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Association between Early Trauma and Ideal Cardiovascular Health among Black Americans: Results from the Morehouse-Emory Cardiovascular (MECA) Center for Health Equity

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Abstract

Background: Early trauma (general, emotional, physical, and sexual abuse before age 18) has been associated with both cardiovascular disease (CVD) risk and lifestyle-related risk factors for CVD including smoking, obesity, and physical inactivity. Despite higher prevalence, the

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Supplemental Materials:
Supplemental Tables I–II
Supplemental Figure I.

association between early trauma and cardiovascular health (CVH) has been understudied in Black Americans, especially those from low-income backgrounds, who may be doubly vulnerable. Therefore, we investigated the association between early trauma and CVH, particularly among low-income Black Americans.

Methods: We recruited 457 Black adults (age 53 ± 10, 38% male) without known CVD from the Atlanta, GA metropolitan area using personalized, community-based recruitment methods. The Early Trauma Inventory (ETI) was administered to assess overall early traumatic life experiences which includes physical, sexual, emotional abuse and general trauma. Our primary outcome was the American Heart Association (AHA) Life's Simple 7 (LS7), which is a set of seven CVH metrics, including four lifestyle related factors – smoking, body mass index, physical activity, and diet, and three physiologically measured health factors –blood pressure, total blood cholesterol, and blood glucose. We used linear regression models adjusting for age, sex, socioeconomic status and depression to test the association between early trauma and CVH and tested the early trauma by household income (<$50,000) interaction.

Results: Higher levels of early trauma were associated with lower LS7 scores (β [95% CI] = −0.05 [−0.09, −0.01], p=0.02, per 1 unit increase in the ETI score) among lower, but not higher, income Black participants (p-value for interaction=0.04). Subtypes of early trauma linked to LS7 were general trauma, emotional abuse, and sexual abuse. Exploratory analyses demonstrated that early trauma was only associated with the BMI and smoking components of LS7.

Conclusion: Early trauma, including general trauma, emotional abuse, and sexual abuse, may be associated with worse CVH among low, but not higher-income Black adults.

INTRODUCTION

Early trauma, including stressful life events such as physical, emotional, or sexual abuse experienced in childhood, is associated with multiple chronic illnesses in adulthood including cardiovascular disease (CVD).[1–5] Individuals with early trauma are predisposed to adverse health behaviors such as smoking, poor diet, and inactivity.[6, 7] They suffer from higher rates of cardiometabolic diseases including obesity[6], hypertension[8], and diabetes[9] in adulthood, which in turn put them at higher risk for development of CVD. A recent meta-analysis showed that early traumatic life experiences were associated with CVD outcomes (myocardial infarction, stroke, coronary artery disease) in 92% (22 of 24) of the studies included.[3]

Both cardiometabolic health outcomes and early traumatic experiences are strongly patterned by sociodemographic factors such as race/ethnicity.[10–12] Specifically, Black Americans have a higher prevalence of early trauma relative to White Americans.[12–14] However, the effect of early trauma in Black Americans in regard to cardiovascular health (CVH) remains poorly studied. We conducted an investigation to examine associations between exposure to early traumatic life events (general trauma, physical, emotional, or sexual abuse before age 18) and CVH among Black adults. We were particularly interested in adult income as an effect modifier, as the effects of early trauma could be more pronounced among vulnerable groups such as Black adults living in poverty.

Our primary outcome was the American Heart Association (AHA) Life's Simple 7 (LS7) metric, which is a set of seven modifiable CVH risk factors, four lifestyle related factors and health behaviors – smoking, weight, physical activity, and diet, and three physiologically measured health factors –blood pressure, total blood cholesterol, and blood glucose. LS7 has been associated with lower risk of CVD and all-cause mortality.[15–18] We hypothesized that higher levels of early trauma would be associated with poor CVH, assessed via LS7 in a cohort of Black adults from a southeastern state in the US, and that associations would be stronger in those with lower, versus higher incomes.

