



# Exposure to negative life events, change in their perceived impact, and subsequent well-being among U.S. adults: A longitudinal outcome-wide analysis

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## ABSTRACT

**Objective:** Negative life events have the potential to undermine an individual's ability to function and thrive, but less is known about the implications of changes in subjective appraisals of those events for long-term well-being. This research examines how exposure to negative life events and subsequent changes in the perceived impact of those events are related to longer-term well-being in adulthood.

**Method:** Drawing on three waves of data from the Midlife in the United States study (M1: 1995–1996, M2: 2004–2006, M3: 2013–2014), we applied the analytic template for outcome-wide longitudinal designs to investigate associations of (a) negative life event exposure between M1 and M2 and (b) change in the perceived impact of negative life event exposure assessed at M2 with 25 outcomes across several domains of well-being assessed approximately 9 years later at M3: psychological distress, psychological well-being, social well-being, prosociality, physical health, and health behavior.

**Results:** Whereas negative life event exposure was associated with worse subsequent well-being on selected outcomes (5/25 in total) in some domains, positive change in the perceived impact of negative life event exposure was associated with better well-being on one or more outcomes in most domains (11/25 in total). Effect sizes in both sets of analyses were generally small, with more consistent associations found for psychological and social outcomes.

**Conclusion:** Subjective appraisals of negative life events (particularly positive changes in those appraisals over time) may be more closely related to individual well-being in the long run than mere exposure to negative life events themselves. The findings bring attention to the possibility that positive changes in a person's subjective appraisal of negative life events could have beneficial consequences for long-term well-being.

## 1. Background

Most people will experience some substantial negative life event in their lives (Bonanno, 2004). Negative life events are usually unexpected, uncontrollable, and personally significant events (e.g., job loss, death of a loved one) that involve some degree of life change (Haimson et al., 2021; Luhmann et al., 2021). A large corpus of literature suggests that negative life events tend to be stressful and have the potential to disrupt a person's well-being (Luhmann et al., 2012). However, numerous studies have found that people frequently adapt successfully to negative life events, indicating that exposure to a negative life event may not always lead to maladjustment (see Galatzer-Levy et al., 2018) and can

sometimes even lead to growth (Tedeschi and Calhoun, 2004). As a result, a distinction has been made between the *objective* aspect of being exposed to a negative life event—which is fixed and cannot be modified—and the *subjective* appraisals of the event—which are amenable to change because they involve a person's experience of event-related characteristics (e.g., perceived impact; Christensen et al., 2019; Luhmann et al., 2021). Previous work has shown that appraising the impact of life events more negatively tends to be a stronger predictor of psychological maladjustment than mere exposure to them (e.g., Espejo et al., 2012), suggesting that the objective and subjective aspects of negative life events may have unique implications for well-being. However, less is known about how *changes* in the perceived impact of

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negative life events over time are related to different aspects of well-being in the long run, which could help to improve our understanding of why some people show lasting decreases in their well-being while others do not. In this study, we use longitudinal data from a large sample of U.S. adults to examine the long-term effects of both (a) negative life event exposure and (b) change in the perceived impact of negative life event exposure on a wide range of subsequent well-being outcomes.

### 1.1. Exposure to negative life events and well-being

Well-being is a multidimensional concept that refers to a personal subjective state of quality across different dimensions of human existence (Lomas and VanderWeele, 2022; VanderWeele et al., 2022), including (but not necessarily limited to) the physical, psychological, and social dimensions of a person's life (Cowden et al., 2022b; Hölte et al., 2022; Lee et al., 2022). A considerable amount of research has focused on understanding the consequences of experiencing negative life events for individual well-being, with the bulk of previous research centering on psychosocial outcomes. In a recent meta-analysis, Mangelsdorf et al. (2019) reported evidence supporting a general decline in facets of psychological (e.g., self-esteem) and social (e.g., relationship quality) well-being immediately following exposure to a negative life event. After this initial post-event decline, the results generally supported an increase in psychosocial functioning over time. This trend resonates with set-point theory, which posits that a post-event decrease in subjective well-being tends to be followed by a gradual return to baseline (Luhmann and Intelisano, 2018). However, most of the studies that were part of Mangelsdorf et al.'s (2019) meta-analysis used a single group pre-post design, making it difficult to distinguish event-related changes from other influences (e.g., maturation) that might lead to improvements over time. In the comparably few studies that included a control group, most found little evidence of a difference between participants who were exposed to the target event (e.g., child abuse, divorce, death of a child, life-threatening medical illness diagnosis), and those who were not, suggesting that positive event-related changes in well-being may be more limited. Nonetheless, these findings highlight the importance of distinguishing between the short-versus long-term implications of negative life events for well-being.

Although existing evidence suggests that post-event adaptation to negative life events over the longer-term is relatively common, most of the prior studies in this area tend to report a single or narrow set of well-being outcomes (Luhmann and Intelisano, 2018). When multiple outcomes have been reported, they typically focus on the psychological and/or social domains of well-being (Mangelsdorf et al., 2019). Less is known about how negative life events are related to other domains of well-being over the long-term. For example, physical health is an important domain of well-being (VanderWeele, 2017), yet comparably fewer studies have explored the short- or long-term consequences of negative life events for physical health relative to other domains of well-being (Faust et al., 2021). Moreover, some longitudinal studies have found that the effects of exposure to a specific negative life event can vary considerably by facet of well-being, including (in some instances) outcomes that are highly interrelated (see Mangelsdorf et al., 2019). To obtain a more integrative and holistic understanding of how negative life event exposure is related to the functioning of the whole person, it is important that we study a wider range of well-being outcomes both within and across multiple life domains simultaneously.

