and health-related self-protection and between chronic illness and health engagement strategies were tested by adding both interaction terms to the previous Level-2 model. Significant interaction effects were followed up by estimating the simple slopes of changes in loneliness over time for groups of subjects scoring one standard deviation above and below the sample mean of the predictor variables. Finally, supplemental analyses were performed by adding individual variables separately to the previously conducted models. These analyses explored the independence of the obtained effects from constructs that could be functionally associated with the tested hypotheses, including personality traits and functional disability (controlled on Level 2), and variability in depressive symptoms over time (controlled on Level 1). In all analyses, Level-2 predictor variables were standardized, and the reported effects relate to models using restricted maximum likelihood estimation and robust standard errors.

Results

Preliminary Analyses

As reported in Table 1, loneliness scores were relatively low at baseline, but continuously increased over time.⁴ Fifty-six percent of the sample was female, and participants were on average 71 years old at study entry. Approximately half of the sample was married or cohabiting, and roughly 35% of participants obtained a university degree. Slightly more than half of the participants had an annual income between \$17,000 and \$51,000, and the sample mean of perceived social status fell slightly above the midpoint of the scale. Participants reported an average of two to three chronic illnesses at baseline. Thirteen participants had no chronic illnesses, 30 participants had one chronic illness, 39 participants had two chronic illnesses, and 39 participants had three or more chronic illnesses. The most common chronic illnesses reported were major surgery ($n = 73$), cardiovascular disease ($n = 65$), muscle/bone disorders ($n = 41$), and high blood pressure ($n = 35$). The sociodemographic and health characteristics of this sample were

Table 1
Means, Standard Deviations, and Frequencies of Main Study Variables ($N = 121$)

Construct	<i>M</i> , (<i>SD</i>), or Percentage	Range
Loneliness		
T1	0.91 (2.17)	0–12
T2	1.29 (2.51)	0–14.4
T3	1.36 (2.91)	0–16
T4	1.80 (2.67)	0–13.5
T5	2.16 (4.07)	0–19.2
Chronic illness (T1)	2.17 (1.55)	0–8
Health engagement strategies (T1)	3.15 (0.65)	0.4–4.0
Health-related self-protection (T1)	3.09 (0.82)	0.3–4.0
Age (T1)	71.18 (4.74)	64–83
Female (%) (T1)	56.2	
Partnership status (%) (T1)		
Married, or cohabiting	52.1	
Single, divorced, or widowed	47.9	
Education (%) (T1)		
None	3.4	
High school	28.4	
College/trade	32.8	
Bachelor	24.1	
Master/PhD	11.2	
Annual income (%) (T1)		
Less than \$17,000	18.9	
\$17,001–\$34,000	41.4	
\$34,001–\$51,000	18.0	
\$51,001–\$68,000	15.3	
\$68,000	6.3	
Perceived social status (T1)	6.24 (1.83)	0–10

Note. T1 = Time 1; T2 = Time 2; T3 = Time 3; T4 = Time 4; T5 = Time 5.

within the normative range of community-dwelling older adults (National Advisory Council on Aging, 2006).

The zero-order correlations between the main study variables and covariates are reported in Table 2. Measures of loneliness were positively correlated across waves, indicating some stability in loneliness over time. Eight-year follow-up ratings of loneliness were positively correlated with baseline levels of chronic illness and negatively correlated with baseline levels of health-related self-protection. Health-related self-protection was positively associated with health engagement strategies. Being married or cohabiting was associated with lower baseline ratings of loneliness and was more common in men. Finally, a higher SES was associated

³ Although levels of loneliness exerted a skewed (Poisson-like) distribution (see means and standard deviations in Table 2), the coefficients of change in loneliness approximated a normal distribution more closely ($M = .14$, $SD = .49$; skewness = 1.69; kurtosis = 8.05; Kline, 2009). Nonetheless, additional analyses were conducted with (a) Poisson-based regression techniques and (b) log-transformed scores of loneliness. These results are reported in the online supplemental materials and document an identical pattern of findings across different analyses. Consequently, analyses based on nontransformed data of loneliness are reported in the body of the article because these data can be related to the scale of measurement.

⁴ At baseline, 73.6% reported a loneliness score less than 1 (12.4% = 1–2; 14% > 2), whereas 57.9% reported a score of less than 1 at T5 (17.4% = 1–2; 24.7% > 2). The fact that a substantial proportion of the sample reported low loneliness scores and that the scores are based on daily assessments might have contributed to standard deviations that were higher than the mean values.