METHODS

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Study Sample

The Morehouse-Emory Cardiovascular (MECA) Center for Health Equity study included 502 individuals between the ages of 30 to 70 self-identifying as Black or African American, recruited from the community between 2016–2019 using convenience sampling, since personalized, community-based recruitment methods have been shown to improve research participation among Black Americans.[19] Further details on study design have been published elsewhere.[20] In brief, those with known history of cardiovascular disease (e.g. myocardial infarction, congestive heart failure, cerebrovascular accidents, coronary artery disease, peripheral arterial disease, atrial fibrillation, and cardiomyopathies) were excluded. Other exclusion criteria included those with chronic diseases (cancer, human immunodeficiency virus infection, or lupus), substance abuse (alcohol or illicit drug), and severe psychiatric illness. In addition, pregnant or lactating women and those reporting mobility issues were excluded. Participants completed a physical exam, blood draws, and questionnaires at either Morehouse School of Medicine or Emory University School of Medicine during the study visit. The Institutional Review Boards of both institutions approved the study protocol, and all participants provided written informed consent. Of the 502 participants recruited for the study, 40 were excluded due to missing data on Early Trauma Inventory (ETI) and a further 5 were excluded due to missing income data resulting in a final sample of (n=457) for analysis.

Measurement of Early Trauma

The Early Trauma Inventory (ETI), a self-report questionnaire for assessment of early trauma with demonstrated sensitivity, validity, and reliability, was used to measure childhood traumatic experiences before age 18.[21, 22] The ETI has four components – physical, sexual, emotional abuse, and general trauma. We used the Self Report Short Form version of the ETI, which is presented in the Appendix (Supplemental Table I). In short, physical abuse (5 items) was defined to include physical contact with the intention to hurt or injure. Sexual abuse (6 items) was defined as unsolicited sexual contact performed to either degrade the victim or solely gratify the perpetrator. Emotional abuse (5 items) encompasses verbal communication intended to demean or humiliate the victim. General trauma (11 items) includes a range of stressful traumatic events such as natural disasters, death of caregivers,

family illnesses, etc. These series of dichotomous (yes/no) questions from the Self Report Short Form of the ETI were used to determine exposure to each of these events. Scores from each of the four domains were added to yield a continuous ETI score, which represents an index of total early trauma exposure. Each unit increase represents one additional traumatic life event prior to the age of 18. Analyses were conducted on the continuous ETI score and, as exploratory analysis, the subcomponents, where higher scores reflected more early traumatic events.

Measurement of Depression

The Beck's Depression Inventory II (21 item, maximum score of 63) was used to determine the presence or absence of depression.[23] The recommended classification is as follows: a) borderline depression, a score 21 to 30; b) moderate depression, a score of 31 to 40; and c) severe clinical depression, a score > 40. For the purposes of this analysis, individuals whose scores were equal to or above 21 were categorized as having depression.

Life's Simple 7 Scores

The American Heart Association's Life Simple 7 (LS7) scores were used to determine CVH. The score consists of seven domains of CVH, encompassing both measured and lifestyle elements. These domains include exercise, diet, smoking history, blood pressure, glucose, cholesterol, and body mass index, and are scored as 0 (poor), 1 (intermediate), or 2 (ideal), according to a previously published algorithm.[24] The overall score was computed by adding the scores of the 7 domains, and was examined as the primary outcome variable as composite consistent with prior studies.[25, 26] The score ranges from 0 to 14, and details on scoring each of the subdomains can be found in Supplemental Table II.

Study Covariates

The following information was gathered via self-report on questionnaires: age, sex, annual household income (<$25,000, $25,000 to $50,000, ≥$50,000), education (high school graduate or less, some college/technical school, college or greater), marital status (married or not), and employment status (currently working either full-time or part-time). Since the median household income for Black Americans in the Atlanta, GA metropolitan area was $59,000 per year in 2019[27] and our stratification did not distinguish income categories within $50,000-$75,000, we defined low income as <$50,000. Self-reported medical history was obtained by completing a questionnaire. During the physical exam, vital signs and anthropometric measurements were collected. Blood was drawn after >6 hours of fasting to measure plasma levels of cholesterol and glucose. Hypertension was defined by either of the following: current use of anti-hypertensive medications, systolic blood pressure ≥ 130 mmHg, or diastolic blood pressure ≥ 80 mmHg. Diabetes mellitus was defined by either current use of diabetes medications or fasting glucose ≥126 mg/dL. Similarly, hyperlipidemia was determined by either current use of lipid-lowering medications or a fasting total cholesterol ≥240 mg/dL.

