Health Adversity and Value Change

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Abstract

Lifespan theories of human development assert that people prioritize emotional values over informational values when they believe their time is limited. This process unfolds naturally as people age but may be accelerated by life-threatening events. We tested whether the experience of serious health adversity leads to changes in value orientation. Using 10 annual waves of data from a nationally representative sample, we charted the course of value change in 247 individuals who experienced serious health adversity in comparison to a propensity-score matched group of 714 healthy individuals. Although there were no differences in values related to friendship and love for those with and without health adversity, we found that the importance of social recognition declined in the face of health problems and continued to recede thereafter. This finding is consistent with folk wisdom about value changes in the face of mortality.

Personal values are abstract beliefs about desirable goals that transcend situations and serve as guiding principles in people's lives (Rokeach, 1973; Schwartz, 1992). Although values are by nature relatively stable, there is growing evidence for systematic changes in value orientations over the lifespan (Vecchione et al., 2016), especially in late adulthood (Ritter & Freund, 2014; Brandtstädter et al., 2010).

Several theories have tried to account for changes in value orientations across the lifespan (Baltes, Lindenberger, & Staudinger, 2006; Carstensen, Isaacowitz, & Charles, 1999; Heckhausen, 1997). A core assumption of these approaches is that people adjust their values to changes in relevant resources. A particularly important and ever-changing resource is time. For instance, socioemotional selectivity theory (SST, Carstensen, Isaacowitz, & Charles, 1999) asserts that, when people perceive their time as limited, they prioritize intrinsic values involving emotional meaning over long-term goals related to acquiring information, assets, and status. This shift towards emotional values is thought to serve an important regulatory function when the attainment of future goals becomes less likely (Brandtstädter et al., 2010).

Decreases in people's future time perspective unfold naturally as people age. However, this process can be accelerated by life-threatening events such as serious health adversity (Carstensen et al., 2011; Fung, Carstensen, & Lutz, 1999; Sullivan-Singh et al., 2015). The experience of a heart attack, for example, may radically impact people's time perspective via an increased recognition of one's own mortality (Löckenhoff & Carstensen, 2004). Past research provided initial evidence for links between health adversity and changes in value orientation. For example, Carstensen and Fredrickson (1998) found that HIV positive and symptomatic men placed greater weight on emotional closeness than HIV negative or asymptomatic men.

However, past research has been constrained by methodological issues related to the modeling of the longitudinal interplay between health adversity and values. A first complexity involves the shape of the value trajectory. Existing studies have often relied on two-wave designs that limit developmental analyses to linear change models. These models can test whether value orientations of individuals who experience health adversity increase or decrease in a linear fashion. However, value changes following health adversity may not always be linear (Bleidorn, Hopwood, & Lucas, 2018; Luhmann, Orth, Specht, Kandler, & Lucas, 2014). For instance, people may become disconnected to others immediately after the onset of serious health problems because they feel depressed or lose energy. In this case, the period around the diagnosis would be associated with sudden decreases in both emotional and informational values as individuals cope with the immediate consequences of health adversity. Gradual changes in emotional vs. informational values may initiate after such an initial shock period. Longitudinal multi-wave data are needed to chart possible discontinuous trajectories of value change.

A second complexity involves the timing of assessments. Value changes may already occur before the recognition of health adversity as people anticipate health issues or suffer from precursory symptoms. Studies that only measure participants' value change after the onset of health adversity cannot disentangle pre- and post-adversity changes. Prospective studies that measure people's value orientation at multiple occasions *before* and *after* the onset of health adversity are needed to address this issue.

Third, value change may be driven by variables unrelated to health adversity, such as age-graded biological maturation or historical events. The inclusion of a control group is

necessary to isolate the specific effects of health adversity on changes in value orientation. Given that individuals cannot be randomly assigned to experience health adversity, statistical matching techniques must be employed to rule out the effects of these variables as best as possible. Changes in value orientation can then be compared between these two groups to rule out alternative explanations (Thoemmes & Kim, 2011; van Scheppingen et al., 2016).

The Present Study

We used 10 waves of annual health and value assessments in a nationally representative sample of Dutch individuals with and without serious health problems (cancer, heart attack, stroke, Parkinson's disease) to test the impact of health adversity on value trajectories in a manner that overcomes limitations of previous research on post-adversity value change. Our study had three specific aims (see <https://osf.io/2utwc> for a pre-registration of the hypotheses and analysis plan).

