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Permalink

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Journal

American Journal of Physical Anthropology, 182(4)

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Publication Date

2023-12-01

DOI

10.1002/ajpa.24791

Peer reviewed



Published in final edited form as:

Am J Biol Anthropol. 2023 December ; 182(4): 620–631. doi:10.1002/ajpa.24791.

Childhood adversity during the post-apartheid transition and COVID-19 stress independently predict adult PTSD risk in urban South Africa: a biocultural analysis of the stress sensitization hypothesis

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Abstract

Objectives: The COVID-19 pandemic in South Africa introduced new societal adversities and mental health threats in a country where one in three individuals are expected to develop a psychiatric condition sometime in their life. Scientists have suggested that psychosocial stress and trauma during childhood may increase one's vulnerability to the mental health consequences of future stressors – a process known as stress sensitization. This prospective analysis assessed whether childhood adversity experienced among South African children across the first 18 years of life, coinciding with the post-apartheid transition, exacerbates the mental health impacts of psychosocial stress experienced during the 2019 coronavirus (COVID-19) pandemic (c. 2020–2021).

Materials and Methods: Data came from 88 adults who participated in a follow-up study of a longitudinal birth cohort study in Soweto, South Africa. Childhood adversity and COVID-19 psychosocial stress were assessed as primary predictors of adult PTSD risk, and an interaction term between childhood adversity and COVID-19 stress was calculated to evaluate the potential effect of stress sensitization.

Results: Fifty-six percent of adults exhibited moderate-to-severe PTSD symptoms. Greater childhood adversity and higher COVID-19 psychosocial stress independently predicted worse

post-traumatic stress disorder symptoms in adults. Adults who reported greater childhood adversity exhibited non-significantly worse PTSD symptoms from COVID-19 psychosocial stress.

Discussion: These results highlight the deleterious mental health effects of both childhood trauma and COVID-19 psychosocial stress in our sample and emphasize the need for greater and more accessible mental health support as the pandemic progresses in South Africa.

Keywords

COVID-19; childhood adversity; post-traumatic stress disorder; stress sensitization; adulthood; South Africa

INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) pandemic in South Africa has resulted in close to 3 million infections and 90,000 deaths, producing the worst COVID-19 epidemic across Africa. The South African government instituted a national lockdown on March 26, 2020, which was considered one of the world's strictest societal regulations at the time. Strict government enforcement of the countrywide lockdown during the onset of the pandemic, particularly in lower-income communities of color, included militarization, police violence, and inadequate social relief for already vulnerable communities (Manderson and Levine 2021). These government sanctions, along with the rapid transition to life under quarantine, ongoing fear of COVID-19 infection, and the exacerbation of societal problems like food insecurity and unemployment, had deleterious impacts on mental health among populations in South Africa (Hunt et al. 2021; Kim et al. 2020b; Posel et al. 2021) and worldwide (Kola et al. 2021). Nationally-representative data across the pandemic showed that more than half (52%) of individuals exhibited depressive symptoms during the pandemic (Hunt et al. 2021).

Mental health, COVID-19, and post-apartheid South Africa

After four major waves of COVID-19 infections spread across two years, the mental health repercussions of the COVID-19 pandemic remain acutely concerning in South Africa where one in three individuals are expected to develop a mental illness sometime in their life (Herman 2009) and 92% of individuals requiring mental healthcare do not receive treatment (Docrat et al. 2019). Research from the first wave of the pandemic identified elevated levels of generalized stress, negative emotions, anxiety, and depressive symptoms (De Man et al. 2021). Findings from nationally-representative data during the pandemic have shown that depressive risk among South African adults was higher relative to pre-pandemic levels and adult depressive risk has increased throughout the course of the pandemic (Hunt et al. 2021). Recent research has also found that a range of COVID-19 related stressors, including higher risk perceptions of COVID-19 infection, financial concerns, hunger, and generalized stress, strongly predict adult depressive symptoms (Kim et al. 2020b; Nwosu and Oyenubi 2021; Posel et al. 2021). The prolonged and uncontrollable nature of many of these stressors have exacerbated their effects on individual psychosocial health and household well-being (Engelbrecht et al. 2021; Kim et al. 2020b). (Docrat et al. 2019). In response to these stressors, individuals and communities have utilized a variety of coping

mechanisms and psychosocial resources to safeguard their mental health throughout the pandemic (Engelbrecht et al. 2021; Jarvis et al. 2021).

While the pandemic amplified conditions of psychological distress and suffering in South Africa, South African society has continued to experience the lingering societal impacts of the apartheid system after the dissolution of the white supremacist regime in 1994. Ongoing legacies of apartheid include residential segregation, racialized class inequality, a surge in violent crime characteristic of transitioning societies, and the manifestations of physical and mental health inequities (Hart 2014; Makhulu 2015). These past conditions of social oppression along with ongoing traumatic experiences during the post-apartheid transition are known to impact poor mental health across the lifecourse (Kim et al. 2020b; Manyema et al. 2018; Naicker et al. 2021). While significant societal improvements have been made to redress the historical and societal ills of apartheid, the lasting psychological and material impacts of societal precarity and trauma from the post-apartheid transition may continue to linger among current generations.