Statistical Analysis

Demographic, socioeconomic, and clinical characteristics were presented by low (<$50,000) and high annual household income (≥$50,000) categories. Continuous variables that were normally distributed were reported as means (± standard deviation [SD]) and compared using t-tests across the two categories. For non-normally distributed continuous variables, we reported the median (interquartile range) and compared across the two categories using the Wilcoxon rank-sum test. Categorical variables were reported as proportions (%) and compared using chi-square tests.

Linear regression analyses were conducted to assess the association between cardiovascular health (LS7, higher scores representing better CVH) and composite score of early trauma (higher scores indicating more traumatic events) treated as a continuous variable. A priori-selected covariates were added in a stepwise manner to assess the effect of covariate adjustment: Model 1: unadjusted; Model 2: adjusted for age and sex (male vs female); Model 3: Model 2 + marital status + socioeconomic status (annual household income, education, and employment status); Model 4: Model 3 + depression. As secondary analyses, we constructed similar linear regression models to examine the associations between each of the four early trauma domains (general trauma, emotional, physical and sexual abuse) and LS7.

We then tested the interaction between early trauma and income (defined by annual household income greater/equal or less than $50,000) using an interaction term between early trauma and income. The interaction was significant (p-value < 0.05), therefore subsequent analyses were stratified by high (≥$50,000 per year) and low income (<$50,000 per year) groups.

In order to be consistent with prior studies[25, 26], in exploratory analyses, we fitted multinomial logistic regression models using covariates from our final models examining ideal compared to poor health for each of the seven LS7 subcomponents. This was done to explore whether specific subcomponents of LS7 were driving any observed associations. All statistical analyses were performed using R 4.0 (Vienna, Austria) and p-value < 0.05 was considered statistically significant.

RESULTS

Of the 457 subjects in the analysis dataset, 118 reported high (≥ $50,000) and 339 reported low (<$50,000) annual households. Those with higher incomes were more likely to have graduated from college, be employed either part-time or full time, and married. In addition, they had lower smoking rates. Further, depression, hypertension, and diabetes rates were slightly, but not significantly, lower in the high-income group. Finally, composite early trauma scores were lower in the high-income cohort (8.23±4.84 vs. 9.23±5.77). Similar trends were noted for the subcategories of early trauma (Table 1).

Supplemental Figure I shows the crude scatterplot of the association between composite early trauma and total LS7 score. Although modeled continuously, when the ETI was

divided into quartiles (for descriptive purposes only) there was a stepwise decrease in LS7 with increasing levels of early trauma in the low but not high income group (Figure 1).

In linear regression analyses, each additional early traumatic life event was associated with worse CVH after adjusting for age and sex (β [95% CI] = −0.04 [−0.07, −0.003], p=0.03, per 1 unit increase in the composite ETI score) for the entire sample. The association weakened and became marginally significant after adjusting for employment, education, income, and marital status (−0.03 [−0.07, 0.001], p=0.06) and was no longer significant after adjusting for depression (−0.03 [−0.06, 0.01], p=0.11) (Table 2). There was a significant interaction between severity of early trauma and income category (p=0.04). In income-stratified analyses, early trauma was associated with lower LS7 score after adjusting for age, sex, employment, education, and marital status in the low (−0.05 [−0.09, −0.02], p=0.006) but not high (0.04 [−0.04, 0.11], p=0.34) income group. The association remained in the low-income group after adjusting for depression (−0.05 [−0.09, −0.01], p=0.02) (Table 2, Figure 2). All subcomponents of early trauma except for physical abuse were associated with lower LS7 after covariate adjustment in the low-income sample (Figure 2).

In order to determine whether our observed results were explained by specific subcomponents of LS7, in exploratory analysis, we further investigated the relationship between the overall ETI score, and components found to be significant in our linear regression analyses (i.e., general trauma, sexual and emotional abuse) and CVH by individual domains of LS7 within the low-income group. We found that for 1 unit increase in the total early trauma score, participants had lower odds of ideal BMI (OR [95% CI]: 0.94 [0.88 – 0.99]) and had lower odds of being non-smokers (0.94 [0.90 – 0.99]). Similarly, with 1 unit increase in the emotional (0.81 [0.68–0.97]) and sexual (0.72 [0.56–0.93]) abuse scores, participants had significantly lower odds of ideal BMI. Despite its association with overall LS7, there were no associations observed between general trauma and any specific LS7 subcomponents (Supplemental Table III).

