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Validating the stress and adversity inventory for adults (Adult STRAIN) among urban middle-aged and older African Americans

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Abstract

The Stress and Adversity Inventory for Adults (Adult STRAIN) systematically assesses the count, severity, timing, types of lifetime stressors, primary life domains, and core social-psychological characteristics. The study aimed to replicate findings from the original Adult STRAIN validation study with a sample of middle-aged and older African American adults. Participants from the Health among Older Adults Living in Detroit study [$N = 200$; $M(SD) = 67.48$ years old (8.53), range = 50–89; 74.50% female], completed two home visits, daily diaries, and questionnaires. Pearson correlations and regression models assessed concurrent, discriminant, predictive, and comparative predictive validity (vs. the Perceived Stress Scale-4 and Risky Family Questionnaire) of the Adult STRAIN to stress-related (e.g. subjective physical health) and expected unrelated outcomes (e.g. personality variables), with and without covariates. The present study provides evidence of the Adult STRAIN as a valid measure of cumulative lifetime stressor exposure in older African American adults.

Keywords

lifetime stressor exposure, measurement, validity, health disparities, African Americans

Introduction

Stress is a complex process that involves the appraisal of environmental stimuli as taxing, leading to emotional, physiological, and behavioral responses. However, there is no universally accepted definition of stress, and questions remain about how stress should be measured to estimate its effects on health (Epel et al., 2018). Three stress-measuring traditions have been developed: epidemiological, psychological, and biological (Cohen et al., 2016). The epidemiological tradition focuses on assessing stressful life events, the psychological tradition emphasizes individual differences in stress perception, and the biological tradition focuses on

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physiological responses to stress. Despite focusing on different aspects of the stress process, each tradition acknowledges the importance of measuring stress across time to understand its impact on health. The Stress and Adversity Inventory for Adults (Adult STRAIN; Slavich and Shields, 2018) is a comprehensive system for assessing life stressors that combines the epidemiological tradition of assessing stressor exposure (i.e. stressor count) and the psychological tradition of measuring stress perception (i.e. stressor severity) across the entire life course. To date, the Adult STRAIN has been validated in a primarily White American sample (Slavich and Shields, 2018). Given the unique life experiences and health patterns faced by other groups, such as Black Americans, the Adult STRAIN should be validated in these subgroups. We addressed this important issue in the present study with a sample of urban middle-aged and older African American participants.

Stress and health

Across each stress measurement tradition, stress is associated with a variety of health consequences, including increased engagement in negative health behaviors (e.g. Jackson et al., 2010), greater risk of cardiovascular disease (CVD; e.g. Steptoe and Kivimäki, 2012), and higher risk of premature mortality (e.g. Cunningham et al., 2017). Rates of some of these health outcomes, such as CVD, tend to be higher among older Black Americans compared to older White American adults (e.g. Carnethon et al., 2017). According to the Theory of Fundamental Causes (Link and Phelan, 1995; Phelan and Link, 2015), socioeconomic status (SES) and racism are enduring social conditions that underlie health disparities by restricting access to flexible, health-promoting resources (e.g. social capital, money). Racism, in particular, has been recognized as a pervasive social determinant of health operating across structural, cultural, and interpersonal levels (Harnett and Ressler, 2021; Jackson et al., 1996; for a meta-analysis, see Paradies et al., 2015). The Adult STRAIN was not designed primarily to assess racism or race-related stressors, limiting its utility in capturing stressor exposure among Black Americans if used alone. However, if used alongside racism-related stress measures, it may add complementary health-relevant information by capturing downstream lifespan stressors that may stem from structural and interpersonal racism (e.g. Malat et al., 2022). For example, structural and interpersonal racism might increase exposure to financial and occupational stressors (American Psychological Association, 2017), all of which are exposures assessed by the Adult STRAIN. Stress scores from the Adult STRAIN have been associated with a wide variety of health outcomes (e.g. Foubert et al., 2021; Smith et al., 2020). Nonetheless, before it can be used as a tool to complement work on stress and health among Black Americans, a formal examination of its validity in this group is needed.

Stress and adversity inventory for adults

The Adult STRAIN can either be self-administered by the participants or administered by trained interviewers (see https://www.strainsetup.com). For each stressor that a participant reports, follow-up questions assess the stressor's severity, frequency, exposure timing, and duration, as well as its primary life domain and core social-psychological characteristic (Slavich and Shields, 2018). Despite the growing usage of the Adult STRAIN (e.g. Klatzkin et al., 2024; Parra et al., 2023), to date, only three published studies using the Adult STRAIN have focused exclusively on Black American adults (Gillespie et al., 2017, 2021, 2022); moreover, all three studies examined the same sample of pregnant Black American women. Gillespie et al. (2017) found that pregnant Black women who reported more childhood stressors experienced shorter gestation time. In the second study, racial discrimination and cumulative stressor counts interacted to significantly predict levels of several inflammatory markers (IL-8, TNF-α, IL-1β; Gillespie

et al., 2021). Finally, the third study found that cumulative lifetime stressor severity mediated the association between higher lifetime stressor count and higher inflammatory plasma marker levels of IL-1β in the same sample (Gillespie et al., 2022). Further research is needed to validate the utility of the Adult STRAIN among Black American adults beyond pregnant women.

Accordingly, the goal of the present pre-registered study[1] was to replicate the initial Adult STRAIN validation study (Slavich and Shields, 2018), including assessment of concurrent validity, discriminant validity, predictive validity, and comparative predictive validity, in a sample of middle-aged and older African American adults. Consistent with the original validation study, we examined sex differences across Adult STRAIN dimensions (primary life domains and core social-psychological characteristics), and health outcomes (subjective general health and self-reported chronic conditions).

Method

Participants and procedures

The Health among Older Adults Living in Detroit (HOLD) study recruited participants from the Detroit area between Fall 2017 and Winter 2020. Participants were recruited through the Institute of Gerontology's Healthy Black Elders Center Participant Research Pool (Mitchell et al., 2020), advertisements, and snowball sampling. The eligibility criteria included self-identifying African Americans. We refer to participants in this study as African Americans, recognizing its distinction from Black Americans. The HOLD study sample included 211 participants total [$N = 200$ with available Adult STRAIN data; $M_{age} = 67.48$ years old, SD = 8.53, and range = 50–89 years old]. The sample was comprised of predominantly women (74.50%).

