

Changes in Self-Esteem and Chronic Disease across Adulthood: A 16-year Longitudinal Analysis

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Abstract

Rationale: Self-esteem is an adaptive personality factor that has been associated with good physical health. While research has observed that self-esteem and physical health typically decline in older adulthood, there is a paucity of research investigating the associations between changes in self-esteem and physical health across the adult lifespan. **Objective:** The present study examined whether changes in self-esteem and chronic disease exert reciprocal effects on subsequent changes in self-esteem and disease. In addition, it investigated whether individuals' age would moderate these associations. **Methods:** The study analyzed data from 14,117 adult (18+) Canadians who completed surveys over 16 years, from cycles 1 to 9 of the National Population Health Survey (NPHS). Self-esteem, chronic diseases, and demographic information were collected. **Results:** Cross-lagged panel analyses indicated reciprocal age-related associations between changes in self-esteem and chronic disease. Initial decline in self-esteem predicted subsequent increases in chronic disease, and initial increases in chronic disease predicted subsequent declines in self-esteem, only among young adults, and not middle-aged or older adults. **Conclusion:** These results suggest that age may qualify the associations between declines in self-esteem and physical health and that adverse changes in both factors may be particularly problematic for young adults' prospective personality functioning and physical health.

Keywords: self-esteem; self-esteem change; chronic disease; health; adult lifespan; longitudinal analyses; cross-lagged panel analyses.

Introduction

Individuals' self-esteem and their physical health can influence each other over time. This process most likely occurs in a recursive fashion, in which low self-esteem can jeopardize a person's physical health, and vice versa (Reitzes & Mutran, 2006; Sowislo & Orth, 2013). In addition, life-span developmental research has documented significant changes in self-esteem and physical disease as individuals advance in age. Both self-esteem and physical health remain relatively protected during adulthood, but decline in old age (Heckhausen, Wrosch & Schulz, 2010; Orth, Erol, & Luciano, 2018; von Soest, Wagner, Hansen, & Gerstorf, 2018). However, there is a paucity of research on the longitudinal associations between such changes across the lifespan. Here we address this gap by capitalizing on a 16-year longitudinal study. We apply a developmental approach focusing on how changes in psychological processes, such as self-esteem, and changes in the experience of chronic disease can influence one another across the lifespan. On the one hand, we reasoned that declines in self-esteem and increased chronic disease could be most influential in predicting subsequent decreases in self-esteem and health during life periods when they are most likely to occur, such as older adulthood. On the other hand, we considered that declines in self-esteem and increases in chronic disease are non-normative and least expected in young adulthood, and could reflect underlying developmental difficulties (Heckhausen et al., 2010; Neugarten, Moore, & Lowe, 1968). Thus, declines in self-esteem and increases in chronic disease could also become paramount at younger ages and predict a subsequent deterioration of individuals' self-esteem and physical health.

Self-Esteem and Chronic Disease

Global self-esteem is considered an important psychological variable that reflects individuals' general feelings of self-worth across different areas of life (Rosenberg, 1986). Research has identified various effects of self-esteem on physical health outcomes. For example, low self-esteem has been associated with physiological dysregulation in the context of stress (Liu, Wrosch, Miller, & Pruessner, 2014; Pruessner, Hellhammer, & Kirschbaum, 1999; Rector & Roger, 1997) and physical health problems (Cott, Gignac, & Badley, 1999). Such effects of self-esteem on physical health may be observed because low self-esteem can contribute to psychological consequences and lead to maladaptive coping behaviors (Orth, Robins, & Meier, 2009; Watson, Suls, & Haig, 2002), which in turn is likely to exert downstream implications by enhancing a person's physiological risk of experiencing chronic disease (Cohen, Janicki-Deverts, & Miller, 2007; Lazarus & Folkman, 1984; Liu et al., 2014).

Chronic disease may also have a significant impact on individuals' self-esteem. Indeed, research has identified recursive effects of poor physical health on low self-esteem (Reitzes & Mutran, 2006). For example, among individuals diagnosed with chronic pain, those who experienced their condition as uncontrollable and experienced a depletion of resources reported particularly low levels of self-esteem (Skevington, 1993). As such, self-esteem may also be influenced by changes in physical health (Rector & Roger, 1997). Moreover, the presence of chronic disease may disrupt coping activities and contribute to undesired outcomes, which may exert negative influences on individuals' self-esteem (Sowislo & Orth, 2013). Thus, associations between self-esteem and physical health are likely reciprocal, suggesting that low self-esteem may not only forecast health declines, but the occurrence of chronic disease can also compromise a person's self-esteem.

Changes in Self-Esteem and Chronic Disease across the Adult Lifespan

Age-related biological changes can contribute to physical health across the adult lifespan. While early development is characterized by increased physical functioning, physical health remains relatively stable throughout adulthood, until it tends to deteriorate in old age and is associated with a number of chronic diseases (Gerstorf et al., 2010; Heckhausen et al., 2010). Similarly, a growing body of research has examined the lifespan trajectory of self-esteem suggesting that self-esteem increases during young adulthood, plateaus in midlife, and declines throughout older adulthood (Orth et al., 2018; Robins et al., 2002). Note that there is considerable variability around these trajectories, suggesting that self-esteem and physical health can also increase or decline for individuals at any age (Heckhausen et al., 2010; Robins et al., 2002).