DISCUSSION

In this cross-sectional analysis of Black Americans recruited from a major Southern U.S. metropolitan city, we demonstrated that traumatic life experiences prior to the age of 18 (i.e. early traumas) were associated with poor CVH as defined by the LS7 score, particularly among those reporting incomes lower than $50,000. Of note, general trauma, emotional abuse and sexual abuse in childhood were associated with worse CVH among low-income Black adults. Exploratory analyses demonstrated that early traumas were primarily associated with the behavioral and lifestyle domains of CVH, such as higher BMIs and smoking. No associations between early traumas and LS7 were noted in individuals from higher income households, highlighting the fact that the impact of early trauma on adult CVH maybe particularly problematic for low-income Black individuals.

It is noteworthy that associations were only observed among Black adults who had low (versus high) household incomes in adulthood, which is consistent with prior findings linking childhood adversity to CV risk factors in a cohort comprised of low-income White individuals.[28] Our study showed that lower income individuals had more severe abuse in

childhood based on the total score on the ETI than their higher income counterparts, in keeping with prior studies which found that those who suffer from child maltreatment are at increased risk for financial difficulties in adulthood.[29]. However, as noted in a recent AHA scientific statement on childhood adversity and CVD risk, by Suglia et al, data examining the synergistic effects of early trauma and SES on CVH are lacking—particularly among racial/ethnic minority populations.[5] Thus, the observed findings fill an important gap in the literature.

One potential explanation for our findings in low-income Black adults is a possible "double jeopardy" effect. Adult household income has been independently associated with cardiovascular disease and its risk factors.[30] In addition, early trauma also independently affects CVH. Therefore, low-income individuals who have suffered from early trauma may be at a higher risk of poor CVH due to the compounding effect of these factors together. Another hypothesis is that those who reached higher adulthood income may have other resiliency factors that allow them to overcome the burdens of early trauma and achieve ideal CVH. Previous studies have demonstrated that resilient coping may buffer early traumatic life experiences on distress and somatic symptoms,[31] but future studies are required to understand whether resiliency mitigates the association of early trauma on CVH, especially for low-income Black adults.

Our finding linking emotional abuse in childhood to poor CVH in adulthood is quite novel. Despite its high prevalence and its association with long term health outcomes including depressive disorders or sexually transmitted infections in adulthood,[32, 33] childhood emotional abuse and its relation to CVH remains understudied.[34] Previously, instruments for the assessment of early trauma focused on physical or sexual abuse, with some inclusion of parental neglect but not emotional abuse per se. Thus, there has been less general awareness of emotional abuse and its potentially damaging effects, which our findings suggest can have adverse long-term physical effects that persist into adulthood. However, it is unclear why emotional abuse was more impactful than physical abuse in our cohort, but research has found that emotional abuse is a strong predictor of poor emotional regulation capabilities which can lead to poor health behaviors during times of stress.[33] Nonetheless, our results suggest that emotional abuse in children may be an important public health concern and requires further investigation.

The mechanisms through which early traumatic life experiences lead to worse CVH in low-income Black adults are likely multifactorial and encompass behavioral, mental health and biological domains and an intermixture of all these components.[2, 5, 35] Although the indices driving our association between early trauma and LS7 were those commonly viewed as behavioral (i.e. smoking and BMI), it is widely accepted that early life stressors are associated with activation of the hypothalamic-pituitary-adrenal axis, leading to a lifetime of chronically increased levels of stress hormones and catecholamines, which in turn are associated with dysregulations in endothelin 1[36], insulin[37–39], and leptin[40] levels and their downstream effects including components of CVH traditionally considered behavioral such as obesity.[2, 5, 35, 41] As such, the mechanism through which early trauma maybe impacting CVH in our study population is likely both behavioral and biological.