### 1.2. Negative life event appraisals and well-being

A complex arrangement of event-related contextual factors (e.g., type of event), individual characteristics (e.g., attributional style), and social resources (e.g., emotional support) can influence whether experiencing a negative life event has detrimental consequences for a person's well-being (Cohen et al., 2019). Much scholarly attention has been

dedicated toward identifying and understanding the cognitive-emotional processes that can affect when and why exposure to negative life events might undermine a person's well-being, in part because of the possibility that such insights could reveal opportunities for individual treatment or intervention (Haehner et al., 2023). One of the dominant theories in this area of research is appraisal theory (Lazarus and Folkman, 1984), which proposes that an individual's subjective appraisal of a given event often has a stronger bearing on their well-being than the objective characteristics of the event itself (e.g., type of event, valence). Appraisal theory also introduced the concept of *reappraisal*, broadly referring to changes in the initial appraisal that emerge from the dynamic interplay between the person and the environment (Lazarus and Folkman, 1984). On this view, reappraisal may be "intentional as well as unintentional, and could reflect overt changes to the situation as well as covert changes to the interpretation" (Uusberg et al., 2019, p. 268).

According to the meaning-making model (Park, 2010), interpretative changes concerning the perceived impact of a negative life event will often be shaped by meaning-making processes that unfold as people attempt to reduce the discrepancy between situational meaning (i.e., the appraised meaning of the event they encountered) and global meaning (i.e., their general orienting system that consists of the values, beliefs, goals, behaviors, relationships that guide the way they view and interact with the world). For example, people may intentionally engage in meaning-focused coping strategies (e.g., positive reframing, benefit finding) that alter the situational meaning of a negative life event so that it aligns more closely with existing global meaning (Riley and Park, 2014). Such meaning-making processes may culminate in meanings made (e.g., acceptance, changes in causal attributions, perceived positive life changes), which are the "changes derived from attempts to reduce discrepancies or violations between appraised and global meaning" (Park, 2010, p. 260). Meanings made usually signal that meaning-making attempts have reduced the discrepancy between situational and global meaning, with longitudinal evidence suggesting that greater reduction in this discrepancy is generally related to better adjustment (Davis and Novoa, 2013).

If meaning-making processes lead to more positive perceptions about the impact of a negative life event over time (meanings made), it is reasonable to expect that such change in appraisal would be associated with higher well-being. Relevant to this theorizing is the empirical literature on perceived posttraumatic growth, referring to self-appraised positive change as a result of dealing with challenging negative life events (Tedeschi and Calhoun, 2004). Research on the potential benefits of perceived posttraumatic growth for well-being is mixed (Park et al., 2022), although longitudinal studies have rarely explored associations involving *change* in perceived posttraumatic growth (Chen et al., 2022). One post-disaster longitudinal study that followed participants up to 19 months after Hurricane Harvey found that increases in perceived posttraumatic growth were associated with a subsequent decrease in posttraumatic stress symptoms (Shigemoto, 2020). In a slightly different pair of recent studies, Haehner et al. (2023) found that positive changes in the perceived impact, worldview, emotional significance, and extraordinariness of major life events were not correlated with changes in life satisfaction, positive affect, and negative affect over three months. Although these findings provide some insight into how changes in self-appraised impact of a negative life event might be related to some domains of individual functioning (e.g., psychological), limited evidence has been reported for other domains of well-being (e.g., physical health). In addition to the need for research involving an expanded scope of well-being outcomes, longitudinal evidence in this area is largely based on research that has used follow-up intervals that span a few months between assessments. Longer timeframes between assessments may be needed to capture changes in the perceived impact of a negative life event more comprehensively, as well as to understand how such changes are related to different indicators of well-being in the longer-term.

### 1.3. The present study

Extending previous research, we used longitudinal data from the Midlife in the United States (MIDUS) study to examine the long-run associations of (a) negative life event exposure and (b) change in the perceived impact of negative life event exposure with 25 subsequent well-being outcomes across domains of psychological distress, psychological well-being, social well-being, prosociality, physical health, and health behavior. To do so, we applied the analytic template for outcome-wide longitudinal designs with observational data (VanderWeele et al., 2020). By ensuring clear temporal ordering of the predictor and outcomes and adjusting for a rich set of potential confounders that precede the timing of the predictor, the outcome-wide analytic framework offers a useful approach for estimating potential causal effects of a predictor like negative life event exposure that cannot be ethically manipulated. Such methodological rigor is important because it can increase confidence in the causal inferences that are made, thereby improving the theoretical and practical utility of the findings. Based on previous research, we expected that negative life event exposure itself would generally show little evidence of long-term association with well-being. We anticipated somewhat stronger associations to emerge for change in the perceived impact of negative life event exposure, such that positive change in perceived impact was generally expected to be associated with higher well-being in the long run.

## 2. Methods

### 2.1. Study sample

We used three waves of data from MIDUS. The first wave of data was collected in 1995–1996 (MIDUS 1 [M1]). Random-digit-dialing was used to recruit a national sample of 7108 non-institutionalized, English-speaking adults in the U.S. between the ages of 25 and 74, with an oversampling of older adults and of men. Participants were first administered a telephone interview, and those who completed the telephone interview were then mailed a self-administered questionnaire (SAQ). Approximately 70% ( $N = 4963$ ) of respondents were re-contacted by investigators for a second wave of the study between 2004 and 2006 (MIDUS 2 [M2]), and a third follow-up survey was conducted with the longitudinal respondents ( $N = 3683$ ) in 2013–2014 (MIDUS 3 [M3]). In this study, we restricted the sample to those who participated in the M2 survey wave and completed the phone interview and SAQ from which information about the predictors was derived ( $N = 4041$ ). Because this study used de-identified and publicly available data, it was exempted from review by the institutional review board (IRB) at Harvard University. The original MIDUS study was approved by the IRB at the University of Wisconsin-Madison, and all participants provided written informed consent (Radler, 2014). The research plan was not preregistered, and the code that was used for the analyses is available upon reasonable request.