Table 2
Zero-Order Correlations Between Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Loneliness (T1)											
2. Loneliness (T2)	.45**										
3. Loneliness (T3)	.35**	.59**									
4. Loneliness (T4)	.24*	.38**	.41**								
5. Loneliness (T5)	.22*	.39**	.35**	.60**							
6. Chronic illness (T1)	-.06	.10	.15	.16	.22*						
7. Health engagement strategies (T1)	-.14	.05	-.10	.03	-.04	.05					
8. Health-related self-protection (T1)	-.13	.04	-.08	-.14	-.20*	.02	.66**				
9. Age (T1)	.10	.05	-.03	-.05	.01	-.03	.04	.09			
10. Female (T1)	.08	.03	.05	-.11	.04	-.11	-.11	-.01	.04		
11. Partnership status (T1) ^a	.32**	.14	.14	.11	.06	-.05	-.13	-.01	-.00	.28**	
12. Socioeconomic status (T1)	-.30**	-.09	-.04	-.05	-.04	-.13	.04	.06	-.07	-.20*	-.21*

Note. T1 = Time 1; T2 = Time 2; T3 = Time 3; T4 = Time 4; T5 = Time 5.

^a married or cohabiting = 1; single, divorced, or widowed = 2.

* $p < .05$. ** $p < .01$.

with lower baseline levels of loneliness and was more common in men.

Main Analyses

Table 3 summarizes the results of the Level-1 growth-curve model, which was conducted to estimate the variability in loneliness ratings across study waves by an intercept, years since study entry, and a residual term. This analysis revealed a significant intercept, ($t = 4.66, p < .01$), suggesting that baseline levels of loneliness were significantly different from zero ($M = .91, SE = .19$). In addition, there was a significant slope effect ($t = 3.36, p < .01$), demonstrating that feelings of loneliness increased linearly over the course of the study. Finally, the analysis confirmed significant variability around the average intercept, $\chi^2 > 224, p < .01$, and the average within-person slope of loneliness, $\chi^2 > 268,$

$p < .01$, indicating the presence of reliable individual differences in these estimates.

The subsequently conducted Level-2 model attempted to explain the observed between-person variability in the intercept and slope coefficients obtained in the Level-1 model. To this end, the between-person main effects of sociodemographic variables, chronic illness, health-related self-protection, and health engagement strategies were estimated (see Table 3). With respect to sociodemographic variables, the results confirmed a significant effect of partnership status on baseline levels of loneliness ($t = 2.58, p = .01$). Participants who were single, divorced, or widowed reported higher baseline levels of loneliness than did their married or cohabiting counterparts. No other effects of the sociodemographic variables were obtained, either for predicting baseline levels or yearly changes in loneliness. Moreover, none of the

Table 3
Results of Growth-Curve Analyses Predicting Baseline Levels and Yearly Changes in Loneliness

Model	Loneliness			
	Intercept		Slope	
	Baseline Levels		Yearly Change	
	Coefficient (SE)	<i>t</i>	Coefficient (SE)	<i>t</i>
Level 1	.907 (.195)	4.66**	.149 (.044)	3.36**
Level 2: Main effects (T1)				
Age	.127 (.147)	.86	-.013 (.037)	-.35
Female	-.114 (.187)	-.61	.023 (.051)	0.46
Socioeconomic status	-.371 (.188)	-1.97	.069 (.045)	1.53
Partnership status ^a	.523 (.203)	2.58*	-.026 (.056)	-.46
Chronic illness (CI)	-.097 (.174)	-.56	.125 (.055)	2.25*
Health engagement strategies	-.187 (.221)	-.84	.108 (.048)	2.28*
Health-related self protection	.127 (.255)	.50	-.157 (.054)	-2.92**
Level 2: Interactions				
CI × Health engagement strategies	.114 (.318)	.36	.041 (.074)	.55
CI × Health-related self-protection	-.041 (.264)	-.16	-.171 (.057)	-2.99**

Note. The Level-1 model had 120 degrees of freedom; the Level-2 models had 113 degrees of freedom (main effects) and 111 degrees of freedom (interactions).

T1 = Time 1.

^a married/cohabiting = 1; single/divorced/widowed = 2.