Adverse mental health has been identified as another particularly powerful pathway, and in some instances an amplifier of, the association between early trauma and CV health.[42] However, our findings were independent of depression, suggesting that there may be other psychological pathways at play that require further exploration. Nevertheless, in the clinical setting, early trauma is both under-recognized and under-treated.[43] This is especially worrisome for Black Americans, as some,[44, 45] but not all,[46] studies have found that Black Americans are less likely to disclose or report childhood traumas, particularly child sexual abuse,[45] compared to other racial/ethnic groups. Researchers have argued that this is primarily due to negative experiences that Black Americans have had with police, in the courts, and with social service agencies.[47] However, it is unclear how disclosure, or lack thereof, might ultimately impact CVH, as the majority of this work has focused on mental health outcomes; and some of these studies have found that disclosure is beneficial for outcomes,[48] whereas others have found that it is not.[45, 47] Consequently, future studies should consider whether disclosure, or perhaps more importantly, disclosure followed by trauma-specific support in the form of clinical intervention, might mitigate the negative impact of early trauma on poor CVH in Black Americans.

There are multiple limitations that must be considered. Even though our analyses adjusted for depression, we lacked data on other psychological illnesses that may mediate the impact of early trauma on CVH such as post-traumatic stress disorder (PTSD).[49, 50] While there is a strong linkage between early trauma and substance use disorders, exclusion of individuals with a history of substance abuse is another limitation. However, we also find it noteworthy that we observed associations even without this group included, suggesting that pathways other than substance use also play a role. We also did not have data on childhood socioeconomic status and information about early trauma was entirely self-reported and measured retrospectively, which could induce measurement error. However, Berg et al. demonstrated that both retrospective and prospective measures of early trauma simultaneously predicted CVD risk in adulthood in a sample of Black adults and as such, retrospective measures of early trauma may be reliable in this population to assess CVD risk.[51] Similarly, we acknowledge that non-responders to the ETI may be more likely to have experienced trauma and thus may have biased our results more to the null.

In addition, while the ETI assesses various domains of early traumatic life experiences, it does not include trauma resulting from discrimination and racism among Black children, which has been shown to impact adult health outcomes. [52, 53] Thus, future studies in this area are required. Our study is also relatively small and only represents Black adults from a specific geographic area, which limits its generalizability to other Black populations. As such, findings need to be confirmed in larger, more representative samples. Finally, this study is cross-sectional; thus, causality and exposure of early traumatic life experiences and CVH are not able to be drawn.

In conclusion, we demonstrated that among Black Americans from a major Southeastern city, early trauma, including general trauma, emotional abuse, and sexual abuse, is associated with poor CVH in terms of modifiable health behaviors and that the effects are amplified in those with low adult household income. Further studies need to be conducted

across the U.S. that are prospective and longitudinal to clarify these associations and uncover mechanisms of the effects of early trauma on CVH in low-income adults.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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NON-STANDARD ABBREVIATIONS AND ACRONYMS

AHA	American Heart Association
BMI	Body Mass Index
CI	Confidence Interval
CVD	Cardiovascular Disease
CVH	Cardiovascular Health
ETI	Early Trauma Inventory
IQR	Interquartile Range
LS7	Life’s Simple 7
OR	Odd’s Ratio
SD	Standard Deviation
SES	Socioeconomic Status

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What is known:

- Early trauma (general, emotional, physical, and sexual abuse before age 18) has been associated with both cardiovascular disease (CVD) risk and lifestyle-related risk factors for CVD including smoking, obesity, and physical inactivity.
- Despite higher prevalence, the association between early trauma and cardiovascular health (CVH) has been understudied in low-income Black Americans.

What the study adds:

- Early trauma, including general trauma, emotional abuse, and sexual abuse, is associated with worse CVH among low, but not higher-income Black adults.
- Components of CVH, traditionally considered behavioral, including BMI and smoking were mainly driving these associations.

