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REGULAR ARTICLE

Effects of Chronic Burden Across Multiple Domains and Experiences of Daily Stressors on Negative Affect

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Abstract

Background Exposure to chronic psychological stress across multiple life domains (multi-domain chronic burden) is associated with poor health. This may be because multi-domain chronic burden influences daily-level emotional processes, though this hypothesis has not been thoroughly tested.

Purpose The current study tested whether (a) multi-domain chronic burden is associated with greater exposure to daily stressors and (b) multi-domain chronic burden compounds negative affect on days with stressors compared to stressor-free days.

Methods The MIDUS Study (Wave II) and the National Study of Daily Experiences sub-study were conducted from 2004 to 2006 (N = 2,022). Participants reported on eight life domains of psychological stress used to create a multi-domain chronic burden summary score. For eight consecutive days, participants reported the daily occurrence of stressful events and daily negative affect.

Results Participants with greater multi-domain chronic burden were significantly more likely to report daily stressors. There was also a significant interaction between multi-domain chronic burden and daily stressors on negative affect: participants with higher multi-domain chronic burden had greater negative affect on stressor days than stressor-free days compared to those with lower multi-domain chronic burden.

Conclusion Participants with higher multi-domain chronic burden were more likely to report daily stressors and there was a compounding effect of multi-domain chronic burden and daily stressors on negative affect. These results suggest that experiencing a greater amount of psychological stress across multiple life domains may make daily stressors more toxic for daily affect.

Keywords Chronic burden · Daily stressors · Negative affect

Introduction

It is well-established that exposure to chronic stressors and their appraisal as psychologically stressful or difficult is related to poorer health [1, 2]. Chronic stressors are conceptualized as the persistent or recurrent difficulties of life and can occur across multiple domains (e.g., work, financial, and relationship) [3]. In recent years, a growing body of literature indicates that combining exposures to chronic stressors from across multiple domains (e.g., work, financial, and relationship) *and* the psychological responses to these stressors into a single composite measure of "multi-domain chronic burden" may have greater predictive power on health and disease than if considering individual domains alone [4].

There are multiple ways in which multi-domain chronic burden is thought to affect health outcomes; one such way is through the experiences of daily life. Day-to-day stressors are oftentimes relatively minor events that emerge in people's typical days, such as conflict with a spouse or others, work deadlines, or traffic. There is considerable research suggesting that exposures to daily stressors and differences in affect reported on days with

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stressors compared to stressor-free days predict long-term declines in mental and physical health [5, 6], as well as increases risk of earlier mortality [7, 8]. According to Epel et al.'s [1] transdisciplinary model of stress, chronic stressors—and how they are perceived—shape both exposure and responses to daily stressors and, ultimately, disease and biological aging. In this model, individuals with higher multi-domain chronic burden are hypothesized to have greater exposure to stressful events on a daily basis and to respond to these events more negatively. However, the combined affective effects of multi-domain chronic burden and daily stressors remains relatively unexplored. As such, the current manuscript investigates the relationship between multi-domain chronic burden and daily exposure to stressful events, and the extent to which they interact to predict daily negative affect.

Multi-Domain Chronic Burden

Multi-domain chronic burden represents the additive value of stressor exposures and perceptions across multiple domains of life stress [4, 9]. Multi-domain chronic burden has been measured in several ways, including checklists of exposures to stressors over a 12-month period or more across multiple domains (e.g., health, financial, housing, and relationship) and the appraisal of the extent to which each one of these stressors is considered upsetting or difficult, as done in the Health and Retirement Study [10, 11]. In the Midlife in the United States (MIDUS) Study, multi-domain chronic burden has been measured by standardizing the scores of multiple items assessing respondents' psychological experiences of specific life domains and combining these standardized scores into one total score [4, 12]. These individual domain measures typically go through rigorous validation and reliability testing, assess the extent to which the domain of interest has been stressful, difficult, upsetting, etc. using a set of multiple items, and each one has a predefined length of exposure to consider (e.g., 1 month, 6 months, and 1 year). Regardless of how multi-domain chronic burden is measured, the goal of multi-domain chronic burden measures is to gain insight into a broad range of potentially stressful experiences across several different domains that have been ongoing and appraised as stressful, burdensome, or threatening for a while.

Regardless of the time scale, growing evidence indicates that combining effects across multiple domains is often more impactful than assessing each domain separately [4, 13]. However, it is much more common for researchers to focus on individual domains of life stress and their relationships with health (e.g., examining the effect of caregiving stress on disease and mortality). Although individual life domains are often related to health outcomes, this approach fails to account for a person's cumulative experience across domains and how the accumulation of stressor exposures and perceptions might contribute to health. In addition, focusing on a single domain of stressor exposure may overestimate the impact of the selected domain, given that stressor exposures are often correlated [14].