First, we charted the trajectories of two emotional (*mature love; true friendship*) and two informational (*social recognition; accomplishment*) values in individuals who experienced serious health adversity. Consistent with lifespan theories of human development (e.g., Carstensen et al., 1999; Heckhausen, 1997), we predicted that the onset of serious and potentially life-threatening health problems would lead to a shift in people's time perspective and thus initiate changes in value orientations. We expected increases in emotional values such as *love* and *friendship* among people with serious health issues because these values offer immediate emotional gratification. We predicted decreases in informational values that are associated with future payoff, such as *achievement* or *social recognition*, when faced with serious health issues. We hypothesized that these value changes unfold discontinuously.

Specifically, we predicted that the initial shock of a life-threatening diagnosis will be associated with temporal declines in both value domains followed by gradual increases in emotional values and decreases in informational values.

Second, we tested moderators of value change following health adversity. We expected that individuals who were more impacted by their illness would be less optimistic about their future. As such, we predicted a stronger connection between health adversity and value change for individuals who experienced negative shifts in their subjective health and life expectancy after the onset of health adversity. We further predicted that individuals who score high in the interpersonal traits of extraversion and agreeableness would experience more pronounced increases in emotional values following health adversity. Although a basis for strong hypotheses about other moderators was not available in the literature, we explored the effects of other psychological and demographic variables that may shape the link between health adversity and value change.

Third, we tested whether post-adversity value changes differed from value changes in healthy individuals. We expected normative age-graded increases in emotional values and decreases in informational values in both participants with and without health adversity. However, value changes should be accelerated by the experience of serious health adversity. Specifically, we predicted more pronounced increases in emotional values and more pronounced decreases in informational values in individuals who experienced serious health adversity compared to a matched control group of healthy individuals.

Method

Sample

Data came from the Longitudinal Internet Studies for the Social Sciences (LISS) panel, which followed a representative sample of the Dutch population from 2008 to 2018 (Scherpenzeel, Das, Ester, & Kaczmirek, 2010). LISS participants completed annual online surveys on various topics including their health and value orientations. For the purpose of the present study, we excluded participants a) younger than 18 or older than 70 years at baseline, b) who provided no data on their health status, age, gender or value orientations throughout the study period, or c) who reported that they suffered from a serious health issue *before* entering the study. These exclusions resulted in a relevant sample size of 8,203 participants. From this pool of participants, we selected a group of participants who experienced serious health adversity during the research period and a propensity-matched control group of healthy participants (see below).

We have used LISS data in previous studies (Bleidorn & Schwaba, 2018; Denissen, Luhmann, Chung, & Bleidorn, 2018; Schwaba & Bleidorn, 2018; Schwaba & Bleidorn, 2019; Schwaba, Luhmann, Chung, Denissen, & Bleidorn, 2018) to examine the development of personality traits and self-esteem over the life span and in response to major life events. None of these studies have analyzed changes in value orientation following health adversity (<http://dataarchive.lissdata.nl/publications>).

Health Adversity Group

At each assessment wave, participants answered the question “*Has a physician told you this last year that you suffer from one of the following diseases/problems?*”. Starting at the 2nd assessment, we coded “yes” responses to four pre-registered options as indicating the onset of a serious health adversity, resulting in a sample of 247 participants (age in years: $M = 55.80$, SD

= 11.15) who reported being diagnosed with: 1) *“a heart attack including infarction or coronary thrombosis or another heart problem including heart failure”*; 2) *“a stroke or brain infarction or a disease affecting the blood vessels in the brain”*; 3) *“cancer or malignant tumor, including leukemia or lymphoma, but excluding less serious forms of skin cancer”*; 4) *“Parkinson’s disease”* (see Table 1). Unlike other options such as *“asthma”* or *“a broken bone”*, these four diagnoses were identified as potentially life threatening.