Participants completed two home visits separated by a five-day daily diary period and a two-day questionnaire period. At the first home visit, trained research assistants provided the study overview, obtained informed consent, and administered the Adult STRAIN in an interview format, which took an average of 40 minutes to complete. The Pittsburgh Sleep Quality Inventory, subjective general health, number of chronic conditions, and demographic information were collected during this visit. Participants then received daily diaries and a set of questionnaires to complete independently at home. The daily diaries contained items about daily somatic symptoms and the modified Perceived Stress Scale. Global questionnaires included the Risky Family Questionnaire, Trait Adjective Questionnaire, 10-Item Personality Inventory, and 10-Item Center for Epidemiologic Studies Depression Scale Short Form. At the second home visit, participants were compensated up to $200 for their participation. The HOLD study was approved by the Institutional Review Board at Wayne State University. Data are available from the authors upon reasonable request.

Measures

Continuous life stress measures

Adult STRAIN. The Adult STRAIN contains a maximum of 286 potential questions that assess 55 lifetime stressors across five dimensions: exposure indices (stressor count, stressor severity), exposure timing (early life stress, adulthood life stress), stressor types (acute life events, chronic difficulties), primary life domains, and core social-psychological characteristics (for more details, see Slavich and Shields, 2018). The 12 primary life domains include housing, education, work, treatment/health, marital/partner, reproduction, financial, legal/crime, other relationships, death, life-threatening situations, and possessions. The five core social-psychological characteristics are interpersonal loss, physical danger, humiliation, entrapment, and role change/disruption. The Adult STRAIN has an intelligent logic feature to omit irrelevant questions. The number of individual stressors endorsed is summed into an exposure index representing cumulative lifetime stressor count, with scores ranging from 0 (i.e. no stressors) to 166 (i.e. maximum

number of stressors). The number of stressor severities endorsed is also summed into an exposure index representing cumulative lifetime stressor severity, with scores ranging from 0 (i.e. no severity) to 265 (i.e. maximum severity). This study primarily focused on the cumulative lifetime stressor count.

Childhood adversity. The Risky Family Questionnaire (RFQ; Taylor et al., 2004) is a 13-item scale used to assess childhood adversity in the household (e.g. "How often did a parent or other adult in the household push, grab, shove, or slap you?"; "Would you say the household you grew up in was chaotic and disorganized?") on a 5-point scale, ranging from 1 (*not at all*) to 5 (*very often;* re-scaled 0–4). Responses were averaged to create a composite score; higher scores represent greater childhood adversity. Resulting RFQ scores showed very good internal consistency (Cronbach's $\alpha = 0.86$).

Perceived stress. A modified version of the Perceived Stress Scale 4 (PSS-4; Cohen et al., 1983) was used to assess daily perceived stress (e.g. "Thinking about today, how often did you feel that you were unable to control the important things of the day?") on a 4-point scale, ranging from 0 (*never*) to 4 (*very often*). Items were summed into daily scores for days on which all items from the HOLD daily diaries were answered. Daily responses were averaged to create a composite score across days, such that anyone who completed all four items on at least 1 day received an overall score. Higher scores represent greater perceived stress. Resulting PSS-4 scores showed acceptable internal consistency (Cronbach's $\alpha = 0.72$).

Health measures

Mental & physical health complaints. The Adult STRAIN also included the Kessler 6-Item Psychological Distress Scale (K-6; Kessler et al., 2002). The K-6 assesses how often specific feelings (e.g. "nervous"; "restless") were experienced within the last 30 days, on a 5-point scale ranging from 1 (*all the time*) to 5 (*none of the time*). Responses were reverse-coded and summed to create a composite score; higher scores indicate more mental health complaints. Resulting K-6 scores showed acceptable internal consistency (Cronbach's $\alpha = 0.78$). Although the initial validation study (Slavich and Shields, 2018) included the Physical Health Questionnaire (PHQ; Schat et al., 2005), PHQ scores were excluded in the present study due to poor internal consistency (Cronbach's $\alpha = 0.67$).

Additionally, 14 items in the HOLD daily diaries assessed daily somatic symptoms (e.g. "headache"; "backache"; list adapted from Larsen and Kasimatis, 1991) on a 6-point scale, ranging from 1 (*none*) to 6 (*very severe*). Daily scores were summed only for days on which all items were answered. Daily responses were averaged to create a composite score, such that anyone who completed all items on at least 1 day received an overall score. Higher scores represent more severe daily self-reported somatic symptoms.

Sleep quality. The Pittsburgh Sleep Quality Inventory (PSQI; Buysse et al., 1989) is a 19-item sleep quality inventory (e.g. "During the past month, what time have you usually gotten up in the morning?"; "During the past month, how would you rate your sleep quality overall?"). Raw scores for each of the seven components (e.g. sleep efficiency, sleep latency) were re-coded on a 3-point scale ranging from 0 (*no difficulty*) to 3 (*severe difficulty*). The global PSQI score was created by summing each component score; higher scores indicate poorer sleep quality. Global PSQI scores showed acceptable internal consistency (Cronbach's $\alpha = 0.71$).

Depressive symptoms. The 10-item Center for Epidemiologic Studies Depression Scale Short Form (CES-D-10; Andresen et al., 1994) assesses depressive symptoms (e.g. "I felt depressed."; "I felt lonely.") on a 4-point scale, ranging from 1 (*rarely or none of the time*) to 4 (*most of the time*; re-scaled 0–3). Responses were averaged to create a composite score; higher scores indicate more severe depressive symptoms. CES-D-10 scores showed acceptable internal consistency (Cronbach's $\alpha = 0.76$).

Physical health

Self-reported subjective physical health. During the first home visit, one item assessed subjective general health ("In general, how would you describe your health quality?") with response options ranging from 1 (*excellent*) to 5 (*poor*). Responses were reverse coded, such that higher scores indicate better subjective general health.

Self-Reported chronic health conditions. Chronic conditions experienced in the previous year were assessed using a 16-item questionnaire (e.g. "Have you suffered from asthma in the past 12 months?"), coded as 0 = no, 1 = yes. Responses were summed to create a composite score; higher scores indicate more self-reported chronic conditions.