Importantly, there is a growing literature linking multi-domain chronic burden to health-related outcomes. Multi-domain chronic burden is thought to be particularly deleterious to health because it captures the additive or compounding effects of multiple or repeated stressors across domains and psychological appraisals of these stressors [4]. Indeed, the studies that have been done in this area show that greater multi-domain chronic burden is associated with worse mental and physical health outcomes [9, 12, 15–18], poorer health behaviors [12, 19, 20], and accelerated cellular aging [21–23] than individual domains alone. Despite the growing body of work on the relationship between multi-domain chronic burden and health, there is still much that remains unknown about how multi-domain chronic burden might influence physical and mental health. For instance, it has been hypothesized that multi-domain chronic burden may exacerbate daily stress processes [1, 4, 24], but this topic requires further study.

Daily Stressors: Exposure and Affective Reactivity

One way that multi-domain chronic burden may worsen health is by increasing the number of daily stressors. Daily stressors are relatively minor hassles or challenges of day-to-day living that make everyday life more difficult. Such stressors can be routine challenges (e.g., daily commute, difficulties at work) or small disruptions to daily life (e.g., an argument with a partner) [25–29]. Daily stressor exposure is not random; although the relationship between multi-domain chronic burden and daily stressor exposure has not yet been tested, individuals who report chronic stress within specific domains (i.e., reporting long-term, persistent, or recurrent stressors) are more likely to report daily stressors. For instance, greater perceptions of chronic work and home stress are associated with more daily stressors [30]. In another study, chronically stressed family caregivers of dementia and Alzheimer's patients are more likely than non-caregivers to report multiple daily stressors in a given 24-hour period [31]. Similarly, mothers of children with autism spectrum disorder (ASD) report a higher number of stressor days to stressor-free days compared with mothers of children without ASD [32].

Exposure to daily stressors has important implications for health. There is established literature showing that greater daily stressor exposure is linked with lower psychological well-being [29, 33], more global and daily health symptoms [29, 34, 35], and higher mortality [36]. Furthermore, experiencing a greater number of daily stressors is associated with multiple stress-related

biomarkers that are predictive of future health, such as higher levels of systemic inflammation [31] and greater cortisol output on stressor days [37].

Daily stressors are also related to differences in daily affective states. Daily measurements of both stressor exposure and affective states enable researchers to examine the correspondence between fluctuations in daily stressors and corresponding fluctuations in affect [29, 38]. Prior work has found that up to 20% of the variance in negative mood can be explained by the occurrence of daily stressors [39]. There is variability in the extent to which individuals fluctuate in negative affect on days when stressors occur compared to days without stressors, with some people showing large differences in negative affect between stressor and non-stressor days and others showing little difference [34]. Greater fluctuations in negative affect on stressor days compared to non-stressor days have been evidenced to predict a range of health issues, including future chronic health problems [6], elevated inflammation [40], poorer sleep [41], higher risk of mental health issues [5], and higher mortality risk [7, 8, 42, 43].

Why do some individuals display greater negative affect on days that they experience stressful events compared to days that are experienced as free of stressors? Past stressor exposure may play a role. Exposure to stressful life events or chronic stressors may impact the way an individual respond to daily stressors [1, 24]. For example, adults reporting more frequent maternal abuse during their childhood showed greater negative affect on days when stressful events occurred compared to days free of stressors to [44]. Other contextual factors that often correspond with greater life stress, for example, lower education, are also related to such day-to-day changes in negative affect. In prior work with the National Study of Daily Experiences (NSDE), individuals with less than high school education reported greater negative affect on stressor days (compared to non-stressor days) than individuals with higher education levels (i.e., high school graduates and college graduates) [45]. In line with these findings, prior work also shows that chronic work and home stress exacerbate the relationship between daily stressors and psychological distress [30]; although psychological distress is distinct from negative affect, this finding supports the potential for chronic burden experienced across multiple domains to compound the relationship between daily stressors and reports of negative affect on these days.

Current Study

Despite growing knowledge about the importance of multi-domain chronic burden, the relationship between multi-domain chronic burden and daily stressor exposure remains unexplored. It is also unknown whether multi-domain chronic burden exacerbates the extent to which negative affect increases on days with stressors compared to days that are free of stressors. As such, the current analyses tested the relationships between multi-domain chronic burden, exposure to daily stressors, and negative affect. The current study had two primary hypotheses: *Hypothesis 1:* Individuals who report greater multi-domain chronic burden will have a higher likelihood of reporting daily stressors. *Hypothesis 2:* Multi-domain chronic burden will moderate the relationship between daily stressor exposure and daily negative affect, such that individuals with higher multi-domain chronic burden will report greater negative affect on stressor days compared to non-stressor days than individuals reporting lower multi-domain chronic burden.