Healthy Control Group

A total of 4,943 participants reported that they had *“no diseases or health problems”* across all assessment waves. To create a matched control group from this pool, we estimated propensity to experience serious health adversity using 19 psychological, demographic, and health variables (see Table 2). We then used the R package MatchIt (Ho, Imai, King, & Stuart, 2006) to select healthy participants who were most similar in their propensity to experience health adversity to those in the health adversity group. To maximize the size of the control group and to increase overall statistical power, we matched each participant in the health adversity group to the 4 most similar healthy participants, with replacement. To ensure that matches were sufficiently similar to participants with health adversity, we pruned matches with a caliper distance of .2 or greater (Thoemmes & Kim, 2011). Our final control group was composed of 714 participants (age in years: $M = 55.94$, $SD = 12.87$). We used independent t-tests to test whether participants in the health adversity group differed from the matched control group in any of the covariates. Of the 22 tests, two were significant suggesting that participants in the health adversity group were older ($t(485.04) = 3.95$, $p < .001$, $d = .27$) and

reported lower subjective health ($t(399.70) = -2.36, p = .02, d = .18$) than participants in the matched control group.

Table 1. *Mean-levels and standard deviations of emotional and informational values in participants who experienced health adversity.*

Time period	N	True friendship	Mature love	Accomplishment	Recognition
-9 years	43	6.37 (0.82)	6.00 (0.87)	5.21 (1.15)	4.72 (1.05)
-8 years	45	6.09 (1.04)	6.07 (0.94)	5.09 (1.38)	4.73 (1.05)
-7 years	12	6.42 (0.51)	6.25 (0.62)	5.17 (0.94)	5.08 (0.90)
-6 years	54	5.93 (1.08)	5.89 (1.08)	4.89 (1.14)	4.70 (1.21)
-5 years	56	6.02 (1.1)	5.98 (1.02)	5.38 (1.29)	4.91 (1.39)
-4 years	107	6.14 (1.18)	5.93 (1.06)	5.15 (1.13)	4.69 (1.25)
-3 years	138	6.03 (1.26)	5.70 (1.30)	5.06 (1.25)	4.61 (1.36)
-2 years	89	5.97 (1.40)	5.80 (1.31)	5.27 (0.96)	4.69 (1.43)
-1 year	60	6.37 (0.96)	6.03 (1.06)	5.18 (1.23)	4.73 (1.25)
Year of onset	247	6.06 (1.1)	5.84 (1.09)	4.90 (1.20)	4.63 (1.31)
+1 year	58	5.78 (1.48)	5.83 (1.09)	5.05 (1.23)	4.52 (1.58)
+2 years	80	6.05 (1.11)	5.69 (1.23)	4.81 (1.34)	4.30 (1.44)
+3 years	35	5.86 (1.29)	5.86 (1.19)	5.00 (1.21)	4.69 (1.39)
+4 years	85	6.05 (1.13)	6.00 (0.96)	5.01 (1.11)	4.46 (1.5)
+5 years	40	6.08 (0.94)	6.00 (0.91)	4.5 (1.11)	4.47 (1.28)
+6 years	31	5.87 (1.20)	5.16 (1.49)	4.84 (1.59)	4.03 (1.62)
+7 years	30	6.07 (1.20)	5.87 (1.11)	4.63 (1.00)	4.27 (1.36)

Note. Time period = years from onset of serious health adversity.

Measures

Values. Values were measured annually using the Rokeach Value Survey (Rokeach, 1973). Participants indicated which values act as a guiding principle in their life using a 7-point Likert scale (1= *extremely unimportant* – 7= *extremely important*). We pre-registered analyses of two emotional / present-oriented values: “*true friendship*” and “*mature love*” and two informational / future-oriented values: “*a sense of accomplishment*” and “*social recognition*”

that corresponded most closely to the SST conceptualization of these categories (see Table 1 and Table S1 and S3 in the Supplementary Online Materials [SOM] for descriptive statistics and intercorrelations).

Moderators. We examined the moderating effects of 3 time-invariant and 6 time-varying variables (see Table 2). Gender (0=male, 1 = female), age, and perceived change in life expectancy at onset of health adversity were modeled as time-invariant moderators. The latter was operationalized using the item: *“How would you rate your chance of living to be 80 years old or older? Please rate your chance on a scale from 0 to 10, where 0 means ‘no chance at all’ and 10 means ‘absolutely certain’.”* We computed the difference between participants’ average scores on this variable across all available assessments before vs. after the onset of health adversity as shift in subjective life expectancy, with negative scores indicating a negative shift in perceived life expectancy following health adversity.