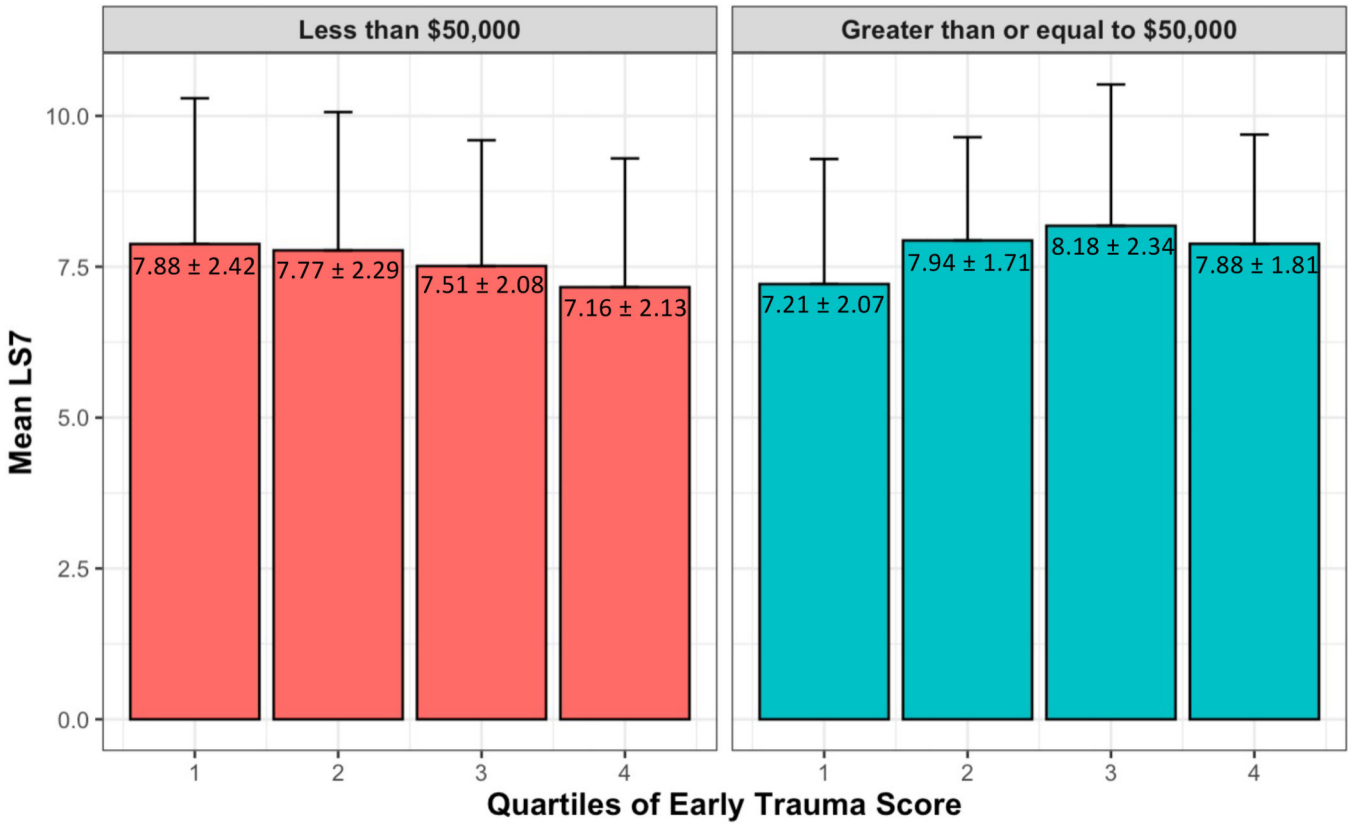

Figure 1:

Mean Life's Simple 7 (LS7) Score presented by quartiles (for descriptive purposes only) of composite Early Trauma Score, with higher quartiles indicating higher exposure to early traumatic life events, stratified by low (< $50,000 per year) and high (≥$50,000 per year) annual household income. Of note, higher LS7 indicates improved cardiovascular health.