Methods

Sample and Procedures

The data used in this study were taken from the second wave of the MIDUS Study. MIDUS II is a national sample of American adults between the ages of 35–86. Details of the study have been described extensively elsewhere [46, 47]. Participants provided informed consent prior to enrollment in MIDUS; further details regarding recruitment, sampling, experimental attrition can be found elsewhere. Participants provided informed consent prior to enrollment in MIDUS; further details regarding recruitment, sampling, experimental attrition can be found elsewhere [48]. Analyses for the present study included 2,022 MIDUS participants who were also part of the NSDE II, 2004–2006. As a part of the MIDUS study, participants completed an extensive questionnaire battery that included assessments of stressor exposure and perception across several domains of stress. The NSDE II participants are a representative subsample of respondents randomly selected from the second wave of the MIDUS study. The NSDE II was conducted at least 3 months after completion of the participation in the main MIDUS study (range = 3–18 months after completing MIDUS). As part of the NSDE II protocol, each respondent was contacted on eight consecutive days for daily telephone interviews regarding their daily experiences; all respondents completed at least one telephone interview. The overall response rate for the daily interviews was 92.2% and the majority of participants (68.6%) completed all eight of the daily interviews (mean = 7.39 completed assessments, standard deviation [*SD*] = 1.27).

Measures

Multi-domain chronic burden

The measure of multi-domain chronic burden used in the present analysis is a composite score across eight domains

of life stress that were identified by the MIDUS study investigators as particularly relevant to this sample of midlife adults in the United States. This composite score was created by investigators of the MIDUS II survey project using responses to self-administered questionnaire that participants completed prior to the NSDE II. Domains have been defined and described in prior work by Slopen et al. [49] and included (a) work stress, measured with the 20-item Work Stress scale; (2) financial stress, measured with the 2-item Financial Stress Scale; (3) relationship stress, measured with a 20-item Relationship Stress questionnaire; (4) discrimination, measured with the 19-item Discrimination schedule; (5) neighborhood disadvantage, measured with the 4-item Neighborhood Stress scale; (6) work family spillover; measured with the 8-item Work-family Spillover questionnaire; (7) perceived inequality, measured with the 18-item Perceived Inequality questionnaire; and (8) family problems over the past year, measured with the 10-item Past Year Problems in Immediate Family schedule. The scales used to create the multi-domain chronic burden measure are included in the Supplementary Material. Further details for each measure can be found in the MIDUS 2 scale documentation, available at https://www.icpsr.umich.edu/web/NACDA/studies/4652. Chronbach's α for each individual measure included in the multi-domain chronic burden variable in MIDUS II have been previously reported [49] and range from 0.68 to 0.97. All measures for a given domain were standardized into *z*-score distributions, before being summed and standardized as a single resulting value of multi-domain chronic burden. This approach is reported in further detail by Slopen and colleagues [4, 49].

In some cases, particular stress measures may not be applicable to a respondent (e.g., a work-stress measure for respondents who were not working). In these cases, a dummy variable indicated whether a respondent was ineligible based on demographic characteristics and the lowest value possible was substituted for missing information. This procedure was also performed for marital stress measures for single respondents, and child-related measures for respondents without any children. This procedure was drawn from the MIDUS documentation on the calculation of multi-domain chronic burden in MIDUS [50].

Daily stressors

On each day during the telephone diary protocol, participants reported the occurrence of stressors in any of seven domains: (a) arguments with others; (b) avoiding an argument; (c) stressors at work or school; (d) stressors at home; (e) discrimination; (f) network stressor; (g) any other stressor. These items are from a commonly used measure of daily stressors, the Daily Inventory of Stressful Events [51]. Participants were asked to report whether each type of stressor occurred in the 24 h prior to the phone interview. The occurrence of any of these seven stressors was coded as a dummy variable with 1 = any stressor occurred and 0 = no stressor occurred [52]. This dichotomous approach was used due to the high frequency of days where participants reported no stressors (62%) and the low occurrence of days with multiple stressors (10%); this approach is consistent with many other previous publications with the NSDE [37, 47–49, 53].

Daily negative affect

Participants reported daily negative affect on each of the 8 consecutive days (14 items, summed each day for a range of 0–56). Participants were asked "how much of the time today did you feel…" restless/fidgety, nervous, worthless, so sad nothing cheer you up, everything was an effort, hopeless, lonely, afraid, jittery, irritable, ashamed, upset, angry, or frustrated. The items utilized by MIDUS for daily negative affect were a combination of items from the Nonspecific Psychological Distress Scale [54] and items from the Positive and Negative Affect Schedule [55]. The responses to the 14-item scale were a 5-point Likert-type scale with the responses: (0) none of the time, (1) a little of the time, (2) some of the time, (3) most of the time, (4) all of the time (day-level Chronbach's α = .91) [5]. Mean daily negative affect was calculated by averaging daily responses to the 14 affect items.