The Big Five traits openness to experience, conscientiousness, extraversion, agreeableness, and emotional stability were assessed using the 50-item International Personality Item Pool Big Five scale (IPIP-50, Goldberg, 1992). Each domain was assessed as the mean of 10 items and responses were made on a 5-point Likert scale (1= *very inaccurate* – 5 = *very accurate*). Alpha consistencies ranged from .74 to .86 at first measurement occasion (omega reliability: .54-.72; see Table S2 in the SOM for more information). Subjective health was measured using the item *“How would you describe your health, generally speaking?”* (1= *‘poor’* - 5 = *‘excellent’*). We included these variables as time-varying moderators.

Table 2. *Mean-levels (and standard deviations) of covariates in participants who experienced health adversity and healthy participants before and after propensity-score matching.*

	Health adversity group (N = 247)	Matched healthy group (N = 714)	All healthy participants (N = 4,943)
True Friendship	6.16 (1.06)	6.16 (1.09)	6.05 (1.12)
Mature Love	5.91 (1.14)	5.94 (1.09)	6.01 (1.04)
Accomplishment	5.19 (1.23)	5.13 (1.20)	5.00 (1.26)
Social Recognition	4.70 (1.33)	4.65 (1.46)	4.76 (1.40)
Extraversion	3.27 (0.62)	3.28 (0.62)	3.32 (0.64)
Agreeableness	3.92 (0.44)	3.92 (0.50)	3.86 (0.51)
Conscientiousness	3.83 (0.48)	3.79(0.50)	3.69 (0.52)
Emotional Stability	3.48 (0.68)	3.48 (0.66)	3.48 (0.66)
Openness	3.47 (0.50)	3.49 (0.49)	3.54 (0.49)
Satisfaction with Life	5.19 (1.12)	5.23 (1.06)	5.18 (1.01)
Self-Esteem	5.73 (0.93)	5.71 (1.01)	5.68 (0.97)
Age	55.80 (11.15)	52.42 (12.76)	40.69 (13.44)
Female	0.48 (0.50)	0.49 (0.50)	0.53 (0.50)
Employed	0.48 (0.50)	0.56 (0.50)	0.69 (0.50)
College Educated	0.50 (0.50)	0.52 (0.50)	0.59 (0.50)
Subjective Health	3.27 (0.76)	3.40 (0.70)	3.47 (0.72)
Ever Smoked	1.32 (0.47)	1.36 (0.48)	1.47 (0.50)
Alcohol Consumption	3.79 (2.28)	3.85 (2.07)	4.40 (1.98)
Body Mass Index	25.78 (3.70)	25.37 (3.65)	24.45 (3.77)
Financial Hardship	3.51 (2.18)	3.46 (1.96)	3.42 (1.94)
Exercise	0.51 (.50)	0.55 (0.50)	0.61 (0.49)
Change in life expectancy	-.95 (2.29)	---	---
Propensity to experience health adversity	.13	.13	.04

Note. Mean-levels and standard deviations correspond to the first measurement occasion. Change in life expectancy = perceived change in chances of living to 80 years or older (this variable was not included in propensity-score matching analyses).

Analyses

We conducted multilevel model analyses in R version 3.3.3 (R core team, 2017) using the package nlme (Pinheiro, Bates, DebRoy, & Sarkar, 2014) and visualized results using the package ggplot2 (Wickham, 2016). We used -2 loglikelihood difference tests to compare fits of nested models and the Bayesian Information Criterion (BIC; Duncan, Duncan, & Stryker, 2013) to compare fits of non-nested models. We used the multiple-group option in Mplus (Version 8, Muthén & Muthén, 2012) and χ^2 difference tests based on log-likelihood values and scaling correction factors obtained with the MLR estimator (Satorra, 2000) to test whether the best-fitting post-adversity value trajectories in the health adversity group were different from the trajectories in the propensity-score matched control group. R and Mplus scripts that allow researchers with access to the LISS dataset to reproduce all results are available at

<https://osf.io/6br3j/>

Results

Is Health Adversity Associated with Changes in Subjective Life Expectancy?