Developmental origins of adult psychopathology: the stress sensitization hypothesis

As the mental health effects of the COVID-19 pandemic becoming increasingly evident, scientists have extensively documented the importance of past adversity, particularly those that occurred during childhood, in shaping adult psychopathological risk (Kim et al. 2020a; Shapero et al. 2014; Wade et al. 2019). The mechanisms underlying the lasting mental health impacts of childhood adversity, however, are still being determined. Growing literature on the developmental origins of adult psychopathology has suggested that the long-term psychiatric effects of childhood adversity may operate through changes in individual stress sensitivity across the lifecourse (Cogle et al. 2009; McLaughlin et al. 2010; Shao et al. 2015). Specifically, researchers have posited that childhood adversity may increase an individual's vulnerability (or sensitize the individual) to future stressors and in turn, elevate their psychopathological risk, a process known as stress sensitization (Hammen 2005). As a result of stress sensitization, the adverse psychological impacts of future stressful events may increase with each successive stress exposure over the lifecourse, lowering the threshold needed to trigger a psychiatric episode or worsen mental health (Stroud 2018). Studies have shown that the mental health consequences of recent stressful life events are worse among individuals with a history of developmental trauma (Heim et al. 2019; Kim et al. 2023; McLaughlin et al. 2017; Shapero et al. 2014). The stress sensitization model is described in three component parts: 1) adult psychiatric symptoms (e.g. depression, anxiety, post-traumatic stress disorder) as the outcome, 2) recent adult stress eliciting the psychiatric episode or symptoms, and 3) childhood adversity, representing the developmental exposure responsible for sensitizing the individual to future stress.

Recent research on adult mental health suggests that stress sensitization linked to childhood adversity may operate through pathways of heightened stress reactivity (Stroud 2018). This sustained mental health impact of stress sensitization is believed to manifest partially as a result of long-term alterations in stress physiological function (e.g. hypothalamic-pituitary-adrenal and sympathetic-adreno-medullary axes) in response to acute and/or chronic stress exposure during childhood, a sensitive period of development for stress-sensitive pathways

(McLaughlin et al. 2010). Additionally, childhood adversity is known to contribute to the development of maladaptive cognitive schemas, negative cognition, emotional dysregulation, thereby increasing psychological vulnerability to stress (Alloy et al. 2006; Helenaik et al. 2016). While stress sensitization is likely comprised of a complex interaction of genetic, biological, psychological, and social pathways (Heim et al. 2019), the unfolding of developmental processes that underlie alterations in stress reactivity across the lifecourse is the primary mechanism of focus by which the stress sensitization is understood to operate.

The prolonged history of societal oppression after the dissolution of apartheid and chronic exposure to various forms of adversity among Black communities in South Africa suggest that pathways of stress sensitization may potentially underlie the drastic mental health consequences of COVID-19 in South Africa. Recent studies have highlighted the deleterious impacts of past stress from apartheid and its aftermath on psychological distress and mental health during the COVID-19 pandemic (Gittings et al. 2021; Joska et al. 2020; Kim et al. 2020b). Growing research on the health impacts of COVID-19 in South Africa suggest that its psychological ramifications on public health have been profound, but not much is known about the role of pre-COVID lifecourse experiences, particularly psychosocial stress during the post-apartheid transition, on shaping the mental health impacts of the pandemic and the COVID-19 lockdown.

Biocultural anthropology of psychosocial stress

Finally, the biocultural approach provides a useful framework to contextualize and understand the embodied effects of early life social adversity from the post-apartheid transition and psychosocial stress from the COVID-19 pandemic. Biocultural perspectives in anthropology largely focus on the dynamic interplay between culture, biology, and more recently, political economic forces in shaping human development and health (Hruschka et al. 2005; Goodman & Leatherman 1998; Hoke & Schell 2020). Psychosocial stress has become a major area of focus for biocultural researchers as the experience of stress is both socially patterned and physiologically regulated, and many processes and outcomes of psychosocial stress are inherently a product of biological and social dynamics interacting with one another (e.g. genetic and epigenetic regulation, hormone physiology, disease risk, human behavior, social and health inequalities) (Gravlee 2009).

Biocultural perspectives on stress implicate the historical and social contexts that give rise to the conditions of poor psychosocial well-being and mental ill-health, demonstrating how broader political structures (Rylko-Bauer & Farmer 2016), economic systems (Hoke 2017), and shifting societal conditions (Kohrt et al. 2004) can become embodied and affect human biology, development, and health. These embodied consequences of stress and social adversity can then alter how afflicted communities respond to their broader environments vis-à-vis their biological, psychosocial, and social status (Kuzawa & Sweet 2009; Leatherman & Goodman 2020). Biocultural anthropologists have shown how these social and biological dimensions of stress can interact with one another to alter phenotypic plasticity across development (Worthman & Kuzara 2005), produce patterns of intersectional health inequalities (Zuckerman et al. 2022), and facilitate pathways of lifecourse and intergenerational disease transmission (Kohrt et al. 2015; Kuzawa & Sweet 2009). Recent

biocultural literature on psychosocial stress has examined the biological effects of embodied social adversity, ranging from economic marginalization to transgender-specific minority stress (Worthman & Kohrt 2005; DuBois et al. 2017), and in particular, the long-term physical and mental health impacts of early life stress exposure and historical trauma (Kuzawa & Sweet 2009; Thayer et al. 2017). What is not well known in the biocultural anthropology of stress are the possible underlying mechanisms that may facilitate the long-term disease effects of early life social adversity and also how past and recent adverse conditions interact with one another to shape future health outcomes.