* $p < .05$. ** $p < .01$.

hypotheses-related main effects significantly predicted baseline levels of loneliness. However, the analysis confirmed significant main effects of chronic illness ($t = 2.25, p = .03$), health-related self-protection ($t = -2.92, p < .01$), and health engagement strategies ($t = 2.28, p = .02$), in predicting changes in loneliness over time (see coefficients for slope in Table 3). These effects document that to the extent participants reported higher levels of chronic illness or lower levels of health-related self-protection, they experienced a steeper yearly increase in loneliness over time. In addition, the use of health engagement strategies was associated with increasing levels of loneliness.⁵ Controlling for the included main effects and covariates, chronic illness uniquely contributed to a reduction of 11.15% of the variance in the loneliness slope (self-protection = 10.61%; health engagement = 4.69%).⁶

A second Level-2 model investigated the presence of interaction effects by adding the interaction terms between health-related self-protection and chronic illness and between health engagement strategies and chronic illness simultaneously to the previously estimated Level-2 model. The results of the analysis did not show significant effects of the interaction terms on baseline levels of loneliness. With respect to yearly changes in loneliness over time, however, a significant effect was obtained for the interaction between health-related self-protection and chronic illness ($t = -2.99, p < .01$), but not for the interaction between health engagement strategies and chronic illness ($t = .55, p = .58$; see coefficients for slope in Table 3).⁷

To further examine the significant interaction effect, yearly changes in loneliness were plotted in Figure 1 over 8 years of study for different groups of participants by using one standard deviation above and below the sample mean of the predictor variables as reference points (solid lines). In addition, Figure 1 displays raw data, based on participants who scored above or below the mean of the respective predictor variables (dotted lines). As depicted in the top panel of Figure 1, among participants who reported relatively low baseline levels of chronic illness, feelings of loneliness did not increase over time, regardless of their levels of health-related self-protection (low: coefficient = $-.02, SE = .09, t = -.28, p = .78$; high: coefficient = $.05, SE = .07, t = .68, p = .50$). By contrast, the lower panel of Figure 1 shows that among participants with relatively high baseline levels of chronic illness, feelings of loneliness increased if they reported low levels of health-related self-protection (coefficient = $.59, SE = .13, t = 4.57, p < .01$), but remained stable at a relatively low level if participants reported high levels of health-related self-protection (coefficient = $-.02, SE = .07, t = -.25, p = .80$). As compared with a model, including main effects, covariates, and the interaction between chronic illness and health engagement strategies, the significant interaction effect reduced the variance in the loneliness slope by 13.0%.

Supplemental Analyses

The supplemental analyses showed that the obtained main effects of chronic illness, self-protection, and health engagement strategies, as well as the interaction between chronic illness and health-related self-protection remained significant (all t s > 2.32 , all p s $< .03$), if between-person measures of personality traits (optimism, self-esteem, and neuroticism) or functional disability were included in separate analyses as additional covariates at

Level 2 or if loneliness slopes were controlled for within-person variation in depressive symptoms at Level 1. Note, however, that some of these variables were meaningfully associated with the obtained variance in loneliness. Within-person changes in depressive symptoms were positively associated with within-person changes in loneliness ($t = 6.92, p < .01$), and lower, as compared with higher, optimism ($t = -2.70, p < .01$), significantly predicted increasing levels of loneliness over time. Self-esteem, neuroticism, and functional disability did not predict significant changes in loneliness.

Discussion

The present study documents long-term longitudinal increases in loneliness in a sample of community-dwelling older adults. This process was observed among older adults who experienced high, but not low, baseline levels of chronic illness. In addition, older adults who suffered from high levels of chronic illness were protected from subsequent increases in loneliness if they engaged in self-protective strategies to cope with their health threats.

The observed linear increase in loneliness is consistent with past research, indicating that loneliness can become prominent in old age and is positively associated with advancing age (Demakakos et al., 2006; Hacıhasanoglu et al., 2012; Pinquart & Sörensen, 2001). In addition, it demonstrates a constant and long-lasting increase in older adults' loneliness. Considering that the prevalence of age-related stressors (e.g., health problems, loss of friends or family) is likely to further increase across older adulthood, these results might imply that feelings of loneliness could also continue to rise in participants' future.