### 2.2. Measures

#### 2.2.1. Negative life events and impact of event appraisals

We used items collected at M2 to assess exposure to 18 types of negative life events and appraisals of how those events affected participants initially and in the long-term. The first set of measures is the objective events that individuals experienced over the course of their lives. Participants were asked to indicate whether they had experienced any of the following events: fired from a job, without a job for a long time when desiring to work, parent died, parents divorced, spousal infidelity, significant difficulties with in-laws, sibling died, child died, child had life-threatening accident or injury, lost home (e.g., to fire, flood, natural disaster), physically assaulted or attacked, sexually assaulted, serious legal difficulties or prison, detention in jail or similar institution, declared bankruptcy, financial or property loss unrelated to

work, went on welfare, and combat. For events they endorsed, participants also reported the age at which they experienced a given event. We used this information to isolate events that occurred between M1 and M2 (i.e., within the past 8–10 years prior to assessment at M2;  $n = 1601$ ). We focus on events occurring during this period so that our analyses can adjust for prior values of the outcomes assessed at M1, which can help to reduce concerns about reverse causation (VanderWeele et al., 2020). We assigned a code of 1 to participants who provided an affirmative response to any of the negative life event items occurring between M1 and M2 and 0 to those who did not endorse negative life event exposure during this follow-up window, such that the negative life event exposure variable represents experiencing a negative life event between M1 and M2. The average time since exposure to the most recent negative life event between M1 and M2 was approximately four years.

The second set of measures captured respondents' subjective appraisals of the perceived impact of the most recent event they experienced, which was assessed with two questions: "How did this affect you initially?" and "How did this affect you in the long run?" Response options include 'very negatively,' 'negatively,' 'not at all,' 'positively,' 'very positively' (range: 1 to 5). We focus on the most recent event participants experienced because initial impact perceptions of those events are less vulnerable to recall bias. Similar to prior studies in related literature (e.g., Human et al., 2013), we combined the two measures to create a change score to assess change in perceived impact by subtracting the 'initial' appraisal from the 'long run' appraisal (range: 4 to 4), with higher scores indicating more positive change in the perceived impact of a negative life event. We used the reports of age at event exposure to identify the most recent negative life event that participants had experienced between M1 and M2. For participants who reported experiencing more than one 'most recent' event occurring in the same year, we used perceived impact ratings for the event that appeared first in the survey.

#### 2.2.2. Outcomes

Consistent with previous research (e.g., Cowden et al., 2022a; Shiba et al., 2022), we applied a multidimensional conception of well-being and selected 25 outcomes that tap into distinct facets of well-being across multiple domains of human life. All outcomes were assessed at M3, and decisions about the inclusion of outcomes were *blinded ex post* (i.e., all outcomes were selected before analyses were performed). Outcomes included four indicators of psychological distress (i.e., depression symptoms, anxiety symptoms, panic attack symptoms, negative affect); five indicators of psychological well-being (i.e., positive affect, personal growth, environmental mastery, purpose in life, life satisfaction); four indicators of social well-being (i.e., social integration, positive relations with others, relational support, frequency of social contact); four indicators of prosociality (i.e., volunteering, financial support to civic/religious institutions, contribute to others' welfare, social contribution); four indicators of physical health (i.e., number of chronic conditions, functional limitations, overweight/obesity, self-rated health); and four health behaviors (i.e., alcohol-related problems, current/former smoking, recreational drug use, physical inactivity). Further details about the measurement of each outcome can be found in [Supplementary Text S1](#).

#### 2.2.3. Covariates

We adjusted for a range of covariates from M1. Covariates included age, sex, racial status, nativity status, marital status, child dependents, educational attainment, employment status, annual household income, household wealth, homeownership, health insurance status, sexual orientation, neighborhood quality, abuse by parents during childhood, religious service attendance, sense of control, and the Big Five personality traits (extroversion, neuroticism, openness, conscientiousness, agreeableness). We also included a covariate for number of prior negative life events (total events ever experienced, minus 1 for the most recent event among participants who reported an event occurring

between M1 and M2). The models assessing change in the perceived impact of negative life event exposure additionally adjusted for age at most recent life event. Detailed information about the covariates can be found in [Supplementary Text S1](#).

#### 2.2.4. Analytic plan

Statistical analyses were performed in Stata 17.0. In descriptive analyses, we used independent samples *t*-tests, analysis of variance tests, and chi-square tests to examine bivariate associations of participant characteristics with both negative life event exposure and change in perceived impact. Our main analyses included two sets of models that used an outcome-wide analytic design ([VanderWeele et al., 2020](#)) to prospectively examine the associations of (a) negative life event exposure and (b) change in the perceived impact of negative life event exposure with an array of subsequent well-being outcomes. This approach fits regression models for the relationship between one predictor and multiple outcomes while controlling for the same covariates in each regression. The outcome-wide framework helps provide a broad picture of associations across a range of outcomes, enables the comparison of effect sizes across outcomes within the same sample, facilitates publication of null results, and may help better inform public health recommendations (for further details, see [VanderWeele et al., 2020](#)). Negative life events and change in their perceived impact were assessed at M2. To control for potential reverse causality and reduce concerns of confounding, models adjusted for the full set of covariates drawn from M1 and prior values of all outcome variables assessed at M1. The models involving change in perceived impact also adjusted for age at the time of the event.