As an initial manipulation check, we examined whether onset of health adversity was associated with changes in a participants' subjective perception of living to age 80 or older. The mean-level of this variable was $M = -.95$ ($SD = 2.29$; 95% CI $[-.62, -1.28]$), indicating that, on average, participants felt that their chances of living to be 80 years or older dropped by 9.5% after the onset of health adversity.

Value Changes Following Health Adversity

To estimate changes in values before and after the experience of health adversity, we estimated a series of multilevel change models. In these models, measurement occasions were nested within participants, allowing us to chart the trajectory of each participant's values over time and examine the mean developmental trajectory pooled across participants. Value scores were grand-mean standardized in order to facilitate interpretation of results. We centered participants' scores on the year at which they reported the onset of a health adversity, scaling time in these models equivalent to years before or after the onset of adversity. We used model comparison tests to identify the change models that best captured the shape of change in each of the four value orientations (see Table S4, SOM).

Figure 1 shows the hypothetical models tested. The first two models (1a, 2a) would indicate no effect of health adversity. The only parameter in model 1a is a random intercept indicating no change before or after the onset of health adversity. Model 2a includes a random intercept and a random slope indicating linear value change across time; however, this change would be independent of the onset of health adversity. The remaining models expand on these models and would indicate an effect of health adversity on value change. Specifically, Models 1b and 2b include a second intercept that reflects sudden shifts (drop or rise) in value levels after the onset of health adversity. Models 1c and 2c include random post-onset slopes that indicate gradual value changes (increase or decrease) following health adversity that are different from any change prior to health adversity. Models 1d and 2d indicate both a sudden shift (drop or rise) and gradual changes following the onset of health adversity. In addition to the eight hypothetical models depicted in Figure 1, we also tested quadratic extensions of each change model.

We predicted that model 2d would best describe the value trajectories during health adversity. That is, we expected participants to show normative age-graded increases in emotional values and decreases in informational values before the onset of health adversity, sudden declines in all four value domains at the onset of health adversity, followed by linear decreases in informational values and linear increases in emotional values. Parameter estimates for the best fitting models are presented in Table 3 and Figure 2.

Figure 1. *Hypothetical models of value change before, at, and after the onset health adversity (adapted from Schwaba and Bleidorn, 2018 and Doss et al., 2009.) Dashed lines indicate onset of health adversity and solid lines indicate possible change trajectories. In the fitted models, pre-and post-onset trajectories as well as sudden level shifts could have been positive or negative in direction.*

Emotional Values

Fixed effects were not significant for the true friendship model, indicating that health adversity was not significantly associated with average changes in true friendship (similar to model 1a in Figure 1). However, we found significant random effects indicating individual differences in change in valuing true friendship before and at the onset of health adversity (see Table 3 and Figure 2A).

Changes in mature love were best described by a trajectory similar to model 2a in Figure 1, suggesting that participants experienced significant linear decreases in this value throughout the study period. Although the fixed effect of the level shift at the onset of health adversity was not significant, the random effect of the level shift was significant, indicating significant individual differences in change in endorsement of this value at the onset of health adversity (see Figure 2B).

Informational Values

Changes in *sense of accomplishment* were best captured by model 1b, indicating pre- and post-onset stability together with a sudden level shift at the onset of health adversity (Figure 2C). Specifically, the fixed effect suggested that the average participant experienced a sudden decrease of a fifth of a standard deviation in this value at the onset of health adversity. Changes in *social recognition* were best described by model 1c indicating stable levels before the onset of health adversity followed by significant gradual decreases after the onset of health adversity (Figure 2D).

Table 3. *Parameter estimates for best-fitting change models in participants with serious health adversity.*

Value	Parameter	β	95% CI	p	SD random effect	95% CI of random effect
True Friendship	Intercept	-0.016	[-0.188, 0.072]	.854	0.942	[0.781, 1.136]
	Linear Δ before onset	-0.016	[-0.048, 0.000]	.310	0.083	[0.046, 0.150]
	Level Δ at onset	-0.028	[-0.188, 0.054]	.731	0.654	[0.449, 0.953]
Mature Love	Intercept	-0.096	[-0.245, -0.020]	.208	0.891	[0.747, 1.062]
	Linear Δ before and after onset	-0.034**	[-0.058, -0.021]	.007	0.091	[0.060, 0.138]
	Level Δ at onset	0.08	[-0.073, 0.158]	.307	0.555	[0.332, 0.929]
Accomplishment	Intercept	0.11	[0.006, 0.164]	.039	0.680	[0.595, 0.777]
	Level Δ at onset	-0.214***	[-0.318, -0.161]	<.001	0.440	[0.321, 0.603]
Social Recognition	Intercept	0.041	[-0.053, 0.089]	.394	0.636	[0.562, 0.720]
	Linear Δ after onset	-0.056***	[-0.084, -0.041]	<.001	0.070	[0.036, 0.135]

Note. Table shows parameters included in the final best-fitting models. Time in units of years. ** = $p < .01$, *** = $p < .001$.