As there is a body of literature that discusses the various mechanisms through which social determinants are associated with physical health and aging (Jones et al., 2019; Ross & Wu, 1996), age-related changes in self-esteem may also be impacted by psychological and social factors. In this regard, the

management of developmental tasks and age-normative expectations about their own and others' development could influence a person's lifespan trajectory of self-esteem by providing a frame of reference for assessing their own developmental status (Heckhausen & Krueger, 1993). Given that individuals frequently evaluate their self-esteem within a social context (Rosenberg, 1986), they may compare their own development with normative expectations and the development of their peers. As such, they may experience age-related changes in self-esteem as a consequence of perceiving their developmental status as "on-time" versus "off-time" (Neugarten et al., 1968).

In young adulthood, increases in self-esteem may be related to age-normative gains, such as the establishment of new social roles or occupying positions of power and status (Robins et al., 2002). Young adulthood is a period where individuals are expected to, and typically accomplish, a number of developmental tasks that contribute to patterns of successful development (Baltes, 1987; Heckhausen et al., 2010). As young adults continue to meet age-normative expectations by making progress with developmental tasks, self-esteem typically increases and peaks during midlife when high levels of achievement, mastery, and control over the self and the environment begin to plateau (for midlife development, see Lachman, 2004). In older adulthood, declines in self-esteem may reflect the expectation and experience of developmental losses, such as reductions of personal resources, withdrawal from social roles (e.g., retirement), or increases in health problems (Baltes, 1987; Heckhausen, 1999; Robins et al., 2002). Here, self-esteem declines may be observed particularly if older adults experience, but do not expect for themselves, significant developmental losses (Heckhausen & Krueger, 1993).

Age Effects of Changes in Self-Esteem and Chronic Disease

There is a paucity of research investigating the longitudinal associations between changes in self-esteem and chronic disease across the adult lifespan. As such, it is important to examine how declines in self-esteem and physical health influence each other over time across different age segments. One possibility is that the reciprocal associations between self-esteem and chronic disease may become particularly evident in older adulthood, when a considerable proportion of individuals experience both the onset of a number of chronic diseases and a reduction in self-esteem (Orth et al., 2018). It is important to note, however, that lifespan approaches have also documented that older adults are generally well-prepared to effectively cope with developmental challenges, such as chronic disease. This age-related improvement of self-regulation capacities could prevent declines in self-esteem and physical health from influencing each other over time (e.g., through self-protection, emotion regulation, or goal adjustment, Carstensen, Issacowitz, & Charles, 1999; Heckhausen et al., 2010; Wrosch, Scheier, & Miller, 2013).

Another possibility is that reciprocal associations between declines in self-esteem and physical health could be more pronounced when they are less likely to occur, for example among young adults. In young adulthood, normative conceptions about development emphasize individuals' potential for gains and push them towards the accomplishment of important developmental tasks (e.g., finishing an educational degree, transitioning into the work force, or finding a partner; Havighurst, 1972). Given that individuals compare their achievements with age peers and normative expectations, a decline in self-esteem during this period could reflect a failure in achieving developmental tasks, which may affect individuals' psychological functioning and health (Heckhausen et al., 2010; Wrosch, Heckhausen & Lachman, 2000). Similarly, the experience of chronic disease is normatively less expected in young adulthood and may put some young adults at risk of feeling "off-time," which in turn could compromise their self-esteem. In addition, many young adults did not yet develop the coping capacities needed to effectively adjust to circumstances that involve losses or unexpected and uncontrollable events (e.g., through self-protective strategies or goal adjustment capacities, Heckhausen et al., 2010; Wrosch et al., 2013). As such, young adults who experience self-esteem declines and physical health problems may have difficulty adjusting to these challenges, which could jeopardize their physical health and self-esteem over time.

The Present Study

This study builds on previous research documenting significant age-related changes in adults' self-esteem and physical health over time. As such, we attempted to investigate the effects these changes can exert onto each other across the adult lifespan. To this end, this study examined reciprocal associations between changes in self-esteem and chronic disease across the adult lifespan from a Canadian national survey conducted over 16 years. We hypothesized that there would be a reciprocal association between

changes in self-esteem and changes in chronic disease over time, in that declines in self-esteem would predict subsequent increases in chronic diseases, and vice versa. Second, we examined whether participants' chronological age moderated these associations. Because the above literature review suggested different possibilities, the direction of age effects was not specified.

Methods

Sample

Data were drawn from the National Population Health Survey (NPHS), which is a longitudinal panel survey of Canadian residents. As a nationally representative sample, the NPHS targeted household residents of the 10 Canadian provinces; excluding individuals residing in health institutions, Canadian Forces bases, Indian Reserves and Crown lands, and those residing in remote areas of Quebec and Ontario. The NPHS collected socio-demographic, physical health and psychological characteristics of 17, 276 individuals starting in 1994/1995 (T1). Subsequent surveys were collected every two years for a total of 9 cycles over 16 years: 1996/1997 (T2), 1998/1999 (T3), 2000/2001 (T4), 2002/2003 (T5), 2004/2005 (T6), 2006/2007 (T7), 2008/2009 (T8) and 2010/2011 (T9); the attrition rates (compared with prior cycles) were 9.3%, 6.6%, 7.1%, 7.6%, 7.5%, 5.4%, 9.2% and 6.9% respectively. Cumulatively, after nine cycles, 46.2% of the initial sample either had partial responses, refused to participate, could not be interviewed due to mental or physical health problems (including being institutionalized), or to repeated absences, moved outside of Canada, or were deceased. However, after excluding children (<18 years old, $n = 3159$), the reliance on full information maximum likelihood estimation procedures (FIML, Enders, 2010) to handle missing data allowed us to analyze 14,117 adults. This final analytic sample included 6456 males and 7661 females, with a mean age of 45.83 years ($SD = 18.11$ years; 43.9% were between the ages of 18 – 39, 36.7% were between the ages of 39 – 64, and 19.4% were 65 years or older). Study participants included a representative proportion of individuals in advanced old age. Statistics Canada does not permit the release of the exact age ranges to protect participant confidentiality. There were missing data for some of the study variables across the three waves, ranging from 0.20% to 10.84%. More specifically, of those participants who responded at each of the waves, some did not provide data for level of education at T1 (0.30%), self-esteem scores at T1 (7.60%), T4 (6.54%) and T9 (10.84%), and number of chronic diseases at T1 (0.20%), T4 (2.63%) and T9 (6.07%).