For binary outcomes, we ran generalized linear models with a log link and Poisson distribution, and we used linear regression models to model continuous outcomes. We standardized all continuous outcomes (mean = 0, standard deviation = 1) so their effect size can be interpreted as the change in the outcome in standard deviations. All missing data on the covariates and outcomes were imputed using multiple imputation by chained equations ( $m = 5$ ), with imputed estimates pooled following [Rubin's \(2004\)](#) rule. Following recent recommendations, all tables corresponding with multivariate analyses include multiple *p*-value cutoffs to denote significance levels both before and after Bonferroni correction ([VanderWeele and Mathur, 2019](#)). This allows for evidence to be assessed using the conventional *p*-value threshold ( $p < 0.05$ ) and the Bonferroni-corrected threshold ( $p = 0.05/25$  outcomes:  $p < 0.002$ ). Although we acknowledge that different cutoffs can be used to interpret the results, we do not use the Bonferroni correction as the primary lens for interpreting the results for two reasons. First, Bonferroni correction is a conservative method and often produces overly conservative results when the outcomes are correlated ([Blakesley et al., 2009](#)). Second, a typical empirical paper by social science researchers focuses on one or a few outcomes. If each of the outcomes included in this study were to be published in separate papers, the results for each of those separate papers would not be subject to multiple testing correction. Although we concur that  $p < 0.05$  should not be treated as a 'magical' threshold for evaluating evidence ([Wasserstein et al., 2019](#)), for brevity our description of the results centers principally on associations that excluded the null ( $ps < 0.05$ ). Using effect size guidelines provided by [Funder and Ozer, 2019](#), we performed post-hoc power calculations in G\*Power 3.1.9.6 that aligned with our analyses of continuous outcomes (*F*-test, multiple linear regression module) and dichotomous outcomes (*z*-test, logistic regression module). Our first set of calculations corresponding with the negative life events exposure analysis showed that, with a sample of  $N = 4041$  and alpha set to 0.05, our power to detect a very small ( $r = 0.05$ ), small ( $r = 0.10$ ), or medium effect size ( $r = 0.20$ ) for being exposed to a negative life event was 0.89, 1.00, and 1.00 for continuous outcomes and at least 0.13, 0.41, and 0.97 for dichotomous outcomes. Our second set of calculations corresponding with the change in the perceived impact of negative events analysis indicated that, with a sample of  $N = 1601$  and alpha set to 0.05, our power to detect a very

small, small, or medium effect size for change in the perceived impact of negative life event exposure was 0.52, 0.98, and 1.00 for continuous outcomes and at least 0.05, 0.05, and 0.05 for dichotomous outcomes.

We ran several additional analyses. First, we calculated *E*-values to assess the robustness of the main results to potential unmeasured confounding. *E*-values assess the minimum strength of association (on the risk ratio scale) that an unmeasured confounder would need to have with both the predictor and the outcome to explain away the predictor-outcome association (for additional information about calculating of *E*-values, see [VanderWeele and Ding, 2017](#)). *E*-values range from 1 to infinity, with higher values providing stronger evidence of robustness to residual confounding. Second, it is possible that confounding control in our main models may not have been adequate because of the long lag between our covariates and the predictor of interest in each set of models ([VanderWeele et al., 2020](#)). Hence, we reanalyzed both sets of models while adjusting for prior values of all outcomes assessed at M2 instead of M1. Although controlling for covariates assessed contemporaneously with the predictor introduces the risk that models might be adjusting for potential mediators (and therefore it is difficult to determine whether results reflect adjustment for confounding, mediation, or some combination of both), these analyses enabled us to evaluate the robustness of the results after applying a more conservative approach to confounding control. Third, we ran complete-case analyses to compare the results with those of the main analyses in which multiple imputation was used for missing data.

### 3. Results

#### 3.1. Descriptive analyses

Over one third of participants experienced a negative life event between M1 and M2 (39.62%). The distribution of negative life event exposure by type of event overall in the sample, between M1 and M2, and most recently experienced can be found in [Supplementary Table S1](#). The most common negative life event that participants reported experiencing between M1 and M2 was parental death (78.01%), followed by sibling death (31.17%), being fired from a job (30.67%), spousal infidelity (22.74%), parental divorce (18.80%), and being unemployed (17.74%). On average, those who experienced a negative life event between M1 and M2 were younger, had child dependents, and rented their homes. They were also less likely to be in higher quintiles of household wealth, and more likely to come from families in which they experienced abuse from parents ([Supplementary Table S2](#)). Among respondents who experienced a negative life event between M1 and M2 ([Supplementary Table S3](#)), those who had a positive change in the perceived impact of the most recent event ( $n = 731$ ) were on average younger, less likely to be widowed, and had higher educational attainment than those who reported negative or no change ( $ns = 66$  and 804, respectively).

#### 3.2. Negative life events, change in perceived impact, and subsequent well-being

Negative life event exposure was associated with worse subsequent well-being on five outcomes, including two indicators of social well-being and one indicator for each of the psychological distress, psychological well-being, and physical health domains (see [Table 1](#)). Specifically, experiencing a negative life event was associated with a small increase in subsequent panic attack symptoms ( $\beta = 0.09$ , 95% confidence interval [CI] = 0.02, 0.17). Marginally smaller effect sizes emerged for the associations that were found with lower subsequent social integration ( $\beta = -0.08$ , 95% CI =  $-0.14$ ,  $-0.01$ ), relational support ( $\beta = -0.07$ , 95% CI =  $-0.12$ ,  $-0.01$ ), and positive affect ( $\beta = -0.07$ , 95% CI =  $-0.13$ ,  $-0.00$ ), as well as with higher subsequent functional limitations ( $\beta = 0.06$ , 95% CI = 0.00, 0.11). Associations of negative life event exposure with the remaining outcomes, including all prosociality indicators and health behaviors, were more negligible ( $ps >$