Figure 2. Best fitting change models for emotional and informational values before and after the onset of serious health adversity. Standardized scores ($M = 0$ and $SD = 1$). Dotted lines reflect 95% confidence intervals. ** = $p < .01$ *** = $p < .001$.

Moderators of Value Change Following Health Adversity

To examine moderators of value change after health adversity, we estimated additional models that included four parameters: a random intercept, which modeled stable levels of values at the onset of adversity, a moderator term, which modeled associations between the moderator and values at the onset of adversity, a random slope, which modeled change in values post-adversity, and an interaction term between time and the moderator variable, which modeled associations between the moderator and change in values following adversity. Continuous variables were standardized to facilitate interpretation of effects. In cases where moderator variables varied within participants over time (e.g., subjective health), the moderator was modeled as a random variable. We examined each moderator variable in a separate model.

Regarding associations between moderators and *levels of values*, we found that participants who were female and more extraverted, agreeable, conscientious, and emotionally stable valued *true friendship* more at the onset of adversity. Participants who were more extraverted, agreeable, conscientious, and open reported higher levels of *mature love* at the onset of adversity. Participants who were more extraverted, conscientious, and open valued a *sense of accomplishment* more at the onset of adversity. Male participants and participants who were more extraverted and open reported higher levels of *social recognition* at the onset of adversity.

Regarding associations between moderators and *change in values*, only two of the 36 associations tested were significant. Emotionally stable participants experienced less pronounced decreases in *social recognition* following health adversity, and women experienced

less pronounced decreases in *mature love* following health adversity. Given the relatively large number of exploratory tests, we caution against interpreting these effects prior to replication in future research.

Are Post-Adversity Value Changes Different from Value Changes in Healthy Individuals?

We used multiple-group multilevel models to test whether post-adversity value trajectories were different from value trajectories in the propensity-matched control group of healthy participants. We centered the data of the control group at the median time of onset of health adversity elapsed from the health adversity group. Model comparison tests (Table 5) indicated no significant group differences in value trajectories for *true friendship*, *mature love*, and *sense of accomplishment*. However, we found significant differences in the groups' trajectories of *social recognition*. Specifically, in contrast to the significant decreases observed in participants with health adversity, we found stable levels of *social recognition* in the matched control group (Table S5, SOM).¹ We visualize these different trajectories in Figure 3.

¹ We present analyses for two additional emotional values “inner harmony” and “happiness” in the SOM. These analyses were requested in review and not preregistered in our initial analysis plan. Results generally replicated the results obtained for the pre-registered value domains.

Table 4. *Moderators of value trajectories in participants with serious health adversity.*