Study aims and hypotheses

This study examines the interacting effect of childhood adversity during the post-apartheid period and adult psychosocial stress from COVID-19 on adult risk for post-traumatic stress disorder (PTSD). Through this analysis, we test the stress sensitization hypothesis to assess whether childhood adversity potentiates the adverse mental health effects of COVID-19 psychosocial stress. We hypothesize that 1) childhood adversity during the post-apartheid transition and psychosocial stress from COVID-19 will independently predict worse mental health outcomes, and that 2) adults with histories of childhood adversity will experience worse mental health outcomes due to psychosocial stress during COVID-19.

METHODS

Study site

Data come from the Birth to Thirty (BT30) cohort, a longitudinal birth cohort based in Soweto, South Africa and the largest and longest-running study of child health in Africa. All singleton live births delivered in public sector hospitals between April 23 to June 8, 1990 and mothers who were residents in the metropolitan Johannesburg-Soweto area six months after delivery were recruited to participate in Birth to Thirty (Richter et al. 2007). BT30 emerged from collaboration between the University of the Witwatersrand in Johannesburg and the South African Medical Research Council with the aim of assessing the impacts of rapid urbanization towards the end of apartheid on the growth, health, well-being, and educational progress of children. Soweto is a major urban township located southwest of Johannesburg and is currently home to a wide diversity of socioeconomic, linguistic, and ethnic communities. BT30 is roughly representative of the demographic parameters of the metropolitan Johannesburg-Soweto region.

This analysis includes data from six separate waves of data collection from BT30. Exposure data come from prospective assessment of childhood adversity between the ages of 0–18 among the full cohort, and outcome data were collected in a subsample of adult participants between January – August 2021 who reported their experiences of psychosocial stress and mental health during the COVID-19 pandemic. These adult participants, representing the index generation of Birth to Thirty born in 1990, were recruited as part of a larger study on stress and mental health in this cohort, which selected participants based on the following inclusion criteria: original participant of Birth to Thirty enrolled in 1990 and able to provide informed consent. Exclusion criteria included the following: incarcerated individuals, participants with cognitive impairments that may inhibit their ability to provide

informed consent, and individuals under the influence of substances. Eligible participants were contacted telephonically using phone numbers provided during past rounds of data collection.

Surveys were conducted by multiple trained and multilingual interviewers. Where translation of measures was required, consensual agreement on the phrasing of questions was reached. Continuous translation and back-translation were used in order to ensure that the meaning/s attained in the destination language mirrored those intended in the original one. All participants provided written informed consent. Study procedures were approved by the University of the Witwatersrand Human Research Ethics Committee and Northwestern University's Institutional Review Board.

Demographic, Health, and Socioeconomic Variables

All participants completed a survey administered by research assistants that assessed sociodemographic characteristics, household conditions, and social environments. Household socio-economic status (SES) was assessed using an asset index which scored each participant according to the number of household physical assets that they possessed out of a possible 7 (e.g. television, refrigerator, washing machine, radio, telephone, home ownership, car). Household assets were measured again in 2006 using an updated list (e.g. television, car, washing machine, refrigerator, phone, radio, microwave, cell phone, DVD, MNET, DSTV, computer, and internet) and designed based on standard measures used by the Demographic and Health Surveys (<https://dhsprogram.com/>), based on the work of Filmer and Pritchett (2001). To capture the overall SES environment during early childhood and in adulthood (c. 2021) when the follow-up study took place, an aggregate SES variable was constructed by summing standardized assets scores from both years of data collection.

Childhood adversity

Childhood adversity was measured prospectively through the presence or absence of a list of adverse childhood experiences (ACEs), which included: physical abuse, sexual abuse, emotional abuse and/or neglect, child separation, divorce or parent separation, parent death, exposure to violence, exposure to intimate partner violence, chronic unemployment, household substance abuse, household legal trouble, household serious illness or disability, and household death (Naicker et al. 2017). The ACEs survey questions are included in Supplementary Table A. Caregivers reported on the child's environment and experiences before the age of 11. Participants provided self-reports from age 11 through 18. A participant was recorded as having experienced a particular ACE if there was a positive response at any one of these time points. Binary responses across data waves in the first 18 years of the participants' lives (c.1990–2008) were summed together to create a composite measure of childhood adversity. Because exposure to the same list of ACEs were not assessed at each data wave and between caregivers and children, this measure represents an aggregate measure of total childhood adversity between ages 0–18 (see Supplementary Table A).