**Table 1**  
Negative life event exposure and subsequent well-being (Midlife in the United States [MIDUS]: N = 4041).

Outcome	Negative life event exposure		
	Reference <sup>a</sup>	RR/ $\beta$ [95% CI] <sup>b,c,d</sup>	E-values <sup>e</sup> [EE <sup>f</sup> , LCI <sup>g</sup> ]
<b>Psychological distress</b>			
Depression symptoms	0.00	0.06 [-0.00, 0.12]	[1.30, 1.00]
Anxiety symptoms	0.00	0.03 [-0.04, 0.11]	[1.21, 1.00]
Panic attack symptoms	0.00	0.09 [0.02, 0.17]*	[1.40, 1.15]
Negative affect	0.00	0.05 [-0.01, 0.11]	[1.26, 1.00]
<b>Psychological well-being</b>			
Positive affect	0.00	-0.07 [-0.13, -0.00]*	[1.33, 1.07]
Personal growth	0.00	-0.03 [-0.11, 0.04]	[1.21, 1.00]
Environmental mastery	0.00	-0.02 [-0.08, 0.05]	[1.14, 1.00]
Purpose in life	0.00	0.03 [-0.03, 0.10]	[1.21, 1.00]
Life satisfaction	0.00	-0.06 [-0.13, 0.02]	[1.29, 1.00]
<b>Social well-being</b>			
Social integration	0.00	-0.08 [-0.14, -0.01]*	[1.35, 1.13]
Relational support	0.00	-0.07 [-0.12, -0.01]*	[1.32, 1.10]
Positive relations with others	0.00	-0.04 [-0.10, 0.01]	[1.24, 1.00]
Frequency of social contact	0.00	-0.05 [-0.11, 0.02]	[1.25, 1.00]
<b>Prosociality</b>			
Volunteering	0.00	0.02 [-0.04, 0.09]	[1.17, 1.00]
Contribute to others' welfare	0.00	-0.01 [-0.08, 0.06]	[1.10, 1.00]
Financial support to civic/religious institutions	0.00	-0.01 [-0.07, 0.05]	[1.09, 1.00]
Social contribution	0.00	-0.02 [-0.08, 0.03]	[1.18, 1.00]
<b>Physical health</b>			
Number of chronic conditions	0.00	-0.01 [-0.08, 0.06]	[1.11, 1.00]
Functional limitations	0.00	0.06 [0.00, 0.11]*	[1.29, 1.07]
Overweight/obesity	1.00	1.03 [0.94, 1.12]	[1.20, 1.00]
Self-rated health	0.00	-0.04 [-0.12, 0.05]	[1.22, 1.00]
<b>Health behavior</b>			
Alcohol-related problems	1.00	1.00 [0.98, 1.02]	[1.04, 1.00]
Current/former smoking	1.00	1.00 [0.90, 1.10]	[1.06, 1.00]
Recreational drug use	1.00	1.15 [0.96, 1.38]	[1.57, 1.00]
Physical inactivity	1.00	1.03 [0.91, 1.17]	[1.21, 1.00]

Note. RR, risk ratio; CI, confidence interval; EE, effect estimate; LCI, E-value for the limit of the confidence interval.

\* $p < 0.05$  before Bonferroni correction; \*\*\* $p < 0.05$  after Bonferroni correction (the  $p$ -value cutoff for Bonferroni correction was  $0.05/25 = 0.002$  for each outcome).

<sup>a</sup> If the reference value is 1, the effect estimate is RR; if the reference value is 0, the effect estimate is  $\beta$ .

<sup>b</sup> The analytic sample was restricted to those who completed the telephone interview and self-administered questionnaire at M2. Multiple imputation was performed to impute missing data on covariates and outcomes. All models controlled for age, sex, racial status, nativity status, marital status, child dependents, educational attainment, employment status, annual household income, household wealth, homeownership, health insurance status, sexual orientation, neighborhood quality, abuse by parents during childhood, religious service attendance, the Big Five personality traits (extraversion, neuroticism, openness, conscientiousness, agreeableness), and sense of control assessed at M1, as well as number of prior negative life events assessed at M2. All models also controlled for prior values of all outcome variables assessed at M1.

<sup>c</sup> An outcome-wide analytic approach was used, and separate models were run for each outcome. A different type of model was run depending on the nature of the outcome: (1) for each binary outcome, a generalized linear model (with a log link and Poisson distribution) was used to estimate a RR; and (2) for each continuous outcome, a linear regression model was used to estimate a  $\beta$ .

<sup>d</sup> All continuous outcomes were standardized (mean = 0, standard deviation = 1), and  $\beta$  was the standardized effect size.

<sup>e</sup> The formula for calculating E-values can be found in VanderWeele and Ding (2017).

<sup>f</sup> E-values for effect estimates are the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the predictor and the outcome to fully explain away the observed association between the predictor and outcome, conditional on the measured covariates.

<sup>g</sup> E-values for the limit of the 95% CI closest to the null denote the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the predictor and the outcome to shift the CI to include the null value, conditional on the measured covariates.

.05).

Positive change in the perceived impact of negative life event exposure showed some evidence of association with better subsequent well-being on 11 outcomes, including all five indicators of psychological well-being, two indicators for each of the social well-being and prosociality domains, and one indicator for each of the psychological distress and physical health domains (see Table 2). In particular, positive change in perceived impact was associated with small increases in subsequent positive affect ( $\beta = 0.08$ , 95% CI = 0.03, 0.12) and social contribution ( $\beta = 0.07$ , 95% CI = 0.03, 0.10). Associations with increases in subsequent personal growth ( $\beta = 0.06$ , 95% CI = 0.02, 0.11), environmental mastery ( $\beta = 0.05$ , 95% CI = 0.00, 0.11), purpose in life ( $\beta = 0.05$ , 95% CI = 0.01, 0.10), life satisfaction ( $\beta = 0.05$ , 95% CI = 0.01, 0.10), relational support ( $\beta = 0.06$ , 95% CI = 0.01, 0.10), social integration ( $\beta = 0.05$ , 95% CI = 0.01, 0.10), and contribute to others' welfare ( $\beta = 0.05$ , 95% CI = 0.01, 0.10) were slightly smaller, as were the effect sizes found for the associations with lower subsequent negative affect ( $\beta =$

$-0.05$ , 95% CI =  $-0.09$ ,  $-0.01$ ) and functional limitations ( $\beta = -0.05$ , 95% CI =  $-0.08$ ,  $-0.01$ ). Positive change in the perceived impact of negative life events evidenced more negligible associations with the remaining outcomes, including all health behaviors ( $ps > .05$ ).