Procedure

Interviews were conducted by Statistics Canada, and the households were selected at the first-time point (1994/1995). One individual over the age of 12 years was randomly selected from each household to be the respondent for all nine assessments. At each assessment, respondents completed a series of questionnaires. These questionnaires were approved by Statistics Canada and developed by expert committees from Health Canada, the Public Health Agency of Canada, and other Canadian government departments. The analyses presented in this paper were conducted at a Canadian Research Data Centre Network (CRDCN) site. Access to the data was obtained through an agreement with the Research Data Centre of Statistics Canada. Statistics Canada analysts reviewed the analyses to verify confidentiality and appropriate use of the study's sampling weight.

Materials

Self-esteem. A subset of six items from the Rosenberg Self-Esteem Scale (Rosenberg, 1986) was used to assess self-esteem at T1, T4, and T9. The six items formed a single dimension (Pearlin & Schooler, 1978) and include the items: "I feel I have a number of good qualities," "I feel that I am a person of worth at least equal to others," "I am able to do things as well as most other people," "I take a positive attitude towards myself," "On the whole I am satisfied with myself," "All in all, I am inclined to feel like a failure." Respondents' answers were provided on a 5-point Likert-type scale (1 = *strongly disagree* to 5 = *strongly agree*). Negative items were reverse scored and self-esteem was calculated by computing a sum score of the 6 items ($\alpha > .85$). Higher values indicated greater self-esteem. Statistically significant positive associations were observed among self-esteem scores across the three measurement points ($r_s > .28, p < .01$).

Chronic disease. Assessed at T1, T4 and T9, participants were asked to indicate the presence of 22 chronic diseases (e.g., arthritis, asthma, diabetes, heart disease, high blood pressure). Respondents' index of chronic disease was calculated as the sum of "yes" responses. Higher values indicated greater numbers

of chronic disease. There were statistically significant positive correlations between number of chronic diseases across time points ($r_s > .51, p < .01$).

Sociodemographic variables. Covariates at baseline were included in the analyses (see Table 1). Sex was self-reported (1 = *male*, 2 = *female*). Education level was assessed by highest level of education attained (1 = *less than secondary school graduation* to 4 = *post-secondary graduation*). Self-reported partnership status was measured by categorizing participants into two groups: 1) married/lives with partner or 2) single/divorced/separated/widowed. Participants also reported their total household income.

Data Analyses

We conducted preliminary analyses using IBM SPSS Statistics software, to describe the sample (by calculating means), examine mean level differences across time (by using ANOVAs), and explore associations between the main constructs (by calculating correlations). Prior to the main analysis, change in self-esteem and chronic disease were calculated as standardized residuals in regression analyses (using IBM SPSS). Change scores for self-esteem and chronic disease from T1 to T4 (and from T4 to T9) were obtained in separate regression analyses by predicting T4 scores from T1 scores (and T9 from T4 scores) and saving the standardized residuals for further analysis. Standardized residuals have been shown to involve fewer psychometric problems than differences scores (Peter, Churchill Jr., & Brown, 1993; Edwards, 1994). We further note that computing residualized change scores prior to the analyses prevents the possibility that certain covariates associated with levels of the main variables could potentially create suppression effects.

Our main hypotheses were tested using standardized change residual variables in cross-lagged panel models that controlled for relevant covariates. These analyses were performed with MPlus 8.0 (Muthén & Muthén, 2017) and the robust Maximum Likelihood estimator, which provided standard errors, tests of statistical significance and model fit indices that are robust to the non-normality of item response and to the complex design (i.e., sampling weights) of the study. Longitudinal sampling weights were provided by the NPHS based on participants in Cycle 1 and adjusted to appropriately reflect the Canadian population (Statistics Canada, 2012). The reliance on sampling weights implies that the results can be representative at the national level. All analyses controlled for relevant socio-demographic covariates such as, sex, education level, total household income, partnership status, and baseline levels of self-esteem and chronic disease.

A cross-lagged panel analysis was conducted to investigate the reciprocal associations between self-esteem changes and chronic disease (from T1 to T4, and from T4 to T9). Given the known oversensitivity of the chi-square test of exact fit to sample size and minor model misspecification (Marsh, Hau & Grayson, 2005), goodness of fit was assessed using the root-mean-square error of approximation (RMSEA), the Comparative Fit Index (CFI), and the Tucker-Lewis Index (TLI).

We then tested whether the reciprocal associations between changes in self-esteem and chronic disease would be moderated by age, using cross-lagged tests of interaction effects. Specifically, interaction terms between age and changes in self-esteem (from T1 to T4), and age and chronic disease (from T1 to T4) were used to predict subsequent changes in self-esteem and chronic disease (from T4 to T9). Significant interaction effects were followed up with simple slope analyses, examining the associations between self-esteem change and chronic disease at specific age points corresponding to young ($SD = -1.15$, age 25), middle ($SD = -.05$, age 45) and older ($SD = 1.06$, age 65) adulthood. These point estimates of the continuous age distribution were selected to facilitate the interpretation of the findings. In our analyses, we used age as a continuous variable.