Covariates

Several demographic covariates were included in all analyses, including age, sex (−1 = male, 1 = female), race (White, Black, other), ethnicity (−1 = Non-Hispanic, 1 = Hispanic), and education (less than high school, high school or equivalent, college, postgraduate). Also included in the analyses were the dummy variables for marital status (0 = unmarried/not living with partner; 1 = married or living in a marital-like relationship), parental status (0 = childless, 1 = one or more children), and employment status (0 = not currently working, 1 = currently working). We also included two health behavior covariates that are known to be related to multi-domain chronic burden or negative affect in the MIDUS sample: physical activity status and daily smoking [19, 52]. Participants were categorized as either "active" or "underactive" based on whether they met the Center for Disease Control and prevention guidelines of recommended minutes of daily physical activity over the diary period (>172 min over 8 days). Analyses included daily smoking collected as part of the NSDE II, with the smoking variable categorizing days as smoking day = 1 and non-smoking day = −1. Lastly, we included chronic health conditions as a covariate in a sensitivity

analysis because prior work has shown a relationship between chronic conditions and negative affect [6, 56]; this covariate was coded as 0 = no chronic conditions, 1 = any chronic conditions.

Statistical Analysis

Analyses were conducted using SPSS version 26. Missing data for the eight domains of life stress that comprised the multi-domain chronic burden measure ranged from 0% to 22% for measures within domains. To account for missing information that may not be random, sequential multiple imputation was performed using IVEware software [57].

Hypothesis 1 was tested using a generalized linear mixed model with binary logistic regression (logit link), which provided the odds of reporting a daily stressor as a function of multi-domain chronic burden. Covariates included in analyses were age (mean-centered), sex, race, education, marital status, parental status, employment status, physical activity status (active vs. underactive), and daily smoking status.

To test hypothesis 2, moderation analyses were conducted using two-level multilevel models to account for the nesting of days within persons, with within-subject variables at Level 1 and between-subjects variables at Level 2. We ran an unconditional model to confirm sufficient within-subject daily variation in negative affect to conduct primary analyses. These models revealed significant within-person variation: 51% within-person variation in negative affect (intraclass correlation$_{NA}$ =.49, $p < .001$). To test the moderating effect multi-domain chronic burden on the relationship between daily stressor occurrence and daily affect, we conducted a multilevel model with random intercepts and fixed slopes using MIXED syntax with maximum likelihood estimation. Negative affect was regressed on stressor day (yes/no), multi-domain chronic burden, and the interaction between stressor day (yes/no) and multi-domain chronic burden. Covariates included in analyses were age (mean-centered), sex, race, ethnicity, education, marital status, parental status, employment status, physical activity status (active vs. underactive), and daily smoking status.

MIXED syntax estimates the outcome (Y) as a function of one predictor variable (X = stressor day or non-stressor day), a moderator variable (Z = multi-domain chronic burden), and the interaction between the two (X*Z). This generates four relevant coefficients: (a) B_0, (b) $B_{\text{stressorday}}$, (c) $B_{\text{multi-domainchronicburden}}$, and (d) $B_{\text{stressorday}}$ * $B_{\text{multi-domainchronicburden}}$ (i.e., $B_{\text{interaction}}$). With stressor day as a dichotomous variable (stressor day yes/no) and multi-domain chronic burden as a continuous variable these coefficients can be interpreted as such: β_0 is the intercept representing estimated mean negative affect on stressor-free days; $B_{\text{stressorday}}$ is the estimated change in negative affect on stressor days from their estimated means on days without stressors at mean levels of multi-domain chronic burden. Adding $B_{\text{stressorday}}$ to β_0 gives the estimated mean negative affect on stressor days; $B_{\text{cumulativestress}}$ is the estimated change in negative affect from their estimated means with a one-unit change in multi-domain chronic burden on stressor-free days; $B_{\text{interaction}}$ indicates the difference in estimated mean negative affect on stressor days compared to stressor-free days (i.e., negative affective reactivity) with a one-unit change in multi-domain chronic burden. A Pseudo-R^2 was also calculated to assess the reduction in unexplained variance between a covariate-only model and the full analytical model. Pseudo-R^2 is calculated by subtracting the estimated residual variance of the full model from the estimated residual variance of the more basic model (covariate-only model) and dividing this difference by the estimated residual variance from the more basic model.