Psychosocial stress during COVID-19

Psychosocial stress from the COVID-19 pandemic was assessed using a locally-developed, 20-item Likert-based scale that queried the severity of stress brought on by 20 separate experiences and conditions over the course of the pandemic since March 2020 to the time of data collection (Kim in prep). These included experiences such as financial strain, food insecurity, inability to socialize, and concerns about one's future, among others. Survey items were identified and selected from qualitative analysis of 54 in-depth interviews, a majority of adults living in Soweto, and 8 months of ethnographic research with non-BT30 adults living in Johannesburg. The internal consistency of this measure was high (Cronbach's $\alpha = 0.85$).

Post-traumatic stress disorder symptoms

The PTSD Checklist – Civilian Version (PCL-C), a 17-item, likert-based survey, was administered to evaluate adult PTSD symptoms (Ruggiero et al. 2003). This self-administered questionnaire is based on Diagnostic and Statistical Manual of Mental Disorders - Fourth Edition (DSM-IV) diagnostic criteria B, C, and D for post-traumatic stress disorder. These criteria relate to the three different PTSD symptom clusters: reexperiencing, numbing/avoidance, and hyperarousal. Respondents are asked to rate past month symptoms of PTSD on a 1 to 5 scale, and scores range from 17 to 85, with a cut-off score of 31 or more. The internal consistency of the survey in this sample was high (Cronbach's $\alpha = 0.91$) and has also been administered previously in Black South African samples in Soweto (Peltzer et al. 2012).

Statistical analyses

All analyses were conducted in Stata 15.1 (College Station, TX). Covariate selection was determined based on *a priori* knowledge of social, biological, and obstetric risk factors that may potentially confound the relationship between childhood adversity and adult PTSD risk. With the exception of known confounding factors for the relationship between childhood adversity and adult PTSD risk, only those that were statistically significant at the 0.2 level during bivariate analyses with the outcome were included in the final models (Maldonado & Greenland 1993; VanderWeele 2019). These variables included age, sex, household assets in 2020–1, highest educational attainment in 2020, partner status, and social support in 2020. Multiple ordinary least squares (OLS) regressions were conducted to examine the impact of childhood adversity on adult psychiatric risk, and an interaction term between childhood adversity and COVID-19 psychosocial stress was assessed to examine the possible role of stress sensitization in shaping adult PTSD risk.

RESULTS

Complete data were available for 88 adult participants (Table 1). Participants included in the analytical sample were similar to those excluded ($n = 136$) with respect to childhood adversity, age, gender, assets, educational status, partner status, and perceived social support. The analytic sample was slightly older ($p = 0.04$) and more likely to identify as female ($p < 0.0001$). The availability of COVID-19 psychosocial stress data was the primary reason for inclusion in the analytic sample and exclusion from this study as survey measures

on COVID-19 experiences began midway into the larger study in which this analysis is based. The average age was 30.1 and 53% (n=47) of the sample were women. The average number of prospectively-assessed adverse childhood experiences was 6.2 (Table 2). The most common adverse childhood experience was household unemployment (97%), followed by exposure to violence and crime (73%), and living with a family member with a serious illness or disability (62%). The most frequent forms of COVID-19 psychosocial stress were concerns about one's future, the lack of social gatherings, feeling unsafe due to COVID-19, and financial insecurity (Table 3). Fifty-six percent (n=49) of participants reported PTSD symptoms based on the cutoff score for the PCL-C (31).

Table 4 reports findings from multiple regression models examining associations between the composite childhood adversity score and adult PTSD symptomatology at ages 29–31. The unadjusted association (Model 1) between childhood adversity and adult PTSD symptomatology was positive (b = 2.6, 95 CI% [1.2, 4.1], $p < 0.0001$), and childhood adversity accounted for 11.5% of the variance in PTSD scores. After adjusting for demographic covariates (Model 2), childhood adversity remained directly associated with adult PTSD symptoms (b = 2.7, 95 CI% [1.2, 4.2], $p = 0.001$). None of the covariates were significantly associated with PTSD symptoms, and Model 2 accounted for 17.7% of the variance. Model 3 included the role of perceived social support, which did not significantly predict PTSD symptomatology. Model 4 identified a strong association between adult COVID-19 psychosocial stress and PTSD symptoms (b = 0.4, 95 CI% [0.2, 0.6], $p < 0.0001$), and the relationship between childhood adversity and adult PTSD symptomatology remained positive (b = 2.3, 95 CI% [0.9, 3.8], $p = 0.002$). Adding COVID-19 psychosocial stress into the model increased the R^2 from 0.1855 in Model 3 to 0.3047 in Model 4, explaining 11.9% of the variance in PTSD scores alone. The final model tested the interaction between childhood adversity and adult COVID psychosocial stress to assess the stress sensitization hypothesis. Model 5 showed that adults with greater childhood adversity and worse COVID-19 psychosocial stress exhibited non-significantly elevated PTSD symptom severity. The interaction term was not significantly associated with adult PTSD symptomatology (b = 0.08, 95% CI [-0.03, 0.2], $p = 0.146$) (Figure 1), and variables in the final model explained for 32.3% of the total variance in PTSD scores.