The reported analyses further suggest that baseline levels of chronic illness were associated with increases in older adults' loneliness. Whereas participants with high levels of chronic illness experienced a steep increase, feelings of loneliness remained relatively stable among their counterparts who experienced relatively low levels of chronic illness (see Figure 1). This pattern of findings is consistent with theories from life span psychology, postulating that common age-related challenges, such as chronic illness, can trigger emotional distress (Brandtstädter & Renner, 1990; Heckhausen et al., 2010, 2013). In particular, enhanced feelings of loneliness might occur because chronic illness could jeopardize older adults' continued engagement with relevant social activities (Pinquart & Sörensen, 2001). Furthermore, the results support the theoretical notion that effective emotional functioning requires older adults to draw on personal resources (Charles, 2010). If such resources are threatened or absent, as in the case of chronic illness, older adults' emotion regulation capacities might become compromised and they suffer associated emotional distress.

⁵ Note, however, that the effect of health engagement was not significant if self-protective strategies were excluded from the model, ($t = .07, p = .94$), indicating the presence of a suppression effect. The effects of self-protective strategies ($t = -1.99, p < .05$) and chronic illness ($t = 2.23, p < .05$), by contrast, remained significant if health engagement was not considered in the model.

⁶ Effect sizes were calculated by comparing the variance components of the loneliness slope with models that did and did not incorporate the respective significant effect.

⁷ The Level-2 interaction effect between self-protective strategies and chronic illness was also significant if the other interaction was not included in the model ($t = -4.18, p < .01$).

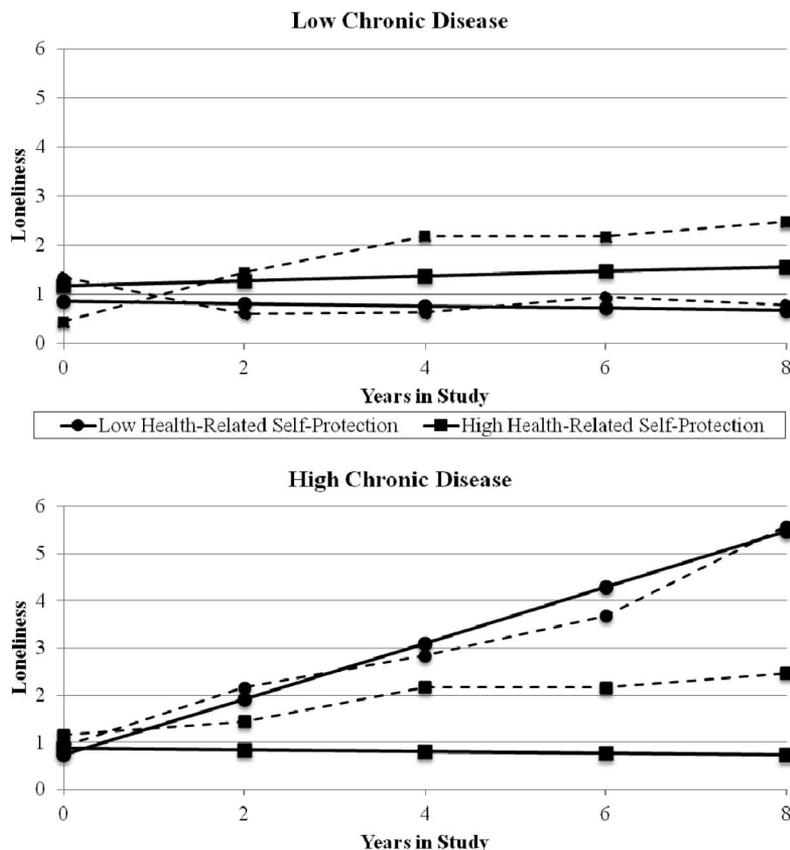


Figure 1. Loneliness trajectories over 8 years of study as a function of individual differences in health-related self-protection, separately for participants with high versus low baseline levels of chronic illness. Model-based trajectories of loneliness are plotted one standard deviation above and below the sample mean of the predictor variables (solid lines). Raw data of loneliness are plotted for groups scoring above and below the mean of the predictor variables (dotted lines).