Results

Descriptive Statistics

Participant demographics are documented in Table 1. Participants in the sample were, on average, 56 years old. The sample was mainly comprised of White participants (84.22%). Slightly over half of the sample was female (57.22%). Approximately half of the participants had completed high school or equivalent (48.12%) and 45.35% had completed college or postgraduate education. The majority of participants were married (71.76%), employed (66.77%), and had at least one child (87.98%). Approximately half of the participants were classified as "active" (53.26%), and the majority were nonsmokers (84.20%). On average, participants reported 2.87 stressor days over the 8-day diary period (range = 0–8 stressor days).

Correlations Between Primary Study Variables

To examine between-person correlations between primary study variables, we conducted Pearson correlations between multi-domain chronic burden and sum of stressor days and average daily negative affect across the 8-day diary period. Higher multi-domain chronic burden was correlated with a greater number of reported stressor days ($r = .24$, $p < .001$) and higher levels of daily negative affect ($r = .34$, $p < .001$). The total number of stressor days was also correlated with average daily negative affect ($r = .29$, $p < .001$).

Hypothesis 1: Multi-Domain Chronic Burden and Daily Stressor Exposure

Generalized linear mixed models showed a significant relationship between multi-domain chronic burden and daily stressors, such that higher multi-domain chronic

Table 1 Participant Demographic Characteristics

	N or mean	% or *SD*
Age, *M*(SD)	56.23	12.20
Sex, *N* (%)		
Female	1,157	57.22
Male	865	42.78
Education, *N* (%)		
<High school	128	6.33
High school or equivalent	973	48.12
College completed	538	26.61
Postgraduate	379	18.74
Race, *N* (%)		
White	1,703	84.22
Black	228	11.28
Other	85	4.20
Hispanic, *N* (%)	60	2.97
Marital status—married, *N* (%)	1,451	71.76
Employment—employed, *N* (%)	1,350	66.77
Parental status—1+ child, *N* (%)	1,779	87.98
Activity status, *N* (%)		
Active	1077	53.26
Underactive	945	46.74
Smoking status, *N* (%)		
Nonsmoker	1711	84.80
Smoker	307	15.20
Number of stressor days, *M*(SD)	2.87	1.95
Daily negative affect, *M*(SD)	0.21	0.28

For negative affect, values were averaged across each participant and then an average for the full sample was calculated.

SD, standard deviation.

burden was associated with greater odds of reporting daily stressors (*odds ratio (OR)* = 1.39, $p < .001$) (Table 2). Specifically, a one-unit increase in multi-domain chronic burden corresponded with a 39% increase in the odds of reporting a daily stressor on a given day during the diary period. As previously reported in analyses with the MIDUS sample [25, 58], several covariates were also linked with greater odds of reporting daily stressors. Females and younger participants were more likely to report daily stressors. White participants were more likely to report daily stressors compared with Black participants and other racial groups. Odds of reporting daily stressors also increased with progressively higher levels of education, with participants holding a postgraduate degree being the most likely to report daily stressors.

Hypothesis 2: Multi-Domain Chronic Burden and Negative Affect

To examine associations between daily negative affect and fixed covariates without primary predictors in the model, daily negative affect was regressed on the covariates in a multilevel model (Table 3). White participants were the referent group for the race variable and postgraduate education was the referent group for the education variable. Age was negatively associated with negative affect, with younger adults reporting higher negative affect ($B = -0.07$, $p < .001$). Participants with postgraduate education reported higher negative affect compared to those with a college degree ($B = -0.56$, $p = .019$). Those who were not currently employed had higher daily negative affect compared with those currently employed ($B = 0.92$, $p < .001$). Participants who were unmarried or not living with a partner had higher daily negative affect compared to those who were married or living with a partner ($B = 0.70$, $p < .001$). Underactive participants had significantly higher negative affect compared to active participants ($B = 0.59$, $p < .001$). There were no other significant differences in daily negative affect by gender, education, race, ethnicity, or parental status.

Results of multilevel models examining the effect of multi-domain chronic burden and daily stress on daily negative affect are shown in Table 3 and Fig. 1. Analyses revealed a significant interaction between daily stressors and multi-domain chronic burden for negative affect. Participants reporting higher multi-domain chronic burden displayed an accentuated relationship between the occurrence of stressors and negative affect on a daily basis, with analyses showing a significant interaction of multi-domain chronic burden and daily stressors in predicting daily negative affect. On days with stressors, negative affect increased by 0.173 at mean multi-domain chronic burden and an additional 0.045 for every 1 *SD* increase in multi-domain chronic burden. These results indicate that the extent to which daily negative affect increased on stressor days compared to stressor-free days varied significantly by level of multi-domain chronic burden, with greater negative affect on stressor days compared to stressor-free days at higher levels of multi-domain chronic burden. Moving from the covariate-only model to the full model accounted for 11% (Pseudo-$R^2 = 0.11$) of the unexplained variance in negative affect. Lastly, a final sensitivity analysis showed that results from the interaction model remained the same after adjusting for chronic health conditions.