### 3.3. Additional analyses

The E-values calculated to assess the robustness of the main results to unmeasured confounding indicated that some of the associations for negative life event exposure (see Table 1) and positive change in perceived impact (see Table 2) were modestly robust to residual confounding. For example, the E-value for panic attack symptoms in the main analysis involving negative life event exposure was 1.40, which means that an unmeasured confounder would need to be jointly associated with negative life event exposure and panic attack symptoms by risk ratios of at least 1.40 (over and above the measured covariates) to explain away the observed association between them and by 1.15-fold to

**Table 2**Change in perceived impact of negative life event exposure and subsequent well-being (Midlife in the United States [MIDUS]:  $N = 1601$ ).

Outcome	Positive change in perceived impact of negative life event exposure		
	Reference <sup>a</sup>	RR/ $\beta$ [95% CI] <sup>b,c,d</sup>	E-values [EE, LCI]
<b>Psychological distress</b>			
Depression symptoms	0.00	-0.01 [-0.06, 0.04]	[1.12, 1.00]
Anxiety symptoms	0.00	-0.02 [-0.07, 0.03]	[1.15, 1.00]
Panic attack symptoms	0.00	-0.01 [-0.06, 0.05]	[1.08, 1.00]
Negative affect	0.00	-0.05 [-0.09, -0.01]*	[1.28, 1.12]
<b>Psychological well-being</b>			
Positive affect	0.00	0.08 [0.03, 0.12]***	[1.35, 1.21]
Personal growth	0.00	0.06 [0.02, 0.11]**	[1.31, 1.16]
Environmental mastery	0.00	0.05 [0.00, 0.11]*	[1.28, 1.06]
Purpose in life	0.00	0.05 [0.01, 0.10]*	[1.28, 1.12]
Life satisfaction	0.00	0.05 [0.01, 0.10]*	[1.28, 1.12]
<b>Social well-being</b>			
Social integration	0.00	0.05 [0.01, 0.10]*	[1.28, 1.10]
Relational support	0.00	0.06 [0.01, 0.10]*	[1.28, 1.12]
Positive relations with others	0.00	0.02 [-0.02, 0.06]	[1.17, 1.00]
Frequency of social contact	0.00	0.06 [-0.00, 0.11]	[1.29, 1.05]
<b>Prosociality</b>			
Volunteering	0.00	0.03 [-0.01, 0.08]	[1.21, 1.00]
Contribute to others' welfare	0.00	0.05 [0.01, 0.10]*	[1.27, 1.08]
Financial support to civic/religious institutions	0.00	0.03 [-0.01, 0.07]	[1.20, 1.00]
Social contribution	0.00	0.07 [0.03, 0.10]***	[1.32, 1.19]
<b>Physical health</b>			
Number of chronic conditions	0.00	-0.05 [-0.10, 0.00]	[1.26, 1.04]
Functional limitations	0.00	-0.05 [-0.08, -0.01]*	[1.25, 1.10]
Overweight/obesity	1.00	1.00 [0.94, 1.05]	[1.07, 1.00]
Self-rated health	0.00	0.03 [-0.01, 0.08]	[1.21, 1.00]
<b>Health behavior</b>			
Alcohol-related problems	1.00	1.00 [0.98, 1.01]	[1.06, 1.00]
Current/former smoking	1.00	0.99 [0.93, 1.07]	[1.08, 1.00]
Recreational drug use	1.00	0.96 [0.84, 1.10]	[1.25, 1.00]
Physical inactivity	1.00	1.02 [0.92, 1.13]	[1.16, 1.00]

Note. RR, risk ratio; CI, confidence interval; EE, effect estimate; LCI, E-value for the limit of the confidence interval.

\* $p < 0.05$  before Bonferroni correction; \*\*\* $p < 0.05$  after Bonferroni correction (the  $p$ -value cutoff for Bonferroni correction was  $0.05/25 = 0.002$  for each outcome).

<sup>a</sup> If the reference value is 1, the effect estimate is RR; if the reference value is 0, the effect estimate is  $\beta$ .

<sup>b</sup> The analytic sample was restricted to those who completed the telephone interview and self-administered questionnaire at M2, and those who experienced at least one negative life event. Multiple imputation was performed to impute missing data on covariates and outcomes. All models controlled for age, sex, racial status, nativity status, marital status, child dependents, educational attainment, employment status, annual household income, household wealth, homeownership, health insurance status, sexual orientation, neighborhood quality, abuse by parents during childhood, religious service attendance, the Big Five personality traits (extraversion, neuroticism, openness, conscientiousness, agreeableness), and sense of control assessed at M1, as well as number of prior negative life events and age at most recent event exposure at M2. All models also controlled for prior values of all outcome variables assessed at M1.

<sup>c</sup> An outcome-wide analytic approach was used, and separate models were run for each outcome. A different type of model was run depending on the nature of the outcome: (1) for each binary outcome, a generalized linear model (with a log link and Poisson distribution) was used to estimate a RR; and (2) for each continuous outcome, a linear regression model was used to estimate a  $\beta$ .

<sup>d</sup> All continuous outcomes were standardized (mean = 0, standard deviation = 1), and  $\beta$  was the standardized effect size.

shift the CI to include the null, but weaker joint confounder associations could not. Risk ratios for the covariate with the strongest conditional association with each outcome in both main analyses were mostly quite similar in magnitude to the E-values, although there was some variation across outcomes in each analysis (see [Supplementary Table S4](#)). For example, the risk ratio for the conditional association between panic attack symptoms and alcohol-related problems was 1.23, whereas the E-value for negative life event exposure was 1.40.