DISCUSSION

In this preliminary analysis of the effects of childhood adversity during the post-apartheid transition and recent COVID-19 stress on adult mental illness risk in urban South Africa, we found that childhood adversity and psychosocial stress from COVID-19 independently predicted adult PTSD risk. Fifty-six percent of adults in our sample reported moderate to severe levels of PTSD symptoms, and we also found a high prevalence of reported ACEs ($\bar{x} = 6$). Finally, our data showed that adults who reported greater ACEs tended to have non-significantly worse mental health responses to COVID-19 psychosocial stress. These results contribute to a limited literature on the developmental origins of adult mental health and the stress sensitization hypothesis in sub-Saharan Africa and LMICs and pathways of poor mental health during the COVID-19 pandemic.

COVID-19 psychosocial stress and mental health

We identified a high prevalence of moderate to severe PTSD symptoms in our sample, with 56% of adults meeting and surpassing the cutoff score for probable PTSD. This prevalence rate is much higher than pre-pandemic prevalence rates reported in other high stress- and trauma-exposed groups, such as female sex workers (39.6%) (Coetzee et al. 2018) and police officers (26%) (Seedat et al. 2003), community-based samples based in urban areas similar to Soweto (15–30%) (Choi et al. 2015; Olley et al. 2005), and the most recent calculation of the national prevalence of PTSD in South Africa (lifetime prevalence of 2.3%) (Atwoli et al. 2013). The prevalence of PTSD found in our sample is also greater than those reported in other adult samples assessed during the pandemic, most of which come from studies of healthcare workers (Engelbrecht et al. 2021; Kim et al. 2021).

The strong relationship between COVID-19 psychosocial stress and adult PTSD symptomatology in general populations (Forte et al. 2020; Jefti et al. 2021; Liu et al. 2020; Olapegba et al. 2021) as well as the growing literature on the mental health impacts of the COVID-19 pandemic (Hunt et al. 2021; Kola et al. 2021) suggest that COVID-19 psychosocial stress is a major contributor to adult PTSD symptomatology in our sample. The direct associations between the various types of psychosocial stress (e.g. health-related, socioeconomic, psychosocial) emphasize the holistic nature of stress brought onto households during the pandemic. Finally, while the mental health impacts of the COVID-19 pandemic in South Africa are becoming increasingly well-known, most research has examined psychological distress and depressive symptoms as outcome variables (Hunt et al. 2021; Kim et al. 2020b; Nwosu and Oyenubi 2021). Very few studies in South Africa have assessed the psychosocial consequences of the COVID-19 pandemic on adult PTSD symptoms in non-clinical samples. A growing body of research has also shown that poor parental mental health may also shape their children through parenting practices, with increases in harsh punishment, difficulties in showing affection, and greater child behavior problems - worsening the cycle of poor mental health across generations (Chung et al. 2020; Spinelli et al. 2020).

Childhood adversity in the post-apartheid era

We also found very high rates of adverse childhood experiences – the average number of adverse childhood events was six. Furthermore, experiences of chronic unemployment, witnessing violence and crime, serious illness or disability, and death in the household were reported by more than half of the sample, suggesting high rates of household dysfunction in our sample. These trends are similar to other South African-based studies of childhood adversity, which also show elevated prevalence of adverse childhood experiences, but heterogeneity in measurement tool use and study design limit us from making direct comparisons on the prevalence of specific forms of childhood adversity. Nonetheless, the high rates of unemployment, violence exposure, and disease morbidity and mortality seen in our sample are similar to past research in urban, lower-income settings in South Africa (Alexander et al. 2013; Barbarin and Richter 2013; Choi et al. 2015; Cluver et al. 2015).

Our findings also showed that prospectively-assessed childhood adversity significantly predicted worse PTSD symptoms in adults. While childhood adversity is a well-known

risk factor for adult mental health, including PTSD, in high-income settings (McLaughlin et al. 2017; Murphy et al. 2014; Pratchett and Yehuda 2011; Thayer et al. 2017), studies in sub-Saharan Africa and LMICs elsewhere suggest that childhood adversity may also affect adult mental health (Kim et al. 2020a; Manyema et al. 2018; Rieder et al. 2019). Childhood adversity is a well-known risk factor for a wide range of adult mental health symptoms in South Africa, including depression, substance use, and suicidal ideation (Bhengu et al. 2020; Hatcher et al. 2019; Orri et al. 2022). While the pathways underlying the adult mental health effects of childhood adversity in South Africa are still being identified, researchers have suggested that poor emotional, familial, household, and socioeconomic conditions likely influence and sustain the poor psychological effects of childhood adversity across the lifecourse (Hatcher et al. 2019; Jones et al. 2018; Mal-Sakar et al. 2021). Our findings also contribute to a limited literature on the early life origins of adult PTSD risk in low- and middle-income contexts (Choi et al. 2015; McLaughlin et al. 2017), which points to similar adverse effects of childhood adversity on adult PTSD symptoms (Geng et al. 2021; Norris et al. 2003). The evidence on the long-term impacts of childhood adversity on adult PTSD risk in sub-Saharan African settings, in particular, is quite limited. One recent study among Kenyan female sex workers found that adverse childhood experiences predicted worse PTSD symptoms, in addition to depression, anxiety, and suicidal symptoms (Beksinska et al. 2021). Additionally, given the memory and emotional biases involved in the retrospective reporting of childhood adversity, the primary source of data on studies of early life stress, the use of prospective measure of adverse childhood experiences serves as a major strength of this analysis.