Results

Preliminary Analyses

Sample characteristics are presented in Table 1. At baseline, participants were on average 46 years old, approximately half of the sample were female, more than half of the sample was married or living with a partner, approximately 55% of the participants had some post-secondary education or higher, and approximately 56% of the participants reported total household incomes of up to \$39,999, with approximately 18% reporting an income greater than \$60,000. Repeated measurement ANOVAs indicated that overall mean levels of our main study variables exhibited a linear pattern from T1 to T9 (see Table 1). Self-esteem declined from T1 to T9, $F(1, 5983) = 624.841, p < .01$, and number of chronic diseases

increased from T1 to T9, $F(1, 6720) = 3269.718, p < .01$.

The zero-order correlations between the main study variables and covariates are presented in Table 2. Overall, declines in self-esteem were associated with increases in chronic disease. In addition, females were less likely to be married or living with a partner, and reported lower levels of income, than males. Those who were married or living with a partner, compared to those who were single, were more likely to have higher levels of education and reported higher levels of income. Older participants were more likely to be female and reported lower levels of education and income, than younger participants. Younger, as compared to older, participants and those with higher, as compared to lower, levels of education and income reported relatively fewer declines in self-esteem (T1 to T4, and T4 to T9) and chronic disease (T1 to T4; and T4 to T9 for younger participants only). Women, as compared to men, were more likely to exhibit declines in self-esteem (from T4 to T9) and reported larger increases in chronic disease (T1 to T4 and T4 to T9).

Reciprocal Associations between Changes in Self-esteem and Chronic Disease

We specified a cross-lagged panel model to examine the reciprocal relations between earlier changes (T1 to T4; across 6 years) and subsequent changes (T4 to T9; across 10 years) in self-esteem and chronic diseases, controlling for age, sex, education level, partnership status, income, and levels of self-esteem and chronic disease at baseline. The standardized cross-lagged model coefficients are presented in Table 3. Significant associations with subsequent changes in self-esteem and chronic disease were evident among the covariates at baseline. Specifically, older participants and participants with lower levels of income, reported greater increases in the number of chronic diseases and greater declines in self-esteem ($|\beta s| > .037, SEs < .024, ps < .022$). Female participants, compared to males, reported greater increases in number of chronic diseases ($\beta = .040, SE = .014, p < .01$). Participants with higher levels of education reported greater increases in self-esteem ($\beta = .096, SE = .017, p < .01$). In addition, baseline (T1) levels of self-esteem predicted subsequent increases in self-esteem (from T4 to T9; $\beta = .216, SE = .018, p < .01$), and baseline (T1) levels of chronic disease predicted subsequent increases in chronic disease (from T4 to T9; $\beta = .131, SE = .020, p < .01$).

The cross-lagged panel model testing the associations between changes in self-esteem and chronic disease is depicted in Figure 1. The results indicated a good fit of the data ($\chi^2 = 4656.810, df = 55, p < .01$; RMSEA = .000; CFI = 1.000; TLI = 1.000). Early increases in self-esteem made it less likely to experience similar increases later ($\beta = -.106, SE = .020, p < .01$). Similarly, early increases in chronic disease made it less likely to experience similar increase later ($\beta = -.203, SE = .019, p < .01$). Changes in self-esteem and chronic disease were negatively correlated with one another across both time intervals (from T1 to T4: $r = -.053, p < .01$; from T4 to T9: $r = -.069, p < .01$).

In addition, the results suggested that the reciprocal main effect of earlier changes in self-esteem on subsequent changes of chronic disease, and vice versa, were not significant ($\beta s < -.032, SEs = .016 - .018, ps > .060$). That said, there was a trend effect that approached significance for the association between earlier changes in self-esteem and later changes in chronic disease ($\beta = -.031, SE = .016, p = .061$), explaining approximately 4% of the variance in changes in chronic disease (T4 to T9). The latter result suggests a cross-lagged trend effect in the entire sample, indicating that declines in self-esteem over the first six years of the study may be associated with subsequent increases in chronic disease over time.

Age Effects of Changes in Self-esteem and Chronic Disease

The next model included interaction terms into the cross-lagged models, examining whether associations between changes in self-esteem and chronic disease differed as a function of age. The results indicated that this model had a satisfactory level of fit to the data ($\chi^2 = 4632.160, df = 78, p < .01, RMSEA = .023, CFI = .997, TLI = .877$). The model revealed two statistically significant interactions: a) age interacted with earlier self-esteem changes in predicting subsequent changes in chronic disease ($\beta = .050, SE = .021, r = .255, p = .020$); and b) age interacted with earlier changes in chronic disease in predicting subsequent changes in self-esteem ($\beta = .047, SE = .023, r = .228, p = .038$). Overall, the predictors accounted for 14.60% of the variance in self-esteem changes (from T4 to T9; $R^2 = .146, SE = .013, p < .01$), and 15.5% of the variance in changes in chronic disease (from T4 to T9; $R^2 = .157, SE = .013, p < .01$).