Of importance, the reported study demonstrates that the adverse effect of chronic illness on increasing levels of loneliness was not observed among older adults who engaged in self-protective control strategies to cope with their health threats (e.g., positive reappraisals or external attribution). By contrast, older adults experienced a steep increase in loneliness if they reported enhanced baseline levels of chronic illness and failed to engage in self-protective control strategies (see Figure 1). Consistent with theory and research from life span psychology, such adaptive effects of self-protective control strategies might occur in the context of uncontrollable health threats because these strategies allow an individual to psychologically accommodate to the stressor (Brandtstädter & Renner, 1990; Heckhausen et al., 2010, 2013). In particular, positive reappraisals of health-related circumstances might buffer feelings of loneliness if these strategies contribute to chronically ill individuals' perceptions of their own health as adequate for participating in social activities. Furthermore, positive reappraisals could prevent loneliness by facilitating the perception of new ways to effectively organize the social environment. In a similar vein, avoiding self-blame for chronic illness might ameliorate feelings of loneliness if these strategies help older adults to maintain their emotional and motivational resources (e.g., by preventing depressive symptoms; Bombardier et al., 1990)

and through this process support the continued involvement in desired social activities.

Note that health engagement strategies (e.g., investing time and effort in overcoming health threats) were not associated with reduced feelings of loneliness among participants who experienced high levels of chronic illness. On the basis of the reported theories and research, such an effect might not be observed because chronic illness is often difficult to control in old age through the use of active control strategies (Hall et al., 2010; Wrosch et al., 2000). In addition, using control strategies that are aimed at overcoming health problems might not facilitate necessary psychological adjustment to the experience of chronic illness, such as reevaluating health-related circumstances or ameliorating negative emotional states.⁸

It is noteworthy to report that the sizes of the observed effects were substantial. Each of the main effects of chronic illness and

⁸ The analyses also showed a significant main effect of health engagement strategies on increasing levels of loneliness. However, because this effect was based on suppression (see Footnote 4), it is difficult to interpret and should be replicated before advancing conclusions (MacKinnon, Krull, & Lockwood, 2000). Therefore, it was not further discussed.

health-related self-protection reduced the obtained variance in participants' loneliness slopes by 11%, and the interaction effects explained an additional 13% of the variance associated with changes in loneliness. Moreover, changes in loneliness were independent of sociodemographic factors, suggesting that the observed process might occur across different socioeconomic strata. Finally, the reported supplemental analyses document that the obtained effects could not be explained by underlying personality traits, functional disability, or depressive symptoms. This independence of effects provides further evidence that feelings of loneliness and depressive symptoms, although correlated, represent separate constructs (Cacioppo et al., 2006). In addition, chronic disease could explain loneliness above and beyond the presence of functional disability because chronic disease might trigger different pathways toward the experience of distress (e.g., compromising emotion regulation, Charles, 2010). Finally, as compared with broader personality traits, health-related control strategies represent more specific constructs that are malleable and can change over time. Control strategies could thus explain different portions of variance in outcomes and might become paramount if life circumstances enhance a person's risk of experiencing loneliness.

Overall, the study's findings have important implications for theory and clinical practice. First, they contribute to the loneliness literature by clarifying the associations between loneliness and physical health. Whereas past research has demonstrated directional effects of loneliness on physical health (Caspi et al., 2006; Eaker et al., 1992; Penninx et al., 1997; Seeman, 2000; Sugisawa et al., 1994; Thurston & Kubzansky, 2009), the present study suggests that the experience of chronic illness can also forecast increasing levels of loneliness. This implies that there might be reciprocal relations between health problems and loneliness, which highlights the potential for chronically ill individuals to enter a downward spiral resulting in poor psychological and physical health. Such an adverse process might be important in the elderly and could become particularly influential toward the end of life when individuals tend to experience a terminal decline in their physical and psychological functioning (Gerstorf et al., 2010).

Second, the reported results contribute to the life span developmental literature by providing insights into the development of emotional functioning in old age. Whereas some research suggests that emotional well-being can be maintained or even enhanced in older adulthood (e.g., Charles & Carstensen, 2010), other work has documented longitudinal declines in older adults' emotional well-being (e.g., Rothermund & Brandtstädter, 2003). The present study lends support to both positions. On the one hand, it documents that certain facets of emotional distress (i.e., loneliness) might generally increase in the elderly population. On the other hand, it demonstrates that such increases in emotional problems can be prevented if older adults are able to either avoid chronic illness or to cope effectively with the disease. The latter conclusion supports recent theoretical developments, postulating that emotional well-being can be maintained into old age as long as individuals are capable of drawing on resources needed for effective emotion regulation (Charles, 2010). In the context of chronic illness, however, such resources are likely to be depleted, which increases an older adult's risk for experiencing a decline in emotional well-being.