Personality Traits. The Ten Item Personality Inventory (TIPI; Gosling et al., 2003) measures the Big Five personality traits (extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience) on a 7-point scale, ranging from 1 (*disagree strongly*) to 7 (*agree strongly*). Each trait is assessed using two items, with one item reverse-coded. Responses were averaged to create a composite score for each trait; higher scores indicate greater endorsement of each personality trait. Due to the structure of the TIPI, internal consistency is not an appropriate index of reliability; the scale has previously shown good test-retest reliability across a 6-week period (mean test-retest $r = 0.72$; Gosling et al., 2003).

Covariates

Demographic variables. From the Adult STRAIN, age was treated as a continuous variable. Sex was treated as a dichotomous variable (0 = male, 1 = female). An SES composite was calculated by averaging participants' *z*-scored education level and annual income. Education level options ranged from 1 (no school/some grade school) to 12 (PhD, EdD, MD, DDS, LLB, LLD, JD, or other professional degrees). Annual income options ranged from 1 (less than $5000 to 13 ($150,000 or more).

Negative affect. The Trait Adjective Questionnaire (TAQ; Usala and Hertzog, 1989) measured trait negative affect (e.g. sad, nervous) on a 5-point scale, ranging from 1 (*not at all accurate*) to 5 (*extremely accurate*). Responses were averaged to create a composite score; higher scores indicate greater negative affect. Negative affect scores showed very good internal consistency (Cronbach's $\alpha = 0.89$).

Missing data on questionnaires. The incidence of missing data at the person level was 5.0%. The expectation maximization (EM) algorithm was used to impute continuous and count variables; imputed values for count variables were rounded to the nearest whole number. Mode replacement for dichotomous variables was used to impute missing data. The EM algorithm method has been shown to consistently provide unbiased parameter estimates and improvement in statistical power of analyses (Enders, 2001; Graham et al., 2007).

Sensitivity analyses. Sensitivity analyses were conducted to examine whether the number of items missed in each scale influenced the pattern of results. For each scale with missing item-level data, scores were generated in two ways: (a) responses were averaged such that all individuals who answered at least one item received a score (i.e. no minimum number of items necessary); and (b) responses were averaged such that only participants who completed all items received a score (i.e. complete cases scoring). Both score versions were used in Pearson correlations and regression analyses. No substantive differences in the results were observed, and ultimately, mean scores without a minimum number of items necessary were used.

Data analyses

Analyses were conducted in IBM SPSS Statistics Version 29 and Rstudio Version 4.2.1 using the ggplot2 package for figures. Pearson correlations were used to examine unadjusted associations between continuous sociodemographic variables (i.e. age, sex, SES) and Adult

STRAIN exposure indices (cumulative lifetime stressor count, cumulative lifetime stressor severity). An independent samples *t*-test was used to examine sex differences in both Adult STRAIN exposure indices.

Concurrent validity was tested by comparing the zero-order Pearson correlations between the Adult STRAIN and two other stress measures (i.e. RFQ, PSS-4). As hypothesized in Slavich and Shields (2018), we expected the cumulative lifetime stressor count to correlate with other stress measures that assessed childhood and adulthood stress.

For discriminant validity, zero-order Pearson correlations were used as a preliminary assessment of the associations between each of the three stress measures (i.e. the Adult STRAIN, RFQ, PSS-4) and personality traits. Partial Pearson correlations were used to examine associations among these variables while controlling for age, sex, and SES. A lack of association between cumulative lifetime stressor count and personality traits would support its discriminant validity (Slavich and Shields, 2018).

Next, as a preliminary assessment of predictive validity, zero-order Pearson correlations were used to examine associations among the Adult STRAIN and all continuous health measures (i.e. mental health complaints, sleep quality, depressive symptoms, self-reported daily somatic symptoms, subjective general health), without adjusting for covariates. To account for covariates, regression was used; separate models were constructed with each health measure as an outcome and cumulative lifetime stressor count as the predictor, adjusting for the effects of age, sex, SES, and negative affect. Most health measures were continuous, allowing the use of multiple linear regression. However, Possion regression was used for self-reported number of chronic conditions because it is a count variable. Significant associations between cumulative lifetime stressor count and health measures would support the predictive validity of the Adult STRAIN (Slavich and Shields, 2018).

In the comparative predictive validity analyses, we tested how well the Adult STRAIN predicted health outcomes compared to other established measures of stress (e.g. PSS-4). These analyses were conducted in a hierarchical fashion. Step 1 models tested the effect of all covariates (age, sex, SES, and negative affect) on each health measure separately. In Step 2, the RFQ and PSS-4 were added to each Step 1 model. Finally, in Step 3, cumulative lifetime stressor count was added to each Step 2 model. Ordinary least squares regression was used for all continuous health outcomes; ANOVA was used to test whether each step significantly increased variance explained relative to the previous step. Additional regression analyses included one stress measure at a time (Adult STRAIN, RFQ, PSS-4) predicting each continuous health outcome, enabling comparison of the standardized betas for each stress measure. Poisson regression and χ^2 tests of change in residual deviances across steps were used to assess effects on self-reported number of chronic conditions. Stronger associations between cumulative lifetime stressor count and health outcomes, compared to other stress measures, would support the comparative predictive validity of the Adult STRAIN (Slavich and Shields, 2018).

Independent samples *t*-tests were used to examine sex differences in cumulative lifetime stressor count across each of the 12 primary life domains (e.g. housing, education) and five core social-psychological characteristics (e.g. interpersonal loss, humiliation). To better understand associations between the five core social-psychological characteristics and health, Poisson regression was used to examine associations between each core social-psychological characteristic and self-reported number of chronic conditions, while adjusting for covariates (age, sex, SES, and negative affect). Zero-order Pearson correlations were used to examine associations with subjective general health.

Although the original validation study (Slavich and Shields, 2018) reported latent class analyses, these were not included in the

present study as our data best supported a one-cluster fit. This means participants could not meaningfully be categorized into high or low-stress level groups. Participants who did not provide complete responses to the Adult STRAIN were excluded from analyses, leaving a final analytic sample of 200 participants.

Results

Participant characteristics and bivariate zero-order correlations

Descriptive statistics are presented in Table 1. Participants had an average cumulative lifetime stressor count of 30.97 (SD = 13.00; range = 1–72) and an average cumulative lifetime stressor severity of 72.57 (SD = 34.88; range = 1–169). As expected, cumulative lifetime stressor count was significantly related to cumulative lifetime stressor severity ($r = 0.86$, $p < 0.01$). Age was significantly correlated with cumulative lifetime stressor count ($r = -0.18$, $p = 0.01$) and severity ($r = -0.21$, $p < 0.01$). SES was not significantly associated with cumulative lifetime stressor count or severity. No significant sex differences were found for cumulative lifetime stressor count or severity.