The pathways by which childhood adversity shapes adult PTSD risk likely manifest through a complex interaction of biological, psychosocial, and socioeconomic mechanisms. Current research has described the alteration of stress-sensitive psychobiological systems, including epigenetic regulation, hypothalamic-pituitary-adrenal axis, inflammation, and neurobiological processes, as possible lifecourse pathways (Yehuda 2010). Additionally, early life adversity may be indicative of larger familial, community, and socioeconomic constraints, which may impart its own mental health effects over the lifecourse (Jensen et al. 2017; Marsh et al. 2020). The long history of state-sponsored racism, violence, and inequality during the apartheid regime and the societal legacies that followed during the subsequent period of post-apartheid reconstruction continue to have lasting effects across South African society, particularly in townships such as Soweto (Barbarin & Richter 2013). Historically marginalized communities have been forced to overcome ongoing systemic oppression from the same societal and political institutions from apartheid, including covert forms of “slow” violence (e.g. chronic poverty and unemployment, everyday racism, disease epidemics, public healthcare deficiencies) that have produced harmful environments of violence and trauma (e.g. police violence, incarceration, gender-based violence), including their widespread effects on mental health (Barbarin and Richter 2013; Bray et al. 2011; Mattes 2012; Mthembu 2017). Past biocultural research has shown that historical systems of oppression, such as racism, classism, and other forms of structural violence, can serve as an both embodied form of social adversity and chronic stress that can alter a child’s developmental trajectory, negatively impact stress physiology, and potentially compromise

the health and development of children the next generation (Conching & Thayer 2019; Kuzawa & Sweet 2009).

Stress sensitization hypothesis

Our results found that adults with greater childhood adversity and worse COVID-19 psychosocial stress exhibited non-significantly elevated PTSD symptom severity. This null finding is inconsistent with the broader literature on the developmental origins of adult mental health, which suggests that childhood adversity can sensitize individuals to future stress and increase psychopathological risk (Shao et al. 2015; Shapero et al. 2014). Notably, most studies on stress sensitization come from Western, high-income nations, which limits our ability to compare and generalize our findings to non-Western, sub-Saharan, urban contexts. A small handful of studies on stress sensitization and those linking early adversity with later-life stress reactivity in urban African contexts exist – these studies point towards early evidence for stress sensitizing effects (Kim et al. 2023). One study conducted in Soweto during the COVID-19 pandemic found evidence for a stress-sensitizing effect of adverse childhood experiences among adults with elevated levels of perceived COVID-19 infection risk, which corresponded with worse depressive symptoms (Kim et al. 2020b). A global study of childhood adversity and adult PTSD symptoms in 27,017 adults from the World Mental Health Surveys, which includes South Africa, found evidence for stress sensitization among specific types of recent trauma exposure (McLaughlin et al. 2017). Other studies, which do not explicitly test the stress sensitization hypothesis but do assess relationships between early adversity and future stress reactivity also in South Africa, document potential stress-sensitizing patterns (Fearon et al. 2017). For instance, Womersley and colleagues (2018) found gene x environment interactions between childhood trauma and HPA axis variants (e.g. *FKBP5*) that predicted anxiety sensitivity in South African adolescents in Cape Town.

Only a small number of studies have reported null evidence for the stress sensitization hypothesis. Hlatala and colleagues (2000) found that stressful life events did not correspond with stress reactivity among individuals with bipolar I disorder. Another study of institutionalized Romanian children with severe early neglect found no evidence for stress sensitizing effects on later-life internalizing problems, but significant effects when predicting externalizing problems (Wade et al. 2019). The lack of studies that report null findings may also be driven by publication bias, leading to an overrepresentation of studies with significant findings.

Nevertheless, there are several reasons for why childhood adversity may not sensitize adults to the mental health effects of COVID-19 psychosocial stress. First, stress sensitization may confer later-life effects depending on the specific developmental period that children were exposed to childhood adversity. Our measure of childhood adversity assessed exposure across a wide age range of 0–18 years and thus collapsed exposures to the entire period of infancy and childhood. Participants may also have experienced a delayed onset of PTSD symptoms related to COVID-19 psychosocial stressors, which may have biased our assessment of stress sensitizing effects. Symptoms of PTSD typically begin within 3 months of the traumatic event but are known to emerge later in some instances (Horowitz 1993). Our

inability to assess the severity of adverse childhood experiences, rather than the presence or absence of such events, may also have introduced measurement error that obscured the long-term sensitizing effects of early adversity. Finally, it is possible that stress sensitization mechanisms may not be involved in shaping adult PTSD in our sample.