Moderator	Intercept	[95% CI]	<i>p</i>	Slope	[95% CI]	<i>p</i>
True Friendship						
Age	0.00	[-0.01, 0.01]	.872	0.01	[0.00, 0.01]	.061
Female	0.25	[0.06, 0.35]	.009**	0.03	[-0.02, 0.06]	.267
Change in time	0.01	[-0.04, 0.04]	.621	0.01	[-0.01, 0.02]	.070
Subjective Health	-0.02	[-0.09, 0.01]	.469	-0.01	[-0.04, 0.01]	.748
Extraversion	0.17	[0.09, 0.21]	.001***	-0.02	[-0.04, -0.01]	.170
Agreeableness	0.20	[0.12, 0.25]	.001***	0.01	[-0.012, 0.02]	.468
Conscientiousness	0.10	[0.02, 0.14]	.014*	0.02	[-0.01, 0.03]	.170
Emotional Stability	0.12	[0.04, 0.16]	.003**	0.01	[-0.02, 0.02]	.665
Openness	0.07	[-0.01, 0.12]	.075	0.02	[-0.01, 0.03]	.159
Mature Love						
Age	-0.01	[-0.02, 0.00]	.093	0.00	[-0.00, 0.00]	.397
Female	-0.00	[-0.20, 0.10]	.991	0.07	[0.01, 0.09]	.020*
Change in time	0.02	[-0.03, 0.04]	.526	0.01	[-0.01, 0.02]	.224
Subjective Health	-0.01	[-0.07, 0.03]	.975	0.02	[-0.01, 0.04]	.205
Extraversion	0.16	[0.08, 0.21]	.001***	-0.02	[-0.05, 0.00]	.193
Agreeableness	0.16	[0.08, 0.20]	.001***	0.01	[-0.02, 0.02]	.472
Conscientiousness	0.10	[0.01, 0.14]	.022*	0.01	[-0.01, 0.03]	.273
Emotional Stability	0.04	[-0.04, 0.08]	.317	0.01	[-0.02, 0.03]	.398
Openness	0.15	[0.07, 0.19]	.001**	-0.01	[-0.04, 0.01]	.512
Accomplishment						
Age	0.00	[-0.01, 0.01]	.653	0.00	[-0.01, 0.01]	.325
Female	-0.17	[-0.37, -0.08]	.078	0.04	[-0.01, 0.07]	.090
Change in time	0.02	[-0.03, 0.04]	.559	0.04	[-0.01, 0.01]	.552
Subjective Health	0.01	[-0.06, 0.05]	.751	-0.02	[-0.04, 0.01]	.897
Extraversion	0.14	[0.06, 0.18]	.001***	-0.02	[-0.05, -0.01]	.125
Agreeableness	0.02	[-0.06, 0.06]	.574	-0.01	[-0.04, 0.00]	.465
Conscientiousness	0.14	[0.06, 0.18]	.001***	-0.01	[-0.03, 0.01]	.635
Emotional Stability	0.07	[-0.01, 0.11]	.092	0.00	[-0.02, 0.02]	.878
Openness	0.14	[0.05, 0.19]	.002**	0.01	[-0.03, 0.01]	.970
Recognition						
Age	0.00	[-0.01, 0.00]	.601	0.00	[-0.00, 0.00]	.410
Female	-0.22	[-0.41, 0.13]	.021*	0.03	[-0.03, 0.06]	.287
Change in time	0.04	[-0.01, 0.06]	.135	0.01	[-0.01, 0.02]	.182
Subjective Health	-0.02	[-0.08, 0.02]	.647	0.01	[-0.02, 0.03]	.584
Extraversion	0.16	[0.08, 0.21]	.001***	-0.02	[-0.04, 0.00]	.257
Agreeableness	0.01	[-0.07, 0.04]	.890	0.00	[-0.03, 0.02]	.878
Conscientiousness	0.05	[-0.03, 0.09]	.230	0.00	[-0.02, 0.02]	.737
Emotional Stability	-0.03	[-0.11, 0.01]	.514	0.03	[0.00, 0.04]	.040*
Openness	0.12	[0.04, 0.17]	.004**	0.00	[-0.03, 0.02]	.996

Note. Change in time = perceived change in chances of living to 80 years or older. Intercept reflects value level at onset of health adversity. Slope reflects post-adversity slope.

Table 5. *Multiple-group tests comparing value trajectories between participants who experienced health adversity and participants in the propensity-score matched control groups.*

Model	Loglikelihood	Scaling factor	df	$\Delta \chi^2$	BIC
True Friendship constrained	-4600.04	2.65	9		9272.86
True Friendship freed	-4599.79	2.49	10	0.47	9280.44
Mature Love constrained	-4527.91	2.12	9		9128.61
Mature Love freed	-4527.69	2.01	10	0.44	9136.35
Accomplishment constrained	-4740.01	1.36	9		9552.81
Accomplishment freed	-4739.37	1.31	10	1.37	9559.61
Social Recognition constrained	-5146.51	1.41	9		10365.81
Social Recognition freed	-5142.12	1.36	10	9.73**	10356.10

Note. Constrained models = trajectories constrained to be equal across groups. Freed models = trajectories freely estimated across groups. *df* = degrees of freedom. BIC = Bayesian Information Criterion. ** = $p < .01$.