Table 1. Participant Characteristics.

Categorical Variable	*n*	%
Sex	200	
Male	51	25.50
Female	149	74.50
Continuous Variables	***n***	***M* (SD)**
Age	201	67.48 (8.55)
SES	199	0.00 (.88)
Negative Affect (TAQ)	183	1.45 (0.56)
Personality Traits (TIPI)		
Extraversion	177	4.25 (1.36)
Agreeableness	179	5.86 (1.09)
Conscientiousness	179	5.87 (1.04)
Emotional Stability	178	5.71 (1.22)
Openness to Experience	179	5.47 (1.25)
Childhood Adversity (RFQ)	184	2.00 (0.76)
Perceived Stress (PSS-4)	192	0.87 (0.62)
Mental Health Complaints (K-6)	201	9.90 (4.12)
Sleep Quality (PSQI)	189	6.52 (3.84)
Depressive Symptoms (CES-D-10)	178	0.61 (0.50)
Self-Reported Daily Somatic Symptoms	192	0.37 (0.43)
Subjective General Health	200	3.13 (0.96)
Self-Reported Chronic Conditions	187	1.28 (1.27)

Note. *n* = sample size; *M* (SD) = mean (standard deviation). Values presented are prior to EM imputation and mode replacement.
TAQ: Trait Adjective Questionnaire; TIPI: Ten Item Personality Inventory; RFQ: Risky Family Questionnaire; PSS-4: Perceived Stress Scale 4-Item; K-6: Kessler 6-Item Psychological Distress Inventory; PSQI: Pittsburgh Sleep Quality Inventory; CES-D-10: 10-Item Center for Epidemiologic Studies Depression Scale Short Form.

Validity

Concurrent validity. Cumulative lifetime stressor count was significantly correlated with other stress-related measures (i.e. RFQ and PSS-4): childhood adversity ($r = 0.31$, $p < 0.01$) and perceived stress ($r = 0.17$, $p = 0.02$), supporting the concurrent validity of the STRAIN.

Discriminant validity. In correlational analyses, cumulative lifetime stressor count was significantly associated with emotional stability ($r = -0.16$, $p = 0.03$) and openness to experiences ($r = 0.15$, $p = 0.04$), but not with extraversion, agreeableness, or conscientiousness. However, after controlling for covariates, cumulative lifetime stressor count was not significantly correlated with any personality trait (p's > 0.05).

Childhood adversity was significantly associated with two personality traits: agreeableness ($r = -0.23$, $p < 0.01$) and emotional stability ($r = -0.20$, $p < 0.01$). Controlling for covariates attenuated, but did not eliminate, correlations between childhood adversity and both agreeableness ($r = -0.23$, $p < 0.01$) and emotional stability ($r = -0.17$, $p = 0.02$). Perceived stress was significantly correlated with four personality traits: agreeableness ($r = -0.44$, $p < 0.01$), conscientiousness ($r = -0.33$, $p < 0.01$), emotional

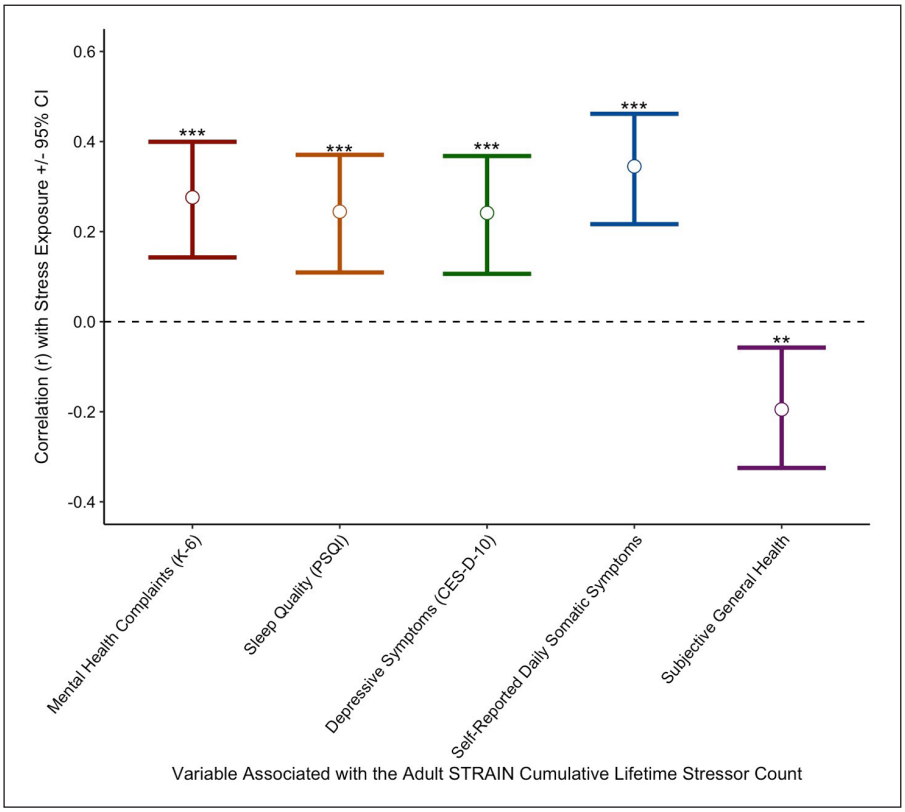

Figure 1. Predictive Validity Correlations of the Adult STRAIN.
Note. Cumulative lifetime stressor count assessed by the Adult STRAIN significantly predicted each health outcome. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

stability ($r = -0.45$, $p < 0.01$), and openness to experience ($r = -0.21$, $p < 0.01$). After adjusting for covariates, all four partial correlations remained significant: agreeableness ($r = -0.40$, $p < 0.01$), conscientiousness ($r = -0.33$, $p < 0.01$), emotional stability ($r = -0.38$, $p < 0.01$), and openness to experience ($r = -0.23$, $p < 0.01$).

Because some associations between childhood adversity, perceived stress, and personality traits remained significant even after adjustment for covariates, this suggests that personality traits may be related to stress reporting in both the RFQ and PSS-4. In contrast, the Adult STRAIN was the only measure not significantly correlated with any personality traits after controlling for covariates, supporting its discriminant validity.