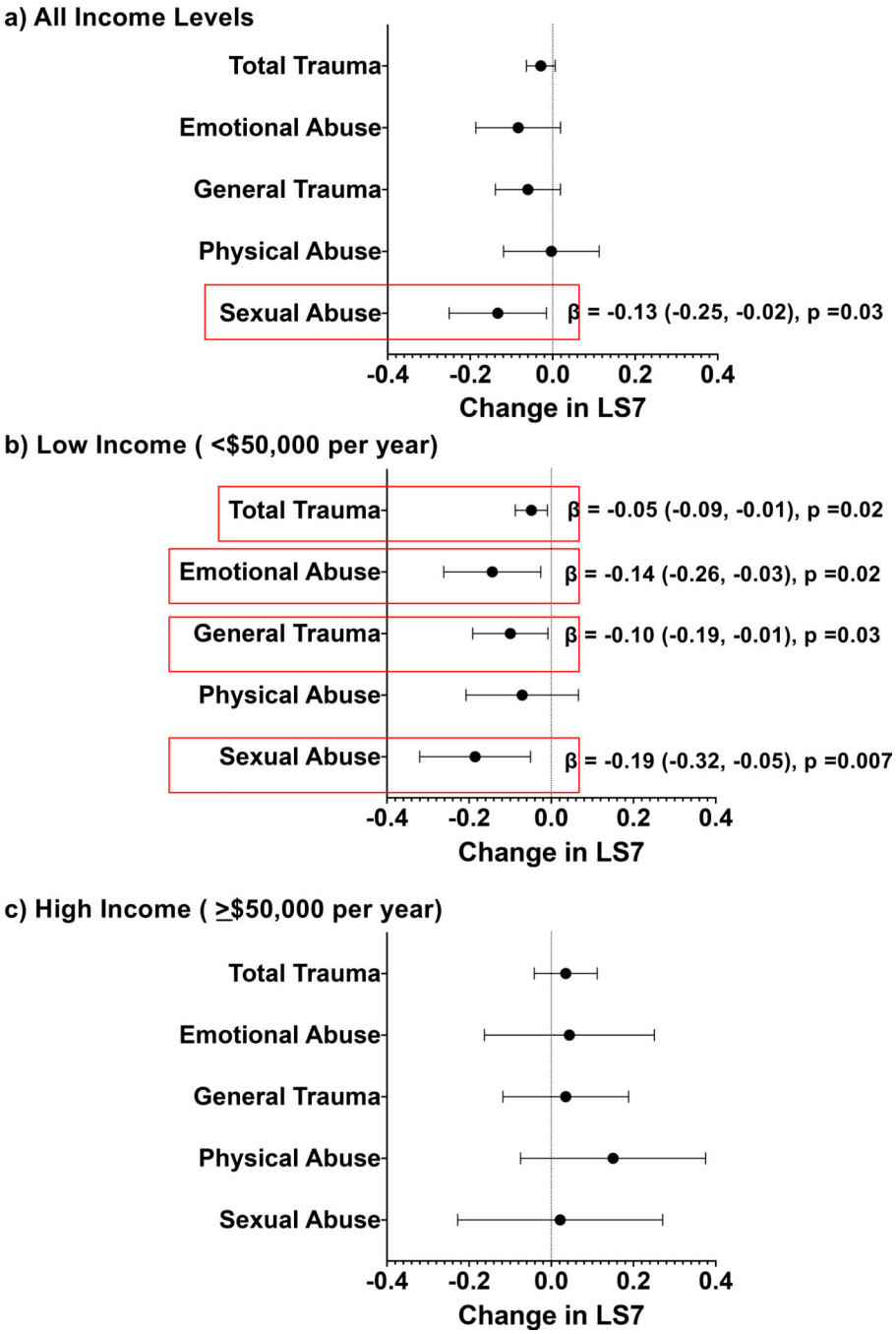

Figure 2:

Association between early trauma and its subcomponents (per for 1 unit increase, indicating one additional exposure to a traumatic event) and Life's Simple 7 (LS7) score for (a) all income levels (b) only high income (annual household income ≥$50,000) and (c) only low income (annual household income <$50,000). For all income levels, estimates are adjusted for age, sex, annual household income, education, marital status,

employment status, and depression. For the high- and low-income groups, estimates are adjusted for age, sex, education, marital status, employment status, and depression.

Table 1:

Demographic, socioeconomic, and clinical characteristics of the cohort stratified by high (>$50,000 per year) vs. low (≤$50,000 per year) annual household income.