Discussion

These analyses examined the relationship between multi-domain chronic burden, daily stressors, and daily negative affect in a large sample of midlife adults in the USA. The results supported the study hypotheses. Consistent with hypothesis 1, participants who reported more multi-domain chronic burden had increased likelihood of having a stressful day during the 8-day diary period.

Table 2 Generalized Linear Mixed Model Showing Odds of Reporting Daily Stressors as a Function of Multi-domain Chronic Burden

Parameter				95% CI		
	OR	*B*	*SE*	Lower bound	Upper bound	*p*
Intercept	0.77	−0.26	.11	−0.47	−0.05	.014
Age	0.99	−0.01	.00	−0.01	−0.00	<.001
Sex	1.29	0.26	.05	0.16	0.35	<.001
Education						
< High School	0.47	−0.75	.13	−1.01	−0.50	<.001
High school or equivalent	0.53	−0.63	.07	−0.76	−0.50	<.001
College	0.74	−0.30	.07	−0.44	−0.16	<.001
Hispanic	1.27	0.24	.15	−0.06	0.54	.112
Race						
Black	0.72	−0.32	.09	−0.49	−0.15	<.001
Other	0.75	−0.29	.13	−0.54	−0.03	.027
Employment status	1.03	0.03	.06	−0.09	0.15	.663
Parental status	1.06	0.06	.08	−0.09	0.22	.435
Marital status	1.04	0.04	.06	−0.08	0.15	.528
Exercise status	1.02	0.02	.05	−0.07	0.12	.637
Multi-domain chronic burden	1.39	0.33	.03	0.27	0.38	<.001

White is the referent group for race and postgraduate education is the referent group for education.

CI, confidence interval.

Table 3 Multilevel Models for Multi-domain Chronic Burden and Daily Stressors as Predictors of Negative Affect

Parameter	Covariate-only model					Full model				
			95% CI					95% CI		
	B	*SE*	Lower	Upper	*p*	*B*	*SE*	Lower	Upper	*p*
Intercept	0.226	0.038	0.151	0.300	<.001	0.139	0.034	0.073	0.206	<.001
Age	−0.005	0.001	−0.006	−0.004	<.001	−0.002	0.001	−0.003	−0.001	.001
Gender (referent = W)	−0.014	0.012	0.037	0.009	.238	−0.011	0.010	−0.031	0.010	.306
Education										
< High school	0.043	0.027	−0.011	0.097	.116	0.18	0.025	−0.031	0.066	.470
High School	−0.023	0.015	−0.053	0.007	.135	−0.026	0.014	−0.054	0.001	.055
College	−0.040	0.017	−0.073	−0.006	.020	−0.038	0.15	−0.068	−0.008	.012
Hispanic (referent = Hispanic)	−0.059	0.035	−0.128	0.010	.095	−0.041	0.03	−0.103	0.0204	.188
Race (referent = White)										
Black	−0.021	0.030	−0.079	0.037	.476	−0.028	0.026	−0.080	0.023	.280
Other	0.036	0.019	−0.001	0.074	.060	0.009	0.017	−0.024	0.043	.584
Employment status (referent = working)	0.066	0.014	0.039	0.093	<.001	0.093	0.012	0.068	0.117	<.001
Parental status (referent = is a parent)	0.006	0.028	−0.030	0.042	.739	0.034	0.016	0.001	0.066	.041
Marital status (referent = is married)	0.050	0.014	0.023	0.078	<.001	0.038	0.012	0.014	0.062	.002
Exercise status	0.042	0.011	0.020	0.065	<.001	0.038	0.010	0.018	0.058	<.001
Stressor day (referent = no)						0.173	0.004	0.165	0.181	<.001
Multi-domain chronic burden						0.058	0.006	0.046	0.070	<.001
Multi-domain chronic burden × stressor day						0.045	0.004	0.037	0.053	<.001

White is the referent group for race and postgraduate education is the referent group for education. The High School education category included those with a high school degree or equivalent.

CI, confidence interval.