Predictive validity. In Figure 1, higher cumulative lifetime stressor count was significantly associated with more mental health complaints ($r = 0.28$, $p < 0.01$), poorer sleep quality ($r = 0.24$, $p < 0.01$), more depressive symptoms ($r = .024$, $p < 0.01$), more self-reported daily somatic symptoms ($r = 0.35$, $p < 0.01$), and poorer subjective general health ($r = -0.20$, $p = 0.01$). Higher cumulative lifetime stressor counts also significantly predicted more self-reported chronic health conditions ($B = 0.02$, IRR = 1.02, 95% Wald confidence interval [CI] = 0.01–0.03, $p < 0.01$), without adjusting for covariates.

After adjusting for covariates (age, sex, SES, and negative affect), higher cumulative lifetime stressor count remained significantly associated with more mental health complaints ($\beta = 0.16$, $p = 0.01$), poorer sleep quality ($\beta = 0.20$, $p < 0.01$),

Table 2. Variance Explained in Each Health Outcome for Comparative Predictive Validity.

Model	Mental Health Complaints (K-6)		Sleep Quality (PSQI)		Depressive Symptoms (CES-D-10)		Self-Reported Daily Somatic Symptoms		Subjective General Health	
	R^2	F	R^2	F	R^2	F	R^2	F	R^2	F
Step 1	0.27	18.38***	0.09	4.64**	0.45	40.62***	0.12	6.74***	0.20	11.42***
Step 2	0.37	19.07***	0.10	3.47**	0.54	36.97***	0.26	10.98***	0.24	10.01***
△	0.10	15.11***	0.01	1.12	0.08	16.63***	0.13	17.24***	0.05	6.02**
Step 3	0.39	17.74***	0.13	4.22***	0.54	32.37***	0.34	13.91***	0.26	9.52***
△	0.02	6.52*	0.04	7.94*	0.01	2.77	0.08	23.56***	0.02	5.26*

Note. Hierarchical regression models controlled for age, sex, socioeconomic status, and negative affect. R^2 values were derived from regressions, and F values were derived from corresponding ANOVAs. Step 1 = Covariates; Step 2 = Covariates + RFQ + PSS-4; Step 3 = Covariates + RFQ + PSS-4 + Adult STRAIN.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

more depressive symptoms ($\beta = 0.11$, $p = 0.05$), greater self-reported daily somatic symptoms ($\beta = 0.30$, $p < .001$), poorer subjective general health ($\beta = -0.13$, $p = .04$), and more self-reported chronic health conditions ($B = 0.03 =$, IRR = 1.03, 95% Wald CI = 0.02–0.04, $p < 0.01$). Greater cumulative lifetime stressor count was significantly associated with worse mental and physical health outcomes, both before and after controlling for covariates, supporting the predictive validity of the Adult STRAIN.

Comparative predictive validity. As shown in Table 2, Step 3 models significantly accounted for more variance than Step 2 models in predicting mental health complaints, sleep quality, self-reported daily somatic symptoms, subjective general health, and self-reported number of chronic conditions. Adding cumulative lifetime stressor count in Step 3 did not account for significantly more variance in depressive symptoms. Overall, the hierarchical regression results suggested that the Adult STRAIN significantly explained more variance than the other stress measures in all health outcomes except for depressive symptoms.

As presented in Table 3, a higher cumulative lifetime stressor count was significantly associated with five out of six health outcomes, specifically more mental health complaints, poorer sleep quality, greater self-reported daily somatic symptoms, poorer subjective general health, and more self-reported chronic conditions. Again, depressive symptoms was not significantly associated with cumulative lifetime stressor count. In comparison, childhood adversity significantly predicted fewer self-reported chronic conditions. Cumulative lifetime stressor count significantly predicted five more health outcomes than childhood adversity. Based on the magnitude of the associations, childhood adversity was the stronger predictor of self-reported chronic conditions. Perceived stress was associated with significantly more mental health complaints, more depressive symptoms, greater self-reported daily somatic symptoms, poorer subjective general health, and more self-reported chronic conditions. Overall, cumulative lifetime stressor count significantly predicted the same number of health outcomes as perceived stress and more outcomes than childhood adversity. These results provide partial support for the comparative predictive validity of the Adult STRAIN, particularly in comparison to childhood adversity

Sex differences aAdult STRAIN dimensions. Across the 12 primary life domains (Figure 2a), women reported significantly more stressors

Table 3. Comparative Predictive Validity of the Adult STRAIN, RFQ, and PSS-4.

Variable	Adult STRAIN	RFQ	PSS-4
		β	
Mental Health Complaints (K-6)	0.16*	−0.03	0.39***
Sleep Quality (PSQI)	0.20**	−0.04	0.12
Depressive Symptoms (CES-D-10)	0.09	0.04	0.34***
Self-Reported Daily Somatic Symptoms	0.31***	−0.04	0.44***
Subjective General Health	−0.15*	0.11	−0.27***
Self-reported Chronic Conditions	0.03***	−0.26*	.030*

Note. Standardized coefficients (β) were derived from regression analyses and beta coefficients from Poisson regressions for self-reported chronic conditions. Participants' age, sex, socioeconomic status, and negative affect were used as covariates. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

involving reproduction [$t=-6.69$, $p<0.01$], treatment/health [$t=-2.67$, $p=0.01$], marital/partner [$t=-2.52$, $p=0.02$], and death [$t=-3.59$, $p=0.002$] than men. Men reported significantly more stressors involving housing [$t=3.10$, $p<0.01$], education [$t=2.60$, $p=0.01$], work [$t=3.41$, $p<0.01$], legal/crime [($t=4.20$, $p<0.01$], and life-threatening situations [$t=2.72$, $p=0.01$]] than women. No significant sex differences were found for financial, other relationships, and possessions life domains. Across the five core social-psychological characteristics (Figure 2b), in turn, women reported significantly more interpersonal loss than men [$t=-2.57$, $p=0.01$], and men reported significantly more role change/disruption than women [$t=3.30$, $p<0.01$]. No significant sex differences were found for social-psychological characteristics of physical danger, humiliation, and entrapment. Overall, significant sex differences emerged in 9 out of 12 primary life domains and 2 out of 5 core social-psychological characteristics, indicating differences in stress experienced by men and women.