	High Income ≥ $50,000 per year (n=118)	Low Income < $50,000 per year (n=339)	Total (n=457)	P value
Demographics, n(%), mean (SD) or median [IQR]				
Age, years	52.6 (9.9)	53.1 (10.2)	53.0 (10.1)	0.68
Female	41(34.7%)	130 (38.3%)	171 (37.4%)	0.12
Annual Household Income				0.14
< $25,000	-	214 (63.1%)	214 (46.8%)	-
$25,000 – <$50,000	-	125 (36.9%)	125 (27.4%)	
≥$50,000	118 (100%)	-	118 (25.8%)	
Currently employed (part-time/full-time)	70 (59.3%)	143 (42.3%)	213 (46.7%)	**0.002**
Household size, person	2 [2,4]	2 [1,3]	2 [1,3]	**0.03**
Married	51 (43.2%)	73 (21.7%)	124 (27.3%)	**<0.001**
Education History				**<0.001**
High school graduate or less	17 (14.4%)	120 (35.5%)	137 (30.0%)	
Some college/technical school	35 (29.7%)	131 (38.8%)	166 (36.4%)	
College Graduate	66 (55.9%)	87 (25.7%)	153 (33.6%)	
Objective/Clinical Measures, n(%), mean (SD) or median [IQR]				
Depression	3 (2.6%)	27 (8.0%)	30 (6.6%)	0.07
Hypertension	60 (50.8%)	189 (55.8%)	249 (54.5%)	0.42
Hyperlipidemia	45 (38.5%)	128 (37.8%)	173 (37.9%)	0.98
Diabetes Mellitus	28 (23.9%)	93 (27.6%)	121 (26.7%)	0.52
Current Smoker	12 (10.2%)	91 (26.8%)	103 (22.5%)	**<0.001**
Body Mass Index (BMI)	34.4 (7.8)	32.9 (8.2)	33.3 (8.1)	0.08
Systolic Blood Pressure (mmHg)	129.2 (15.3)	132.2 (18.6)	131.4 (19.3)	0.14
Diastolic Blood Pressure (mmHg)	80.1 (10.0)	80.5 (12.0)	80.4 (11.5)	0.75
Total Cholesterol (mg/dL)	199.2 (35.9)	190.9 (43.5)	193 (41.8)	0.06
High Density Lipid (mg/dL)	57.5 (17.6)	56.7 (17.0)	56.9 (17.2)	0.06
Low Density Lipid (mg/dL)	120.7 (32.1)	113.4 (37.4)	115.3 (36.2)	0.06
Triglycerides (mg/dL)	95 [69, 129]	89 [64, 123]	90 [65, 126]	0.34
Fasting Glucose (mg/dL)	95 [87, 105]	93.5 [87, 110]	94 [87, 108]	0.68
Total LS7 score	7.78 (2.0)	7.57 (2.2)	7.63 (2.2)	0.69
Early Trauma Measures, mean (SD)				
Composite Early Trauma Score	8.23 (4.84)	9.23 (5.77)	8.97 (5.56)	0.09
Emotional Abuse	1.53 (1.73)	1.65 (1.92)	1.62 (1.87)	0.56
General Trauma	3.93 (2.19)	4.46 (2.47)	4.32 (2.41)	**0.04**
Physical Abuse	1.83 (1.65)	2.05 (1.67)	2.00 (1.66)	0.21

	High Income ≥ $50,000 per year (n=118)	Low Income < $50,000 per year (n=339)	Total (n=457)	P value
Sexual Abuse	0.93 (1.50)	1.07 (1.71)	1.04 (1.66)	0.44

Abbreviations: LS7 = Life's Simple 7; SD = Standard Deviation; IQR = Interquartile Range

Table 2:

Association between composite early trauma score and Life's Simple 7 (LS7) score for the entire sample (n=457) and stratified by low (≤ $50,000 per year) vs. high (>$50,000 per year) annual household income.

Model	Covariates	All Income (n=457)		Low Income (n=339)		High Income (n=118)	
		β (95% CI)	P-value	β (95% CI)	P-value	β (95% CI)	P-value
1	**Unadjusted**	−0.03 (−0.07, 0.004)	0.09	−0.05 (−0.10, −0.01)	**0.01**	0.07 (−0.01. 0.14)	0.09
2	**Model 1+ age and sex**	−0.04 (−0.07, −0.003)	**0.03**	−0.06 (−0.10, −0.02)	**0.005**	0.04 (−0.04, 0.11)	0.33
3	**Model 2 + marital status + SES***	−0.03 (−0.07, 0.001)	0.06	−0.05 (−0.09 –0.02)	**0.006**	0.04 (−0.04, 0.11)	0.34
4	**Model 3+ depression †**	−0.03 (−0.06, 0.01)	0.11	−0.05 (−0.09, −0.01)	**0.02**	0.04 (−0.04, 0.11)	0.37

*Includes education (high school graduate or less, ≥ some college/technical school or college graduate), and employment status. Additionally, income (<$25,000, $25,000 to <$50,000, ≥$50,000) was added as a covariate for the all income group.

†Depression is defined by score of ≥21 on the Beck's Depression Inventory.[23]

Abbreviations: LS7 = Life's Simple 7; C.I. = confidence interval; SES = socioeconomic status.