Figure 2 (left panel) depicts the association between T1 to T4 changes in self-esteem and T4 to T9 changes in chronic disease for ages, 25, 45, and 65. Simple slope analyses (Aiken & West, 1991) indicated

that earlier declines in self-esteem significantly predicted subsequent increases in chronic disease among young adults ($\beta = -.075$, $SE = .019$, $p < .01$), but not among middle-aged ($\beta = -.016$, $SE = .020$, $p = .428$) or older adults ($\beta = .044$, $SE = .039$, $p = .265$). Figure 2 (right panel) depicts the association between T1 to T4 changes in chronic disease and T4 to T9 changes in self-esteem for ages 25, 45, and 65. Simple slope analyses indicated that earlier increases in chronic disease significantly predicted subsequent decreases in self-esteem among young adults ($\beta = -.079$, $SE = .032$, $p = .015$), but not middle-aged ($\beta = -.024$, $SE = .018$, $p = .174$) or older adults ($\beta = .031$, $SE = .029$, $p = .278$).

Discussion

This study investigated the reciprocal association between changes in self-esteem and chronic disease across the adult lifespan. The results suggested relatively small reciprocal and time-lagged associations between changes in self-esteem and chronic disease. These effects, however, were moderated by age, and observed only among young adults, and not among their middle-aged and older counterparts. More specifically, among young adults, earlier declines in self-esteem significantly predicted a subsequent increase in the occurrence of chronic disease; and earlier increases in chronic disease significantly predicted subsequent declines in self-esteem. As such, research on the associations between changes in self-esteem and chronic disease may consider a person's position in the life course to identify how declines in self-esteem can affect subsequent health declines, and vice versa. Of note, this pattern of results was significant after controlling for potential covariates such as sex, partnership status, level of education, total household income, and baseline levels of the included change variables.

The main effects of the cross-lagged panel analyses did not lend much support to the hypothesis that changes in self-esteem and chronic disease would exert reciprocal main effects on one another over time. In the entire sample, the analyses only indicated a small trend effect of earlier declines in self-esteem on subsequent increases in chronic disease, while the reversed main effect was minimal and not significant. This pattern of findings does not provide strong evidence for the possibility that changes in self-esteem and health problems are generally associated with each other (e.g., Orth, Robins, & Widaman, 2012), or that individuals with low self-esteem often experience health-related problems (Trzesniewski et al., 2006, Cott et al., 1999; Sowislo & Orth, 2013).

An explanation for the observed small or non-significant main effects may relate to the inclusion of sociodemographic covariates that can play significant roles in the associations between changes in self-esteem and chronic disease (e.g., Adler et al., 1994). To this end, our results indicated that higher baseline levels of income and education were associated with declines in participants' reported number of chronic diseases and increases in self-esteem. In addition, supplemental analyses suggested that the obtained trend effect of earlier changes in self-esteem on later changes in chronic disease would have been significant ($\beta = -.033$, $SE = .016$, $r = .285$, $p = .046$) if income level was not included in the analyses. As such, it may be difficult to identify significant main effects if a person's low income affects both declines in self-esteem as well as subsequent increases in physical health problems.

Furthermore, we acknowledge that other socio-economic variables, such as employment status, may also play a significant role in the association between self-esteem changes and chronic disease (Leana & Feldman, 1988). Given that older adults normatively retire and employment status is therefore naturally confounded with age, we did not include employment status as a covariate because it could have masked the obtained age effects. We further note that supplemental analyses following a reviewer's request showed that all reported effects remained significant when employment status is added as an additional control to our analyses.

The analyses incorporating age as a moderating factor, however, documented more reliable associations between changes in self-esteem and chronic disease. In fact, our analyses showed that age could qualify the strength of the longitudinal associations between declines in self-esteem and increases in chronic disease. More specifically, our findings revealed reciprocal effects of self-esteem decline on increased physical health problems, and vice versa. However, such an association was found only in young adulthood, and not in midlife or old age. The obtained age effects suggest that it could be particularly problematic for young adults to experience declines in self-esteem or physical health. Such a pattern may occur because young adults who experience self-esteem declines may perceive their development as "off-time," which could exert negative psychological consequences and contribute to the development of chronic

disease (Cohen et al., 2007).

In addition, a discrepancy between young adults' normative expectations, compared to their current self-esteem (Lachman Röcke, Rosnick, & Ryff, 2008), could have a particularly adverse impact on their physical health, since young adults are typically less equipped to effectively cope with circumstances that involve losses (Heckhausen et al., 2010). Such a process may be the starting point of a cascade of maladjustment associated with declines in physical health and self-esteem. Similarly, self-esteem declines may also occur as a function of young adults' health problems, as the onset of chronic disease during this developmental period are least expected or likely to occur. Such non-normative life events could create a negative discrepancy between individuals' expectation and their actual experience (Carver & Scheier, 1990; Higgins, 1987), and jeopardize self-esteem and physical well-being over time if young adults engage in stress-induced psychological processes (e.g., appraising challenges as out of their control, Orth et al., 2009, Rector & Roger, 1997). These results support the hypothesis that age provides a context that qualifies the influence of changes in self-esteem and physical health on subsequent outcomes. This conclusion is consistent with research arguing that contextual changes may influence personality deviations from the normative developmental trajectory, which may contribute to maladaptive personality development and compromise trajectories of physical health (cf. Terracciano, McCrae, Brant & Costa, 2005).