While the interaction term between childhood adversity and COVID-19 psychosocial stress did not significantly predict adult PTSD symptoms, we recognize that our preliminary study was not appropriately-powered to calculate robust estimates of the associations between the interaction term and adult PTSD risk and also lacked the relevant biological measures (such as glucocorticoids, catecholamines, inflammation, or brain activity) to adequately assess the degree to which stress sensitizing effects were present or absent in this limited sample. It is possible that stress sensitization could occur among specific cohorts, such as effects based on the severity of childhood or recent stress or age, however our small sample size, narrow age range, and limitations in measurement prevent us from exploring these possible trends.

While we find no direct evidence for stress sensitization in our preliminary sample, our null evidence does not negate the psychological consequences of childhood adversity and structural violence that are continually experienced in Soweto and across South Africa. Our data highlight the deleterious psychological impacts of childhood adversity during the post-apartheid era and COVID-19 psychosocial stress in this sample of Black South African adults. These findings further highlight the existing mental health concerns experienced in the country during the COVID-19 pandemic, particularly among lower-income and Black African communities in South Africa (Hunt et al. 2021), and emphasize the ongoing need for greater psychosocial resources in community settings in a country where 92% of individuals who require psychiatric treatment do not receive care (Docrat et al. 2019).

Limitations

First, our measure of COVID-19 psychosocial stress assessed retrospective experiences of stress across the entire course of the pandemic to the point of data collection. The wide time frame that participants were prompted to reflect on and the retrospective nature of the assessment may have compromised the reporting of psychosocial stress experiences due to memory and emotional bias at the time of data collection. Similarly, our assessment of childhood adversity represented an aggregate measure of stress and trauma across a wide developmental period (ages 0–18), prohibiting the ability to assess the possible effects of developmental timing. Second, our preliminary sample was not adequately powered to assess the potential interaction between childhood adversity and COVID-19 psychosocial stress. Given our limited sample, the positive coefficient of the interaction term between childhood adversity and COVID-19 psychosocial stress, the confidence interval range, and the strong effects of both childhood trauma and COVID-19 psychosocial stress on adult PTSD risk, we hesitate to fully reject the stress sensitization hypothesis based on these data alone. Future, well-powered studies will provide a stronger evaluation of the stress sensitization hypothesis in this sample. Specifically, future studies can benefit from repeated measures of various stress types during childhood and adulthood as well as adult mental health symptoms, in order to track the emergence and development of stress sensitivity alongside the frequency and severity of stress exposure over the lifecourse. Third, given that

changes in stress physiological function are understood to partially underlie to the process of stress sensitization across the lifecourse, our observational study using survey-based data was unable to assess the proximal biological mechanisms involved in possible stress sensitizing effects. Future studies should also directly examine neuroendocrine function and sensitivity, or the reactivity of stress-sensitive hormonal systems to physical and psychological stimuli, during development and adulthood to assess more exact mechanisms of stress sensitization, as well as neurobiological measures of stress appraisal and reactivity. Finally, future work should also build upon existing measurement tools for childhood adversity to assess other post-apartheid conditions specific to their respective contexts. For instance, perhaps the most utilized measure of childhood adversity in South Africa, the Adverse Childhood Experiences Questionnaire, does not assess experiences of social discrimination, food and water insecurity, and energy blackouts – conditions that have persisted into or emerged during the post-apartheid period. These study designs can allow researchers on the developmental origins of adult mental illness trace the biological, behavioral, developmental, and psychopathological pathways that may alter future stress sensitivity and sustain the long-term impacts of childhood adversity across the lifecourse.

CONCLUSION

In this sample of adults living during the COVID-19 pandemic in urban South Africa, we found an elevated prevalence of moderate to severe PTSD symptoms and high levels of adverse childhood experiences. Both adverse childhood experiences and COVID-19 psychosocial stress were strongly associated with adult PTSD symptomatology, and the mental health impacts of COVID-19 psychosocial stress was nonsignificant worse among adults with greater childhood adversity. Our data do not support the stress sensitization hypothesis, but our preliminary sample and lack of biological measures of stress reactivity across the lifecourse limited our ability to calculate robust estimates of the interaction between childhood adversity and COVID-19 psychosocial stress and adequately assess the presence or absence of stress sensitizing effects in this analysis. Well-powered samples and direct measures of biological stress sensitivity and function are needed in future studies to better evaluate the stress sensitization hypothesis in this setting. The strong adult mental health effects of childhood adversity and COVID-19 psychosocial stress, the ongoing nature of the pandemic, and the lack of adequate public mental health resources emphasize the importance of further research on the lifecourse stress pathways affecting adult mental health in Soweto.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding:

AWK is supported by the Fogarty International Center and National Institute of Mental Health, of the National Institutes of Health under Award Number D43 TW010543. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The support of the DSI-NRF Centre of Excellence (CoE) in Human Development at the University of the Witwatersrand, Johannesburg in the Republic of South Africa toward this research is hereby acknowledged. Birth to Thirty has been funded

by the Wellcome Trust, the South African Medical Research Council, the Human Sciences Research Council, the University of the Witwatersrand, and the Bill & Melinda Gates Foundation.