Associations between adult STRAIN dimensions and health outcomes. Examination of individual Adult STRAIN dimensions (e.g. early life stress; work stress) revealed several significant associations with both self-reported chronic conditions (Figure 3) and subjective general health (Figure 4). For stressor timing, cumulative count of adulthood (but not childhood) life stressors was associated with significantly more self-reported chronic conditions. For stressor type, cumulative count of acute life events and chronic difficulties was significantly associated with more self-reported chronic conditions. For primary life domains, cumulative counts of treatment/health, marital/partner, financial, death, and life-threatening situations were associated with significantly more self-reported chronic conditions. For core social-psychological characteristics, cumulative count of interpersonal loss, physical danger, entrapment, and role change/disruption significantly predicted more self-reported chronic conditions.

For stressor timing, cumulative count of adulthood life stressors had a significant negative association with subjective general health. For stressor types, cumulative count of acute life events was significantly negatively associated with subjective general health. For primary life domains, cumulative counts of housing, education, work, treatment/health, marital/partner, and life-threatening situations treatment/health were significantly negatively associated with subjective general health. For core social-psychological characteristics, physical danger, humiliation, and role change/disruption were significantly negatively associated with subjective general health.

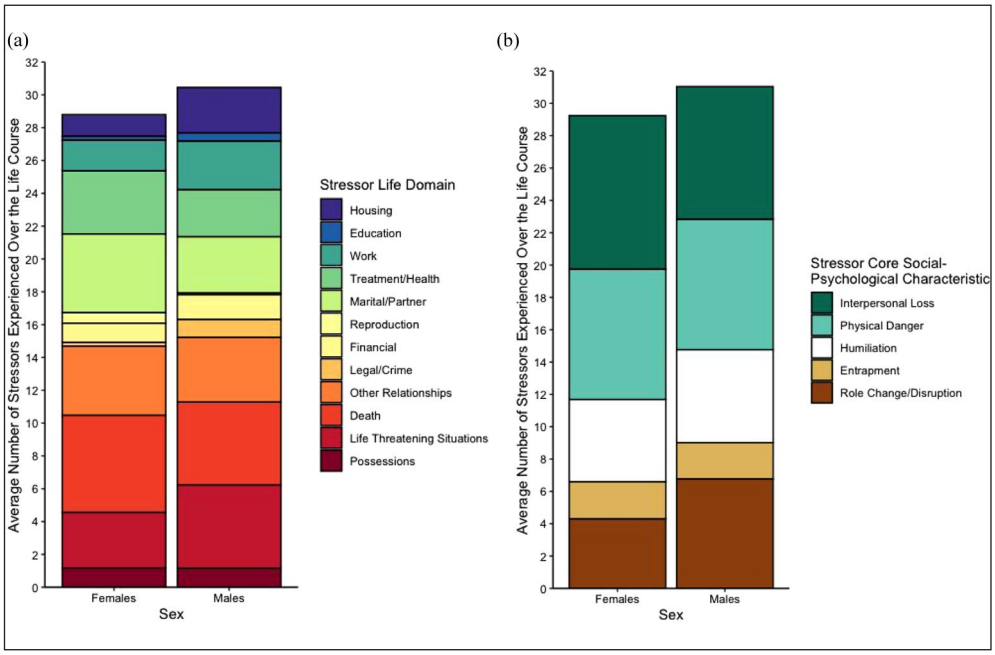

Figure 2. Sex differences in the Adult STRAIN by Stressor Categories. *Note*. (a) Across stressor life domains, women experienced significantly more treatment/health, marital/partner, reproduction, and death stressors; men reported more housing stressors, education stressors, work stressors, legal/crime stressors, and life-threatening situation stressors. (b) Across core social-psychological characteristics, women experienced significantly more interpersonal loss, and men reported more role change/disruption. All other comparisons were nonsignificant.

Discussion

The Adult STRAIN is a relatively new system for assessing stress exposure and severity across the life course. This instrument was originally validated in a community sample of predominantly White American adults (Slavich and Shields, 2018). Here, we sought to replicate and expand upon this research by examining the Adult STRAIN in a community sample of middle-aged and older African American adults, who are known to experience significant health disparities (e.g. Forrester et al., 2020; Kyalwazi et al., 2022). In this sample, we found that cumulative lifetime stressor count was associated with health outcomes and performed similarly to the perceived stress measure and better than the childhood adversity measure. We also found sex differences and different associations with health outcomes (i.e. self-reported chronic conditions, subjective general health) across Adult STRAIN dimensions. In short, these results support the concurrent validity, discriminant validity, predictive validity, and comparative predictive validity of the Adult STRAIN in a sample of older African American adults.

Our study revealed demographic variations in the Adult STRAIN that differed slightly compared to those observed in the original validation study. Slavich and Shields (2018) found that cumulative lifetime stressor count was positively correlated with age, negatively correlated with SES, and higher for women than men. In the present study, cumulative lifetime stressor count was negatively correlated with age, unrelated to SES, and did not differ between men and women. The absence of a significant association between the Adult STRAIN and SES could be understood through two