When we reanalyzed both sets of main analyses using a more conservative analytic approach that adjusted for prior values of outcomes assessed at M2 instead of M1, associations generally attenuated. For negative life event exposure, associations with positive affect, relational support, and functional limitations included the null after adjusting for prior values of all outcomes from M2 ([Supplementary Table S5](#)). Additionally, frequency of social contact no longer included the null after adjusting for outcomes assessed at M2. For change in the perceived impact of negative life event exposure, all of the associations that excluded the null in the main analyses no longer did when adjustment was made for prior values of all outcomes at M2 instead of M1 ([Supplementary Table S6](#)). When we repeated the main analyses using available cases, all associations that were observed for negative life event exposure when imputed data were used no longer excluded the

null ([Supplementary Table S7](#)). The complete-case results for change in the perceived impact of negative life event exposure largely resembled those found for the main analysis with imputed data, except that social integration no longer excluded the null and frequency of social contact did ([Supplementary Table S8](#)).

#### 4. Discussion

Using a national sample of U.S. adults, this study investigated the associations of (a) negative life event exposure and (b) change in the perceived impact of negative life event exposure on 25 indicators of well-being across domains of psychological distress, psychological well-being, social well-being, prosociality, physical health, and health behavior. Our main results indicated that negative life event exposure was associated with worse well-being on a few outcomes in the long run, whereas positive change in the perceived impact of negative life event exposure was related to better long-term well-being on nearly half of the outcomes.

##### 4.1. Negative life events and well-being

We found that negative life event exposure was related to worse well-

being on five outcomes across the domains of psychological distress (i.e., panic attack symptoms), psychological well-being (i.e., positive affect), social well-being (i.e., lower social integration, relational support), and physical health (i.e., functional limitations), with effect sizes that were mostly small in magnitude. Our findings correspond with prior research that has found negative life event exposure may be associated with long-term maladjustment for some people (Lucas, 2007), but suggest that the longer-term implications for well-being tend to be more circumscribed to psychosocial functioning. One possible explanation for this pattern of findings is that most types of negative life events represented in the present study will often have more direct consequences for psychological and social domains of life compared to other domains that are less likely to be directly impacted. For example, the losses of parents and siblings, which were the most prevalent negative life event exposures represented in the sample, may be more immediately consequential for indicators of social well-being because bereavement has the potential to increase strain in relationships, diminish opportunities for support and connection, and lead to social isolation (Stroebe and Schut, 2021). Experiencing the death of a loved one could in turn have more temporally distant impacts on physical health by way of undermining social connections, which are an important resource for promoting health (Umberson, 2017). By addressing a wide range of outcomes across multiple domains of well-being simultaneously, this study documents evidence suggesting that the longer-term negative effects of negative life event exposure might be stronger for some facets and domains of well-being than others.

Although our findings suggest that negative life event exposure may have important long-term implications for some facets of well-being, we found little evidence of associations with most (20/25 in total) outcomes. Taken together, the findings of this study have some resonance with set point theory, which posits that many people who are exposed to negative life events tend to adapt over time and return to their previous well-being 'set-point' after experiencing a transitory period of disruption to their well-being (Ormel et al., 2017). However, it is important to note that there is inter- and intraindividual variability in the extent and rate of adaptation that occurs (Diener et al., 2006), some of which can be shaped by the type of negative life event that a person encounters. For example, research has shown that certain types of negative life events can have longer-lasting effects on well-being than others, and there may be important variations by perceived characteristics of the events (see Luhmann et al., 2021). The present study focused on exposure to a variety of negative life events, and it is possible that impacts to well-being might vary by type of negative life event. In addition, more than half of the negative life events that we assessed were only relevant to adulthood (e.g., spousal infidelity, child died). Some negative life events that occur during childhood (e.g., emotional neglect, witnessing violence between parents) could have particularly devastating consequences for well-being over the life course because they have the potential to reconfigure biological, behavioral, and psychosocial development within this critical period of human maturation (Ben-Shlomo and Kuh, 2002; Shonkoff et al., 2012). Therefore, the findings of this study should be interpreted in light of the types of negative life events that were represented.

#### 4.2. Change in perceived impact of negative life events and well-being

Positive change in the perceived impact of negative life event exposure was associated with better subsequent well-being on one or more outcomes for all domains except health behavior (11/25 in total), the effect sizes for which were mostly small in magnitude. The most consistent associations emerged across outcomes in the domain of psychological well-being (5/5 outcomes), followed by prosociality (2/4 outcomes), social well-being (2/4 outcomes), psychological distress (1/4 outcomes), and physical health (1/4 outcomes). These findings align with a wealth of theoretical (e.g., Lazarus and Folkman, 1984) and empirical (e.g., Espejo et al., 2012) literature that suggests subjective

appraisals of negative life events often tend to be more closely related to well-being than mere exposure to them. However, this study is among the first to explore the potential effects of *change* in the perceived impact of negative life event exposure on numerous well-being outcomes, including domains of well-being (e.g., physical health) that have received considerably less empirical attention in this area. As a result, our findings contribute to developing a broader and more integrative understanding of the possible benefits that may accompany a positive shift in the perceived impact of negative life events for different facets of well-being.

Although an in-depth interpretation of these findings is limited by the crude approach that was used to assess change in the perceived impact of negative life event exposure, one useful lens that can be applied is the meaning-making model (Park, 2010). Within this framework, the degree of adjustment following a negative life event is thought to depend on the extent to which meaning-making processes adequately reduce the discrepancy between situational and global meaning (i.e., meanings made). It is possible that the meaning-making attempts of participants who reported a positive change in the perceived impact of negative life event exposure eventually produced sufficient meanings made. Over time, the salutatory implications of this positive psychological shift for well-being are likely to expand from more proximal benefits (e.g., psychological well-being) to those that are more downstream (e.g., physical health). This could explain why change in the perceived impact of negative life event exposure was associated with many subsequent well-being outcomes across most domains approximately nine years later, including comparably distal outcomes (e.g., functional limitations) that are not particularly likely to be affected by change in perceived impact over the short-term.