Of note, reciprocal associations between changes in self-esteem and chronic disease were not observed among middle-aged or older adults. Midlife has been identified as a period where many individuals use adaptive motivational strategies and focus on the maintenance and stability of functioning (Lachman, 2004), which could potentially explain the lack of observed effects. Self-esteem declines or increases in chronic disease also did not seem reciprocally related among older adults, even though these two phenomena commonly occur (Robins et al., 2002). This could be the case if declines in self-esteem and the experience of chronic disease are generally more expected in older adulthood and thus become more normative. As such, older adults may be protected if they do not perceive much of a discrepancy between their expectations and personal experiences of loss (cf. Carver & Scheier, 1990; Higgins, 1987). The latter possibility is supported by developmental studies suggesting that older adults' physical health may be protected when they have a "healthy dose of realism" (Chipperfield et al., 2019). In addition, older adults may rely on other adaptive motivational strategies that protect their psychological and physical well-being (e.g., self-protective self-other comparisons, cognitive reappraisals, or goal adjustment, Heckhausen et al., 1993; 2010; John & Gross, 2004). These interpretations are consistent with findings suggesting that although older adults are often faced with developmental declines (Gerstorf et al., 2010, Robins et al., 2002), health-relevant processes, such as their psychological well-being, are typically protected well into the 8th decade of life (e.g., Sutin et al., 2013).

We note that our analyses also showed negative autoregressive associations between changes in the main study variables over time (see Table 2 and Figure 1). These results suggest that the pattern of changes in self-esteem (or physical health) over time may not be linear or cumulative. Instead, they indicate that individuals who experienced much change in self-esteem (or physical health) early in the study were less likely to experience similar changes in self-esteem (or physical health) later on. In this regard, it is interesting to speculate if negative autoregressive associations would continue to emerge if our study had an even longer time frame. For example, participants who experienced much change early on, but not at follow-up, may experience more change again subsequently. This possibility is consistent with our framework, which would predict that the adverse effects of self-esteem changes on physical health, and vice versa, could subsequently reduce individuals' physical health and self-esteem.

Overall, our findings have important implications for research in personality functioning and health within a lifespan developmental context. First, examining normative and non-normative changes in levels of self-esteem and physical health across the adult lifespan illustrate the role of the self as a psychological construct that could be influenced by age-contextual events, such as health problems, and exert influence on important developmental outcomes. To this end, the observed results point to age-differentiated reciprocal effects between changes in self-esteem and chronic disease in young adulthood. As young adults are at an age where the accomplishment of developmental tasks and good health are generally expected (Heckhausen & Krueger, 1993; Neugarten et al., 1968), undesired deviations from these normative trajectories or expectations (Lachman et al., 2008) could create lasting effects on their personality and

health.

Second, our results contribute to literature on self-esteem that calls attention to vulnerable periods in the adult lifespan. Although concerns have been expressed regarding the problematic effects of self-esteem declines in older adulthood (von Soest et al., 2018), the present study suggests that these changes may not be particularly influential. Perhaps there are other processes in older adulthood that are more important for successful development, such as the adjustment of expectations, effective coping or emotion regulation (Carstensen et al., 1999; Heckhausen et al., 2010).

Third, our findings complement the literature on the effects of inter-individual differences in self-esteem levels by providing empirical data on the effects of changes in self-esteem. This may be important, considering that literature reviews have challenged the widely held assumption that high levels of self-esteem are an important predictor of positive life outcomes (Baumeister, Campbell, Krueger, & Vohs, 2003). Our results suggest that changes in self-esteem may represent another important phenomenon that should be further investigated in future research. In addition, it adds to a balanced discussion on the adaptive value of self-esteem (Baumeister et al., 2003) by documenting that self-esteem declines can predict adverse physical health outcomes in some segments of the population (i.e., young adults), but not in others (i.e., middle-aged and older adults).

Finally, our findings could have implications for the timing of interventions that aim to increase individuals' personality functioning and health (Orth et al., 2012). Given the age-related differences in the impact of changes in self-esteem and chronic disease, it seems important to protect young adults' self-esteem by facilitating adaptive coping with non-normative challenges (such as an onset of chronic illness or other unexpected setbacks). Effective interventions could likely result in more positive appraisals of difficult life circumstances, push individuals to seek out external resources, and protect them from potentially entering a downward spiral that could compromise their long-term personality functioning and health. Such interventions, however, may be less effective among older adults, as health problems often become increasingly intractable and many elderly individuals have developed effective skills for coping with age-related losses (Heckhausen et al., 2010).

Limitations and Future Research

Although there are strengths to utilizing a large, longitudinal data set, the present study also presents limitations. First, although the design of our study prevents us from drawing causal inferences, the reported cross-lagged analyses provided some evidence for potential directional effects. To overcome limitations associated with correlational data, experimental studies should be conducted to examine in a developmental context whether self-esteem could be improved and whether such manipulations could be related to increased physical health. Such research may further benefit from measuring objective health-related processes to shed light on the biological mechanisms involved in several chronic diseases (e.g., inflammatory cytokines or cortisol secretion, Cohen et al., 2007).

Second, data from a population-based study frequently rely on a broad array of measures, which only allowed us to speculate about some of the events and processes that could contribute to changes in self-esteem and physical health. Future research should thus include more frequent assessments of specific behavioral and cognitive processes (e.g., expectations or coping) and different developmental events that individuals face across the lifespan (Heckhausen, 1999).