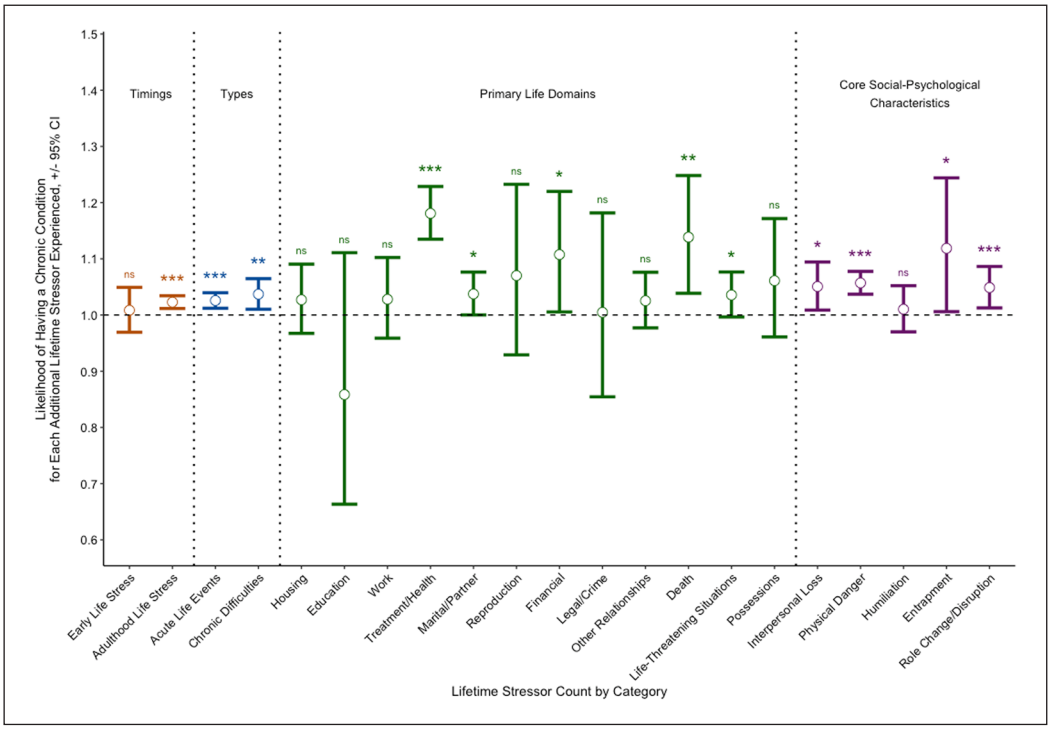

Figure 3. Likelihood of Having Self-Reported Chronic Conditions Across the Adult STRAIN Dimensions.
Note. The likelihood of having a self-reported chronic condition significantly differed by stressor categories across the Adult STRAIN domains. Participants' likelihood of having a self-reported chronic condition was significantly predicted by the cumulative count of adulthood life stress, acute life events, chronic difficulties, treatment/health, marital/partner, financial, death, life-threatening situations, interpersonal loss, physical danger, entrapment, and role change/disruption. ns = not significant, $*p < .05$. $**p < .01$. $***p < .001$.

theoretical perspectives. First, the Theory of Fundamental Causes (Link and Phelan, 1995; Phelan and Link, 2015) posits that, while individuals of higher SES typically benefit from greater access to flexible resources (e.g. money), the protective effects of higher SES are not uniformly experienced across racial/ethnic groups in the United States, leading to racial health disparities. For Black Americans, racism is a fundamental cause that operates independently of SES and can undermine these protective resources. Second, the Diminishing Returns Hypothesis (Assari, 2019; Farmer and Ferraro, 2005) suggests that high SES Black Americans have fewer psychosocial and health benefits than high SES White Americans. In short, high SES does not fully mitigate the effects of racism. For instance, Thomas Tobin et al. (2021) found that Black Americans of high SES did not have the same increases in psychosocial resources (e.g. social support) as White Americans, suggesting that structural racism could constrain benefits derived from upward SES mobility. Additional research is needed to disentangle the effects of racism and SES on stressor exposure among Black Americans.

Results from the present sample of African American adults support the concurrent validity of the Adult STRAIN. Cumulative lifetime stressor count was significantly related to both childhood adversity and perceived stress. Childhood adversity was moderately correlated with cumulative lifetime stressor count, while perceived stress had a weaker correlation. Our

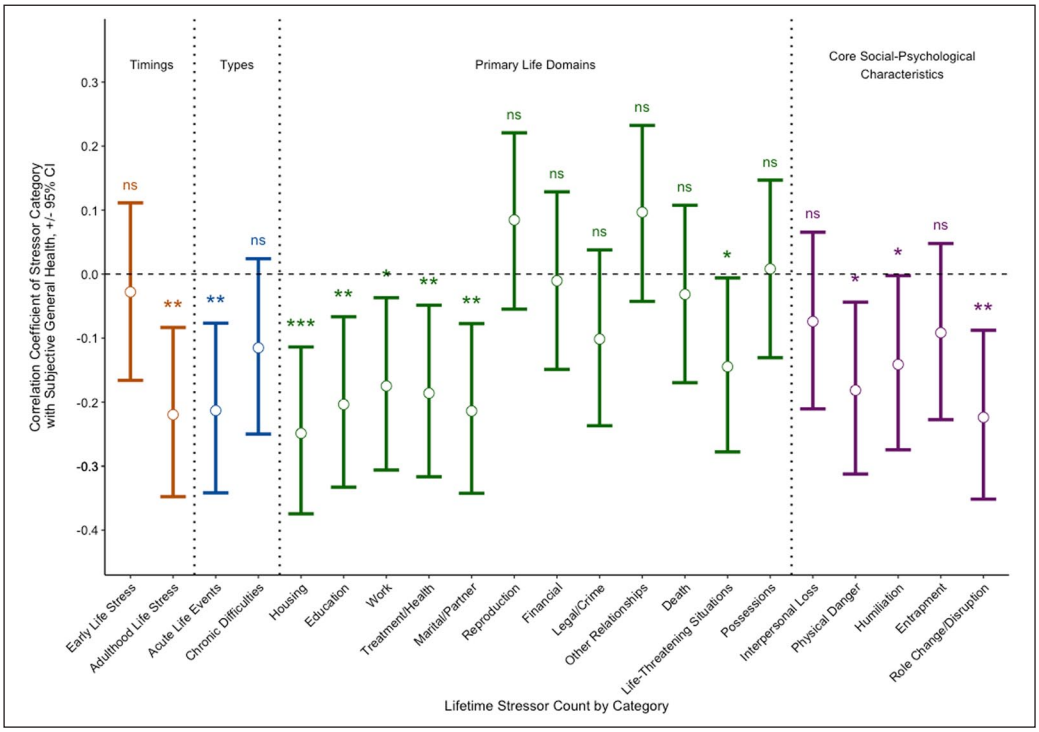

Figure 4. Correlations Between the Adult STRAIN Dimensions and Subjective General Health.
Note. Correlations with subjective general health significantly differed substantially across Adult STRAIN dimensions. Cumulative count of adulthood life stress, acute life events, housing, education, work, treatment/health, marital/partner, life-threatening situations, physical danger, humiliation, and role change/disruption were significantly related to poorer subjective general health.
ns = not significant, $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

results followed a similar pattern to the original validation study (Slavich and Shields, 2018) for their measures of childhood adversity (i.e. Childhood Trauma Questionnaire–Short Form) and perceived stress (i.e. Perceived Stress Scale-10). The observed significant associations with two measures of stress (i.e. RFQ, PSS-4) support the concurrent validity of the Adult STRAIN in the present sample.