Viewed more broadly, this study provides further evidence demonstrating that adversity is a common and inescapable part of life (roughly 40% of participants in this study reported a negative life event within the roughly nine-year timeframe between M1 and M2, and almost 90% had at least one negative life event in their lifetime). Considering this reality, our findings resonate with the idea that individual well-being depends on a person's ability to transform suffering into opportunities to learn, find meaning, and grow (Emmons, 2003; Wong et al., 2022). Indeed, we found evidence suggesting that many people were able to transform the negative life events they experienced into such opportunities (approximately 46% of participants experienced a positive change in the perceived impact of a recent negative life event), and those people were more likely to report better well-being across various domains of functioning in the long run. If people are able to accept and confront suffering, they may be particularly well positioned to transcend challenging life circumstances in ways that contribute positively to their long-term well-being (Ho et al., 2022).

#### 4.3. Limitations and future research directions

This study had several strengths, including its use of a large national sample of adults and an outcome-wide methodological approach with outcomes across domains of well-being that are not often included in studies on negative life events. However, there are several methodological limitations. First, we used a broad approach in this study to examine objective exposure to negative life events alongside the subjective appraisals of the impact of these events, and therefore we did not differentiate between types of negative life events. Treating negative life events as equivalent in our predictor variables may mask variation in the impact of specific types of events and their appraisals on outcomes both within and across different domains of well-being, which could be explored further in subsequent research.

Second, participants retrospectively reported the perceived initial impact of negative life events, with the most recent event between M1 and M2 taking place an average of four years prior to M2 (the wave in which assessment of negative life events occurred). These ratings were used to construct our measure of change in the perceived impact of the

most recent life event, which may be subject to recall bias because perceptions about the initial impact may have been affected by whether participants recollected the initial impact as being worse or better than it was (Blome and Augustin, 2015). It will be important to determine the extent to which our findings replicate using prospective designs that assess changes in the perceived impact of negative life events over time (see Haehner et al., 2023), although there are unique challenges to conducting such studies with a length of follow-up that is comparable to MIDUS.

Third, our findings address a single dimension of negative life event perceptions (i.e., impact), and it's possible that the long-term implications of changes in negative life event perceptions for well-being might vary across dimensions of such perceptions. In future studies, researchers could consider broadening beyond the impact dimension to explore the effects of changes in different dimensions of negative life perceptions. An assessment like the Event Characteristics Questionnaire developed by Luhmann et al. (2021), which evaluates perceptions of major life events along multiple dimensions (e.g., emotional significance, external control), is a valuable alternative for measuring appraisals of life events and can be profitably used to comprehensively evaluate change in life event appraisals when assessed at two separate time points (e.g., Haehner et al., 2023).

Fourth, our approach to assessing change in the perceived impact of negative life events does not capture the content of these changes. Using the survey items available in the MIDUS data, we were unable to determine how individuals understand or would describe their own process of changing their perception of the impact of negative life events. Interviews with individuals who experienced negative life events could provide insight into the cognitive and emotional processes that contribute to changes in perceptions of these events and build on the findings of this study.

Fifth, outcomes were assessed around nine years after the wave in which the predictors were measured. This follow-up period may be better suited to estimating potential causal effects of the predictors we examined on some outcomes compared to others, and it is possible that associations for both negative life event exposure and change in perceived impact might vary across the outcomes as a function of time. Longitudinal studies that include a combination of short- and longer-term follow-up assessments may enrich our understanding of how exposure to and subjective appraisal of negative life events affect different facets of well-being at various points in time.

Sixth, the lag between the covariates and predictors in our main analyses was almost 10 years, which may be too temporally distant for the covariates to sufficiently address potential confounding (VanderWeele et al., 2020). Although *E*-values suggested that many of the main results were at least somewhat robust to residual confounding, these results may be biased away from the null. As such, we performed additional analyses (one set each for negative life event exposure and change in perceived impact) where we applied a more conservative approach to confounding control by adjusting for prior values of the outcomes assessed at M2 instead of M1. In both sets of analyses, effect sizes generally attenuated compared to the results of the main analyses. Because these additional analyses controlled for prior values of the outcomes assessed contemporaneously with the predictors at M2, we cannot rule out the possibility that the results may have attenuated because the models adjusted for mediators (and therefore are biased toward the null). Based on the findings of the main and additional analyses, we submit that the actual estimates for negative life event exposure and change in perceived impact are likely somewhere between the results observed in the main analyses (Tables 1 and 2) and those observed in the more conservative additional analyses (Supplementary Tables S5 and S6). Although it is reasonable to expect that each predictor would be meaningfully associated with most of the outcomes for which the main analyses provided evidence of an association, additional research is needed using longitudinal data with a structure capable of more appropriately addressing confounding control.

## 5. Conclusion

Whereas we found some evidence of association between negative life event exposure and worse well-being on selected outcomes in a few domains, positive change in the perceived impact of negative life event exposure was associated with improved well-being on several outcomes across most domains. Our findings highlight the role of changes in subjective appraisals of negative life events, not necessarily the experiences themselves, in shaping well-being over the longer-term, and the potential for meaning-making processes to produce positive changes in appraisals of negative experiences that lead to better long-term health and psychosocial functioning.

## Credit author statement

**Renae Wilkinson:** Conceptualization, Methodology, Formal analysis, Writing – Original draft preparation, Writing – Review & editing; **Richard G. Cowden:** Conceptualization, Methodology, Writing – Original draft preparation, Writing – Review & editing; **Ying Chen:** Methodology, Writing – Review & editing; **Tyler J. VanderWeele:** Methodology, Writing – Review & editing, Supervision.

## Data availability

The data that support the findings of this study are available in Inter-university Consortium for Political and Social Research (ICPSR) at <https://www.icpsr.umich.edu/web/ICPSR/series/203> (reference numbers ICPSR 2760, ICPSR 4652, and ICPSR 36346). These data were derived from the following resources available in the public domain: MIDUS 1 (<https://doi.org/10.3886/ICPSR02760.v19>), MIDUS 2 (<https://doi.org/10.3886/ICPSR04652.v8>), and MIDUS 3 (<https://doi.org/10.3886/ICPSR36346.v7>).

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2023.115861>.

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