Third, examining age effects involves a potential confound between age and birth cohort. As such, future research should use sequential designs to investigate age and cohort effects (Baltes, 1968). In addition, our analyses only controlled the effects of baseline covariates, and some of these covariates could change over time. To this end, follow-up analyses indicated that time-varying covariates did not impact the interaction analyses such that: a) age interacted with earlier self-esteem changes in predicting subsequent changes in chronic disease ($\beta = .048$, $SE = .021$, $p = .023$); and b) age interacted with earlier changes in chronic disease in predicting subsequent changes in self-esteem ($\beta = .047$, $SE = .023$, $p = .040$). Nonetheless, future work may examine associations with other sociodemographic variables, as our results indicated effects of sociodemographic covariates on both changes in self-esteem and chronic disease. For example, females, participants who reported lower income levels experienced relatively steep increases in chronic disease and declines in self-esteem, and those participants with less education experienced declines in self-esteem. Although these patterns are consistent with previous studies and thus provide validity information

to our data (Jones et al., 2019; Robins et al., 2002; Orth et al., 2012; Matud, 2004; Ross & Wu, 1996), investigating the influence of factors other than age on changes in self-esteem and health could provide additional information for explaining the observed relations between self-esteem and physical health. Research along these lines may further illuminate how normative and non-normative changes in self-esteem and disease may influence successful development across the lifespan.

Conclusions

This study examined associations between changes in self-esteem and chronic disease across the adult lifespan. Reciprocal longitudinal associations between declines in self-esteem and increases in chronic disease were identified, but only among young adults, and not among middle-aged and older adults. These findings suggest that self-esteem declines or the experience of chronic disease can become most important when they are not normatively expected, as in young adulthood, and may be used to develop age-appropriate interventions that target self-esteem and physical health to improve successful development across the adult lifespan.

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Table 1. Means, Standard Deviations, and Frequencies of Main Study Variables ($N = 14,117$)

Constructs	M (<i>SD</i>) or Percentage ^a			
Age (T1)	45.83 (18.11)			
Young adults: 18 – 39 years old (%)	43.90			
Middle-aged: 40 – 64 years old (%)	36.70			
Older adults: 65+ years old (%)	19.40			
Female (%)	54.30			
Education Level (%; T1)				
Less than secondary school graduation	29.60			
Secondary school graduation	15.20			
Some post-secondary	25.00			
Post-secondary	29.90			
Not stated/missing data	0.30			
Partnership Status (%; T1)				
Married/Common-law/Living with partner	58.20			
Single/Separated/Divorced/Widowed	41.80			
Income (%; T1)				
< \$15, 000	18.20			
Up to \$39,999	38.40			
Up to \$59,999	21.00			
> \$60,000	17.80			
Not stated/missing data	4.50			
		Young adults	Middle-aged	Older adults
Self-Esteem				
T1; $n = 13,048$	19.97 (3.01) ^{b, d}	19.96 (3.01)	20.08 (3.08)	19.77 (2.89)
T4; $n = 10, 268$	19.30 (2.69) ^{b, c}	19.55 (2.75)	19.16 (2.64)	18.86 (2.51)
T9; $n = 6,687$	19.13 (2.70) ^{c, d}	19.56 (2.83)	18.79 (2.50)	17.81 (2.08)
Chronic disease				
T1; $n = 14,092$	1.21 (1.50) ^{b, d}	.80 (1.16)	1.25 (1.49)	2.06 (1.78)
T4; $n = 10, 698$	1.52 (1.65) ^{b, c}	1.05 (1.31)	1.71 (1.70)	2.48 (1.92)
T9; $n = 7,045$	2.17 (1.92) ^{c, d}	1.60 (1.61)	2.65 (2.01)	3.31 (2.01)

Notes. M = mean, SD = standard deviation. ^a M and SD are presented for continuous variables. ^b significant mean level difference between T1 and T4 variables, $|t| > 22.03$, $ps < .01$. ^c significant mean level difference between T4 and T9 variables, $|t| > 9.70$, $ps < .01$. ^d significant mean level difference between T1 and T9 variables, $|t| > 58.20$, $ps < .01$.

Table 2.
Zero-Order Correlations Between Main Study Variables ($N = 14,117$)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age											
2. Female	.057**										
3. Education level	-.256**	-.003									
4. Partnership status ^a	-.030**	.079**	-.035**								
5. Income	-.209**	-.102**	.323**	-.344**							
6. Self-esteem (T1)	-.017	-.031**	.117**	-.063**	.134**						
7. Chronic disease (T1)	.322**	.134**	-.098**	.075**	-.165**	-.108**					
8. Δ Self-esteem (T1 to T4)	-.101**	-.001	.112**	-.016	.104**	.000	-.095**				
9. Δ Self-esteem (T4 to T9)	-.199**	-.035**	.125**	.021	.109**	.219**	-.090**	-.064**			
10. Δ Chronic disease (T1 to T4)	.192**	.129**	-.056**	-.001	-.077**	-.030**	.000	-.053**	-.071**		
11. Δ Chronic disease (T4 to T9)	.232**	.057**	-.068**	-.015	-.058**	-.029*	.175**	-.057**	-.124**	-.129**	

Notes. ^a Partnership status was coded as 1 = Married/Living with partner, 2 = Single/Separated/Divorced/Widowed. * $p < .05$. ** $p < .01$.

Table 3. Standardized Cross-lagged Model Coefficients ($N = 14,117$)

	Δ Chronic disease (T4 to T9)		Δ Self-esteem (T4 to T9)	
	β	SE	β	SE
Model 1: Main effects				
Age (T1)	.315**	.021	-.267**	.024
Female	.041**	.014	.000	.017
Education level (T1)	-.025	.016	.095**	.017
Partnership status ^a (T1)	.014	.016	-.015	.020
Income (T1)	-.037*	.016	.059**	.020
Self-esteem (T1)	-.018	.016	.216**	.018
Chronic disease (T1)	.131**	.020	-.020	.022
Δ Self-esteem (T1 to T4)	-.031	.016	-.106**	.020
Δ Chronic disease (T1 to T4)	-.203**	.019	-.026	.018
Model 2: Interactions				
Δ Self-esteem T1-T4 X Age	.050*	.021	---	---
Δ Chronic disease T1-T4 X Age	---	---	.047*	.023

Notes. Partnership status was coded as 1 = Married/Living with partner, 2 = Single/Separated/Divorced/Widowed. * $p < .05$. ** $p < .01$.