Third, this study contributes to the literature on self-regulation and control. In this regard, it lends support to the assumption that

effective self-regulation requires individuals to adjust their control strategies to the controllability of a stressor (Heckhausen et al., 2010). Whereas past work has documented consistent benefits of health engagement control strategies for successful adjustment to treatable acute health threats (Wrosch et al., 2002, 2008), mixed findings have been reported with respect to the role of self-protective strategies for managing relatively intractable chronic disease (Castonguay et al., 2014; Hall et al., 2010; Wrosch et al., 2000). To this end, the present research clarifies these mixed findings by supporting the theoretical premise that self-protective control strategies can provide emotional benefits in the context of chronic disease. In particular in older adulthood, when many uncontrollable stressors arise, individuals need to engage in self-protective control strategies to protect their emotional and motivational resources.

Finally, the study's findings draw attention to the need for psychological interventions in older adulthood. Previous research has shown some success in implementing intervention programs targeted at modifying control over illness experiences (Gitlin et al., 2006). The reported study highlights the need of developing new interventions that promote the use of self-protective control strategies among older individuals diagnosed with chronic illness. Such interventions might prevent further deterioration of older adults' psychological and physical health.

Limitations and Future Directions

The present study is not without limitations. First, although the results suggest longitudinal effects of chronic illness and health-related self-protection on changes in loneliness, data from longitudinal field studies cannot draw causal inferences. For example, it is also possible that some individuals foresee increases in loneliness and thus engage in more self-blame. Moreover, the reported data stem from a relatively small longitudinal sample, limiting the generalizability of the findings. Future research should therefore aim to replicate the obtained findings in larger and more generalizable samples. In addition, experimental studies that engage individuals in self-protective processes could document causal effects of self-protective control strategies on older adults' emotional well-being.

Second, the three-item measure of health-related self-protection incorporated different types of control strategies (e.g., positive reappraisals and attributions) and the reported analyses did not examine differences in the effects of the single strategies. Additionally conducted sensitivity analyses showed that the observed interaction with chronic disease was significant for two of the three items ("... I can look at the bright side of things" and "... I try not to blame myself" [$t_s < -2.35, p_s < .03$]), but not for the third item ("... I can find something positive in life" [$t = -1.34, p = .18$]). Whereas these results might suggest that some processes are more adaptive than others, note that the self-protection scale showed appropriate internal consistency, and differences in the predictive value could also occur as a function of differences in the reliability of single items. To address this issue empirically, future research should devise scales of self-protection that incorporate multiple items for each subprocess.

Third, this study focused on examining chronic illnesses. However, older adults can also confront manageable health threats associated with acute physical symptoms (e.g., difficulty breath-

ing, Wrosch & Schulz, 2008). In this regard, extant work suggests that health engagement strategies can be adaptive in the context of manageable health symptoms (Wrosch et al., 2002). This possibility could further explain the observed positive association between both types of control strategies (sharing 44% of the variance). Given that adaptation to multiple health threats might require older adults to use a variety of different control strategies, there could be a substantial proportion of older adults who engage in both self-protective and goal engagement strategies. Nonetheless, it is important to note that both theory-based constructs had acceptable psychometric characteristics and predicted the study's outcome in different and meaningful ways. Future research should therefore continue to examine the functions of different control strategies in the context of a variety of health threats (e.g., biological functioning, acute symptoms, and chronic illness).

Fourth, the present study examined baseline levels of chronic illness and did not address the effects of changes in chronic illness over time. Given that age-related health problems continue to increase in older adulthood, future research should supplement the reported findings by applying fine-grained analyses of within-person variations in chronic illness and exploring their effects on associated levels of loneliness. On the basis of the discussed theories and study results, it would be possible that levels and increases in self-protective control strategies are adaptive in the context of enhancing chronic disease and protect older individuals from the experience of psychological distress (Heckhausen et al., 2013).

Finally, the reported study did not investigate the effect of loneliness on chronic health problems. This possibility was not addressed because a substantial body of research already demonstrated longitudinal consequences of loneliness on physical health (e.g., Penninx et al., 1997; Sugisawa et al., 1994). Additionally conducted analyses of the reported data, however, suggest that baseline levels of loneliness did not predict longitudinal increases in chronic illness, $t(113) = .36, p = .72$. The absence of such a reversed effect might be due to the relative young age and low levels of loneliness among study participants at baseline. Given that participants' loneliness scores increased considerably over time, future waves of our study might discover whether the observed increases in loneliness compromise subsequent levels of physical health. Research along these lines might shed further light on the associations between loneliness and health and discover psychological mechanisms involved in successful aging.

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