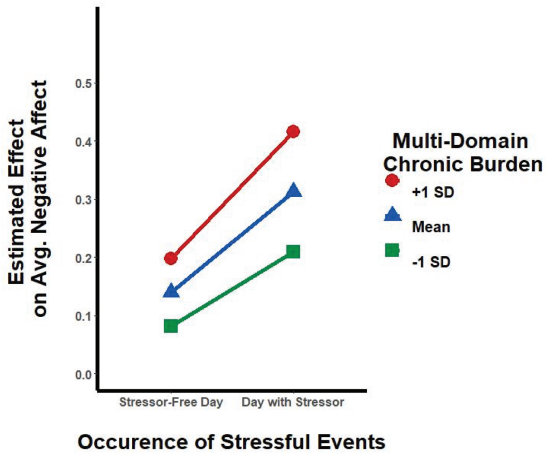

Fig. 1. Estimated negative affect on days with and without stressors by multi-domain chronic burden. * $p < .001$

The results from hypothesis 2 also showed the expected relationships: there was a significant interaction between multi-domain chronic burden and daily stressors predicting daily negative affect, with higher levels of multi-domain chronic burden exacerbating the extent to which negative affect was greater on stressor days compared to days free of stressors. Analyses also indicated that greater multi-domain chronic burden was associated with higher daily negative affect on both stressor days and non-stressor days. Although we did not specifically hypothesize this particular result, this finding points to the pernicious nature of multi-domain chronic burden: one does not need experience daily stressors to experience elevated daily negative affect if they have higher multi-domain chronic burden.

The relationship between greater multi-domain chronic burden and higher odds of reporting daily stressors adds to past work focused on single-domain chronic stress showing that individuals experiencing chronic stress greater number of daily stressors, when chronic stress was measured as caregiving, work, or home stress [30–32]. Similarly, the finding that higher multi-domain chronic burden is associated with higher daily negative affect aligns with prior related work showing that domain-specific stress (e.g., work stress, caregiving burden, and financial strain) are associated with greater daily negative affect [59, 60]. The present work extends this area of work by utilizing a summary score to capture a broad range of stressor exposures and perceptions across several life domains. The current study also extends the literature by finding that there was a significant interaction between multi-domain chronic burden and daily stressor exposure on negative affect, such that higher levels of multi-domain chronic burden were associated with exacerbated increases in negative affect on days participants were reported experiencing a stressful event compared to days that were free of such events. These results demonstrate that multi-domain chronic burden is an important contextual factor that is associated with greater negative affect on days with daily stressors. This has not been shown previously with multi-domain chronic burden measured in this manner.

Theoretically, why would greater multi-domain chronic burden increase the likelihood of experiencing daily stressors and raise a person's negative affect on days with stressors? One possibility is that having greater burden across several domains impacts the appraisal of new events and experiences, even minor daily hassles, such that they are more stressful or threatening [1, 61]. Individuals with higher multi-domain chronic burden may have learned that the world is not a safe place and, thus, when a negative event arises, they appraise it as more threatening than challenging, and respond with negative emotions. It is important to note that negative emotions serve a specific purpose that may be useful in responding to daily stressors: negative emotions can play an important role in impression formation or narrowing the mind's focus on a situation at hand [62, 63]. While negative emotions may be useful in the moment, over time they are associated with worse health [64–66]. In the present study, multi-domain chronic burden was associated with greater daily negative affect, even on stressor-free days, raising the possibility that consistently higher daily negative affect may be one pathway by which multi-domain chronic burden leads to worse mental health over time. Relatedly, greater multi-domain chronic burden may result in depletion of individuals' psychological, interpersonal, or material coping resources, leaving them without resources to maintain a positive emotion in the face of daily stressful events [67]. This resource deficit can lead to an exaggerated threat state and, subsequently, greater increases in negative affect when experiencing minor stressful events during their days [1, 68]. Furthermore, multi-domain chronic burden may lead to reductions in other mood-boosting activities like exercise or positive social interactions that would buffer the negative effects of daily stressors on affect [69].

These findings suggest that there is value in capturing a wide range of stressor exposures and perceptions of how difficult, upsetting, or threatening they are in a cumulative measure. In contrast to focusing on domain-specific stressful experiences and perceptions or groups of individuals with the same experiences (e.g., caregivers of ill family members as a model of "chronic stress"), studying multi-domain chronic burden allows studies to draw conclusions about how stress combines across a broad range of circumstances to burden individuals. This work represents an essential step forward in understanding the relationship between stress and health, given the growing body of research showing that exposure to and perceptions of multiple or repeated stressors across domains has a stronger relationship with health when compared to individual stressors [4, 13, 70].

The present findings set the stage for future work focused on how multi-domain chronic burden and other contextual factors predict daily stress processes and, ultimately, health and aging. For example, future work could test how multi-domain chronic burden predicts daily behavioral responses to stressors (e.g., physical activity, dietary habits), which may then lead to increased disease risk. Another line of work could explore whether multi-domain chronic burden predicts physiological responses to daily stressors. For instance, do individuals who have higher multi-domain chronic burden show greater blood pressure or inflammatory reactivity to daily stressors? If so, it may be appropriate to test psychological interventions that decrease physiological reactivity to daily stressors (e.g., meditation) in groups with greater multi-domain chronic burden. There is also a need for future work to explore protective contextual factors that may promote resilience to daily stressors, even when chronically burdened across multiple life domains. These protective factors include social (e.g., supportive family structures, community social cohesion), psychological (e.g., trait optimism), or behavioral (e.g., physically active lifestyle) individual- and community-level factors [1].