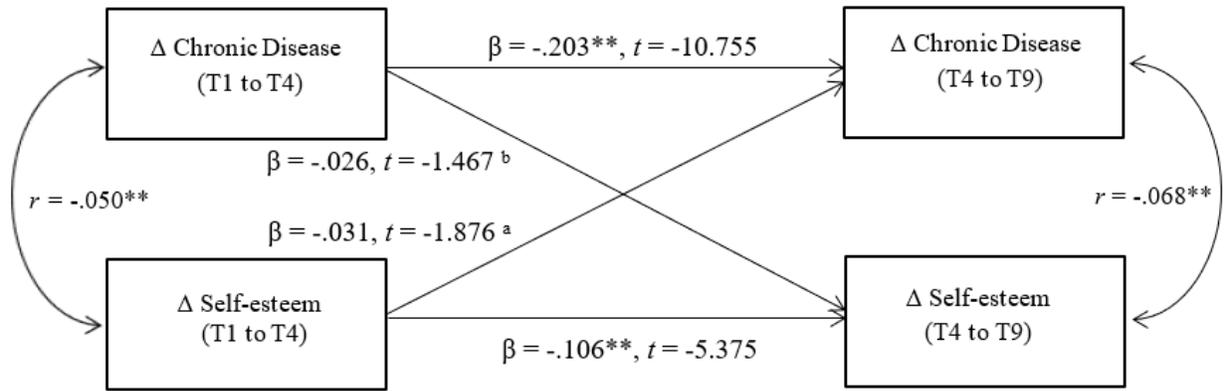


Figure 1. Standardized coefficients in a cross-lagged panel model testing the reciprocal associations between changes in self-esteem and chronic disease, controlling for sex, education level, income level, partnership status, and baseline levels of self-esteem and chronic disease (see Table 3 for covariate effects). ^aEffect size calculated with t value, $df = 77$, $r = .209$. ^bEffect size calculated with t value, $df = 77$, $r = .027$. * $p < .05$. ** $p < .01$.

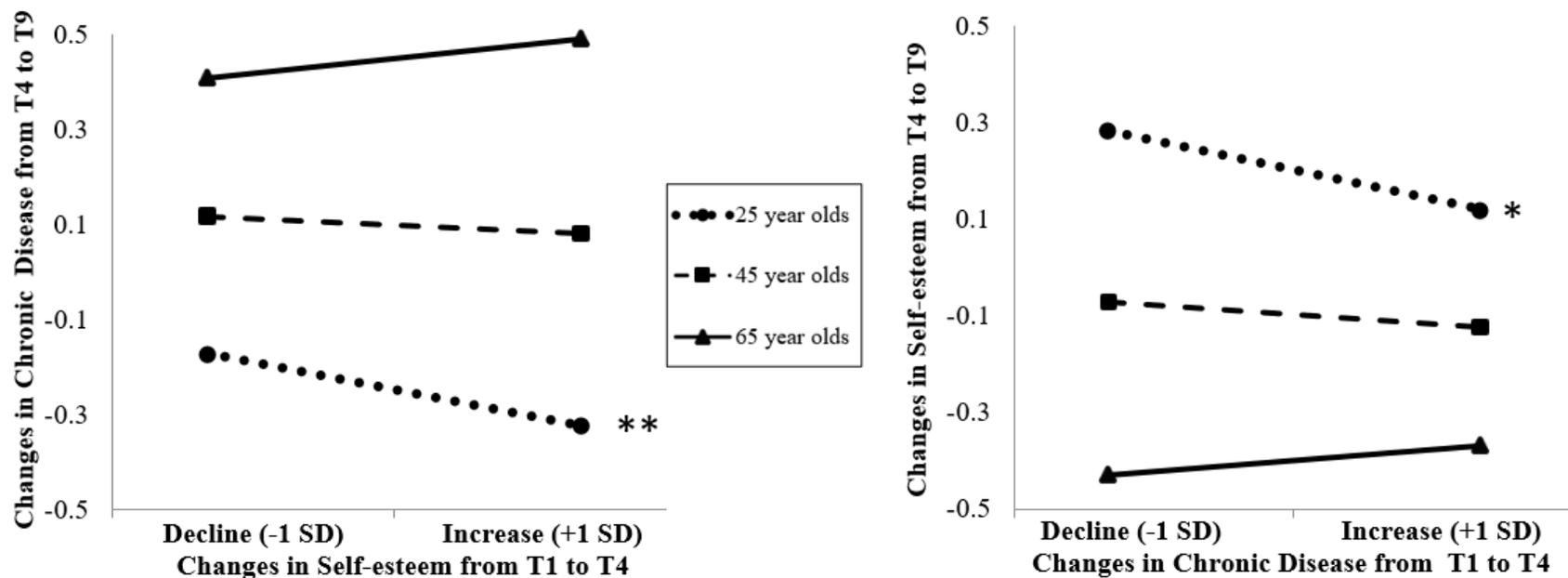


Figure 2. Left panel: Association between self-esteem change (T1 to T4) and changes in chronic disease (T4 to T9). Right panel: Association between changes in chronic disease (T1 to T4) and self-esteem changes (T4 to T9), estimated for young (25 years), middle-aged (45 years), and older (65 years) participants. * $p < .05$. ** $p < .01$