The discriminant validity of the Adult STRAIN was also supported in the present study, with non-significant partial correlations between cumulative lifetime stressor count and all five personality traits. In comparison, childhood adversity was significantly associated with agreeableness and emotional stability, while perceived stress was significantly related to all personality traits except for extroversion. These results differ slightly from Slavich and Shields (2018) in that the Adult STRAIN and childhood adversity had no significant partial correlations with any personality traits, whereas perceived stress was correlated with all personality traits. Prior research has reported associations between perceived stress and extraversion, conscientiousness, and neuroticism/emotional stability (Ebstrup et al., 2011; Lecic-Tosevski et al., 2011).

Despite its self-report nature, the Adult STRAIN distinguishes assessments of stressor exposure (i.e. cumulative lifetime stressor count) from stressor perception (Epel et al., 2018; Luo et al., 2023). Prior research has commonly found personality traits as more strongly

associated with measures of perceived stress than stressor exposure (Luo et al., 2023). The present finding that perceived stress was associated with most personality traits, whereas cumulative lifetime stressor count (an index of stressor exposure) was not associated with any personality traits after adjustment for covariates. This is consistent with prior research and supports the discriminant validity of the Adult STRAIN cumulative lifetime stressor count.

The Adult STRAIN also demonstrated good predictive validity. Higher cumulative lifetime stressor count was significantly related to poorer health across four of the five continuous health outcomes assessed in our study – namely, mental health complaints, sleep quality, self-reported daily somatic symptoms, and subjective general health – and was unrelated to depressive symptoms. Prior studies on exclusively African American samples reported similar findings. For instance, Johnson et al. (2016) found that major life events as a measure of chronic stress were significantly associated with lower sleep quality (PSQI) among African Americans from the Jackson Heart Study. Brown and Gary (1987) reported that stressful life events significantly predicted subjective general health after controlling for age, income, and education among African American adults. Overall, the Adult STRAIN was significantly associated with a range of health-related outcomes, supporting the predictive validity of the measure.

Lastly, the present study supported the comparative predictive validity of the Adult STRAIN. Hierarchical regression analyses revealed that cumulative lifetime stressor count (Step 3) significantly increased the variance explained by childhood adversity and perceived stress (Step 2). Only depressive symptoms were not significantly predicted by the Adult STRAIN. However, depression scores were significantly predicted by perceived stress (Table 3). This finding aligns with prior studies on Black American adults that reported a robust positive association between perceived stress and depressive symptoms (Byrd et al., 2020; Giurgescu et al., 2015).

Limitations

Several limitations should be noted. First, the present study was cross-sectional, and causal statements about the associations cannot be made. Predictive validity generally refers to the ability of a measure at one time point to predict other measures at a future time; however, the study's design precludes examination of predictive validity in its strict sense. Future studies using longitudinal designs are needed to fully test the predictive validity of the Adult STRAIN. Second, unlike the original Adult STRAIN validation study (Slavich and Shields, 2018), social desirability, post-stressor-assessment negative affect, and subjective assessments of the usability of the Adult STRAIN were not assessed. These omissions limited our ability to draw conclusions about the Adult STRAIN's usability. Third, our sample was predominantly female; accordingly, sex differences should be interpreted with caution due to unequal group sizes. Fourth, because our sample included only urban African Americans, our findings may not generalize to rural African Americans or other racially minoritized groups of older adults.

Additionally, the present study is limited by the lack of a direct measure of racism-related stress. A large body of empirical research suggests that racism is a powerful social determinant of health (Javed et al., 2022; Paradies et al., 2015). Conceptual models such as the Theory of Fundamental Causes (Link and Phelan, 1995; Phelan and Link, 2015) and the Diminishing Returns Hypothesis (Assari, 2019; Farmer and Ferraro, 2005) theorize pathways and mechanisms that perpetrate racial health disparities. Together, empirical and theoretical insights underscore the importance of integrating racism measures to more accurately capture the stressors experienced by older Black Americans and their implications for health. We want to be clear that we believe that racism and racial stress exert cumulative effects on health, which we were unable to comprehensively assess in this study. Racism and racial stress could have been a stronger predictor of health outcomes than the stress measures included (i.e.

the Adult STRAIN; RFQ; PSS-4). Nevertheless, the present data establish the validity of the Adult STRAIN, which assesses broad stressors that are not tied to specific racism-related characteristics. Despite the validity of the Adult STRAIN in an African American sample within this study, the Adult STRAIN's depiction of stress in racially marginalized groups is incomplete: future work on stress in an African American sample should include a measure of racial stress. Future research should also aim to replicate the present results, especially with respect to comparative predictive validity, when including a racism or racial stress scale.

Conclusion

Despite these limitations, the present study tested the validity of the Adult STRAIN and in a sample of older African American adults, using methods aimed to replicate the original Adult STRAIN validation study (Slavich and Shields, 2018). Comprehensive measures that enable examination of specific elements of stress, such as the Adult STRAIN, are crucial to understanding the development of stress-related health conditions and improving health outcomes. Further investigation into the underlying dimensions of stress and the mechanisms linking stressor exposure to health outcomes is needed to reduce the health disparities affecting African American adults. Exploring the impact of stress on health throughout the lifespan has the potential to reduce premature mortality and promote healthy aging in older adults. In conclusion, the present study suggests that the Adult STRAIN may be a viable and valid stress measure assessing lifetime stressor exposure in middle-aged and older African American adults.

Author note

The findings and conclusions in this article are those of the authors and do not necessarily represent the views or opinions of these organizations, which had no role in designing or planning this study; in collecting, analyzing, or interpreting the data; in writing the article; or in deciding to submit this article for publication.

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Ethical considerations

The Health among Older Adults Living in Detroit (HOLD) study was approved by the Institutional Review Board at Wayne State University.

Consent to participate

Participants provided written informed consent to participate in HOLD.

Consent for publication

Consent for publication is not applicable to this article as it does not contain any identifiable data.

Author contributions

The authors confirm their contribution to the paper as follows: study conception and design: G.M.S., G.S.S., E.K., and S.Z.; data collection: S.Z.; analysis and interpretation of results: K.M.D., G.S.S., E.K., and S.Z.; draft manuscript preparation: E.K., K.M.D., and G.S.S.; reviewing and editing: G.M.S., N.T.J., and S.Z.; funding: G.M.S. and S.Z.; supervision: S.Z. All authors reviewed the results and approved the final version of the manuscript.

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Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability statement

Data are available from the authors upon reasonable request.

Note

1. This study's variables, objectives, and planned analyses were pre-registered on Open Science Framework (https://doi.org/10.17605/OSF.IO/HWD2V).

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