There are a number of limitations to the current analyses. In particular, the multi-domain chronic burden measure used here does have some limitations. First, the approach used to develop the multi-domain chronic burden variable assumes that all stressors have a comparable impact on the individual, regardless of their domain. It is possible that stressors in some domains have a greater impact on negative affect and health compared with other domains. For example, relationship stressors may have a greater impact on mental health than work stressors [71], but the multi-domain chronic burden measure in the current investigation gives equal weight to both of these domains. Second and relatedly, this approach assumes that stressors are additive and do not address potential interactive effects between life stressors or domains. Finally, the multi-domain chronic burden measure does not consider timing, severity, or duration of the individual domains that contribute to the cumulative score. Despite these limitations, the multi-domain chronic burden measure still provides a breadth and depth of information that is lacking from most studies by drawing on a wide range of domains and measures.

The daily stressor variable was also somewhat limited by focusing exclusively on whether or not a stressor occurred, regardless of the type, severity, or duration of the daily stressors. This end-of-day approach also required participants to recall stressful events and estimate their negative affect across the last 24 h, rather than recording stressors closer in time to their occurrence (as done with ecological momentary assessments delivered repeatedly several times per day to participants). As such, the present analyses do not provide clarity on the timing of negative affect in relation to stressor timing and we cannot provide causal evidence that negative affect increased on days with stressful events as a result of these events or not. Given that negative affect can change on a very short timescale, it is possible that we might see different effects using an ecological momentary assessment approach to measure stressors and negative affect with multiple measurements each day. Relatedly, it should be noted that there are other variables, such as poor sleep, that might predict increases in both negative affect and reports of stressor occurrence on a given day. There are also limitations to the MIDUS sample. Although the large sample size provided excellent statistical power, the sample is largely comprised of mid- to older-aged individuals who identify as White (84%), with a smaller number identifying as Black (11%) or other racial groups (4%); the Black participants were largely from the MIDUS Milwaukee subsample. Past work with the MIDUS sample has indicated that there are age and race differences in exposure and reactivity to certain types of daily stressors, such as interpersonal tensions [72]. As such, it is unclear whether these results generalize to other racial and ethnic groups in the US and to younger populations. Future work with a more diverse sample could provide insight into this issue.

Finally, as conceptualized elsewhere [24], our framework assumes that the experience of chronic and daily stressors are distinct stress concepts. However, others have conceptualized chronic stress as emerging from exposure to daily stressors. Smyth et al. [3] suggested that chronic stress emerges in several different ways: (a) within contexts whereby acute stressors and psychological or physiological responses to them are more frequently generated; (b) when individuals have slow or low psychological or physiological adaptation to an acute stressor(s) because of continued appraisal of threat even after discontinuation of the stressor(s); or (c) a failure to return to pre-stressor homeostatic levels or to recover fully, usually a result of exposure to repeated or prolonged stressors and prolonged exposure to activated physiological or psychological stress response systems. Within the context of MIDUS, it is impossible to determine the extent to which multi-domain chronic burden or the individual measures within specific domains emerged from exposure to repeated or prolonged minor daily stressful events across multiple or single domains.

Although stress is ubiquitous, it is difficult to capture its full complexity. The contexts in which stressors occur have often been ignored by observational studies, with stress researchers focusing narrowly on specific types of stressors—and perceptions of how difficult they are—within specific life domains. While it is methodologically useful and important to accurately capture specific domains of life stress, this approach often misses

the "big picture"—that the experience and appraisals of stressors do not occur in a vacuum, independent of other experiences and circumstances but, instead, occurs within the context of a person's life. Accounting for life circumstances, as well as other individual- and community-level contextual factors, is an important step forward in capturing this bigger picture. This investigation focused on chronic stressors across several domains, but future work should also capture early life and historical life circumstances, as well as characteristics of the broader social context. The current study is the first to show that multi-domain chronic burden is associated with higher likelihood of reporting of daily stressors and greater daily negative affect on days with stressors compared to stressor-free days in a well-powered sample of midlife adults in the USA. Taken together, these findings show that exposure to chronic stressors across multiple domains and perceptions of them as difficult may alter how individuals experience and interpret their daily lives.

Supplementary Material

Supplementary material is available at *Annals of Behavioral Medicine* online.

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Compliance with Ethical Standards

Authors' Statement of Conflict of Interest and Adherence to Ethical Standards All authors declare no conflicts of interest. All procedures, including the informed consent process, were conducted in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

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