Figure 3. *Post-adversity trajectories of social recognition in participants with and without serious health adversity. Standardized scores ($M = 0$ and $SD = 1$). Dotted lines reflect 95% confidence intervals. Data for participants in the healthy control group were centered at the median onset of health adversity among the health adversity group.*

Discussion

In this study we investigated whether the experience of serious health adversity can prompt changes in individuals' value orientations. Specifically, we used a 10-year longitudinal control-group design to examine the course of two emotional vs. two informational values before, during, and after the onset of health adversity. Three findings stand out.

First, health adversity was associated with shifts in subjective life expectancy. People who experienced a serious health problem such as cancer perceived that their chances of living to be 80 years or older dropped by 9.5%. Consistent with lifespan theories of human development (e.g., Carstensen et al., 1999; Heckhausen, 1997), the experience of health adversity was also accompanied by decreases in informational values. People showed significant decreases in the degree to which they valued *achievement* and *social recognition* as guiding principles in their lives. Notably, only post-adversity decreases in *social recognition* differed significantly from the trajectories of a healthy control group. The observed within-person effect together with the significant between-group difference provide strong evidence for an association between health adversity and decreases in the importance of *social recognition* and validates the principle that people tend to disengage from values that promise future payoffs when faced with a shrinking time horizon (Brandstädter et al., 2010).

Second, we found no evidence for increases in participants' endorsement of *true friendship* and *mature love* following health adversity. In contrast to our predictions and some previous work (Carstensen & Fredrickson, 1998), both people with and without health problems remained stable or even decreased in these values. One possible explanation for this unexpected finding is that past work has not taken normative age trends in emotional values

sufficiently into account, as we did in this study. Another is that health problems and normative aging may have qualitatively different impacts on emotional value orientations. A third set of possibilities has to do with limitations of our design and measures. For instance, ceiling effects may have limited the variability in emotional value data as reported by the Rokeach Survey.

Third, we found substantial heterogeneity in individuals' value trajectories, with some decreasing, some increasing, and others remaining stable in their value orientations as they cope with the onset of serious health adversity. This result highlights that a better understanding of the ways people respond to health adversity requires a more comprehensive examination of their life contexts and psychological resources. To begin to address this issue, we examined the potential effects of nine moderator variables. Consistent with our predictions, we found that extraverted and agreeable people placed more emphasis on emotional values at the onset of health adversity. However, we found no evidence that shifts in subjective life expectancy or subjective health were related to value orientations. Moreover, we found little evidence for moderating effects that shaped post-adversity *changes* in value trajectories. This does not imply that demographic, social, or psychological differences play no role in people's value trajectories, but accounting for these differences may require larger and more diverse samples. It may also be that other factors not included in the present study are more relevant in shaping values after health adversity.

Limitations and Future Directions

The strengths of the present study include a prospective control-group design, a representative sample, and advanced statistical techniques to model value changes following health adversity while ruling out potential confounds. However, there are important

limitations. First, the correlational nature of our data prohibits causal conclusions. Second, we focused on four health adversities, but we cannot rule out different health problems may elicit different value changes (e.g., accidents). Conversely, it is possible that for some people, these adversities were not as serious as the norm, and would thus be expected to have a limited impact on value orientation and weaken our power to find hypothesized effects. Third, we assessed value orientations with a common self-report value measure. Other measures such as forced choice instruments that assess individuals' priorities for emotional vs. informational values might show different trends in response to serious health adversity. Moreover, we focused on four pre-registered values but other values may be more sensitive to health adversity. Fourth, future studies using broader sets of moderators may be more successful in revealing factors that shape individuals' value trajectories following health adversity.

Conclusion

Do our guiding principles change as we face serious health issues and mortality? Theory and past research indicated that people who experience severe health problems focus less on building reputation and recognition, and more on spending quality time with close others. Evidence from this study is partially consistent with this hypothesis. There was no evidence supporting changes in the trajectories of *mature love* or *true friendship* as a function of health adversity. Yet, individuals who experienced serious health problems differed from those who did not in that their concerns about *social recognition* declined following the onset of health problems. This receding interest in recognition validates the folk wisdom expressed by US Senator Paul Tsongas that "*No man ever said on his deathbed, I wish I had spent more time in the office.*"

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