Data Availability Statement:

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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ACEs and PTSD severity by COVID-19 stress

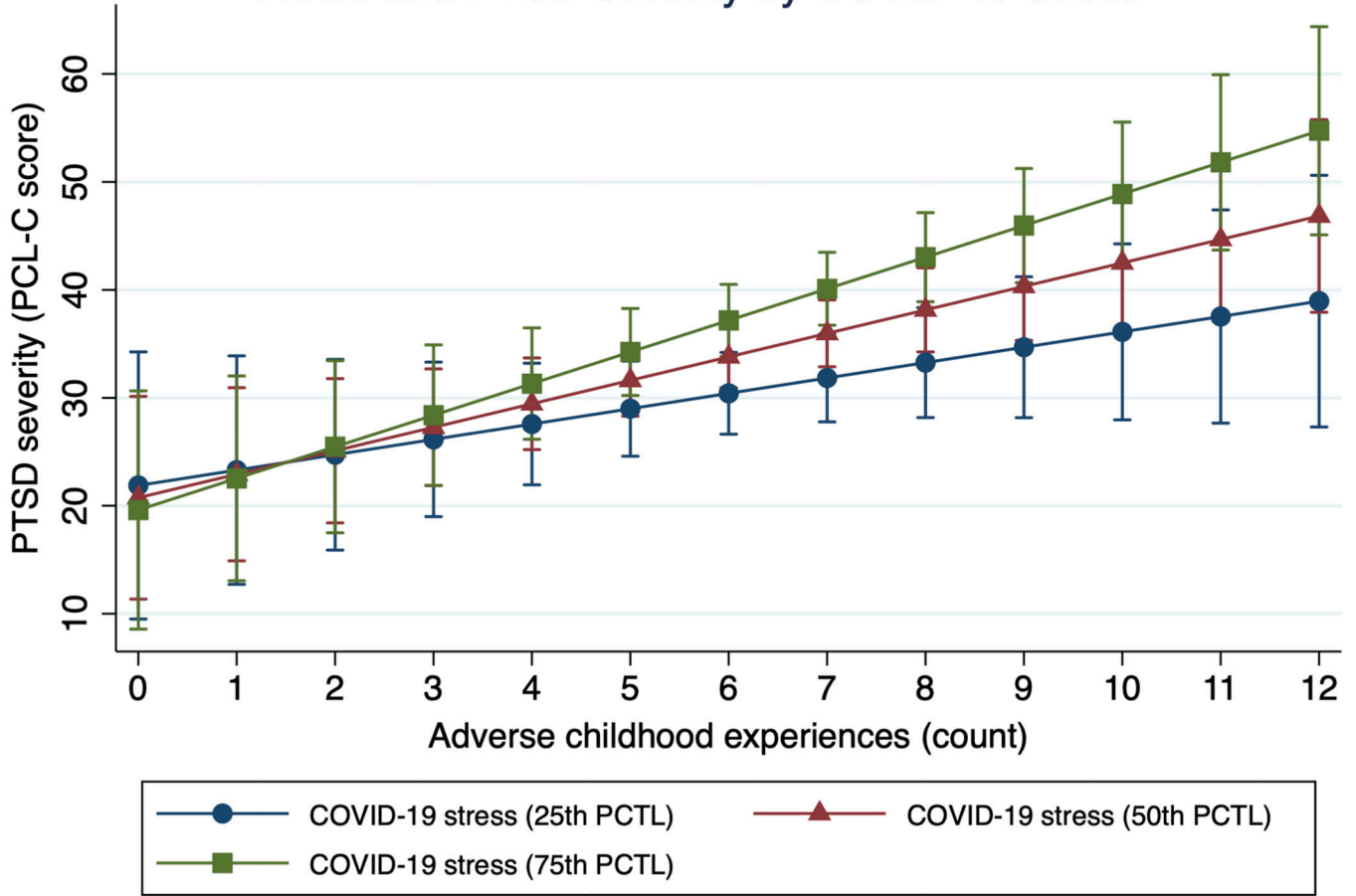


Figure 1. Childhood adversity and adult PTSD severity by adult COVID psychosocial stress. Adults with greater childhood adversity and worse COVID-19 psychosocial stress exhibited non-significantly elevated PTSD symptom severity ($b = 0.08$, 95% CI $[-0.03, 0.2]$, $p = 0.146$).

Table 1

Sample characteristics

Variables	n	Mean/%	SD
Age (years)		30.1	0.3
Female	47	53.1	
Educational status	7	7.9	
Some high school	15	17.1	
Matric	40	45.5	
Some college	17	19.3	
University graduate	9	10.2	
Assets at 2020–2021		10.0	2.2
Partnered	57	64.8	
ACEs		6.2	2.1
COVID-19 stress		24.5	15.3
PCL-C		35.3	15.2
PTSD caseness ^a	47	46.4	12.4

Note. SD = standard deviation; ACEs = Adverse childhood experiences; PCL-C = PTSD Checklist – Civilian Version; PTSD = Post-traumatic stress disorder

^aPTSD caseness was defined based on a PCL-C cutoff score of 31 or greater.

Table 2

Frequency of adverse childhood experiences (ACEs)

Adverse childhood experience	n	%
Chronic unemployment	84	97
Exposure to violence and crime	64	73
Serious illness or disability in the household	54	62
Death in the family/household	52	59
Physical abuse	48	55
Household substance abuse	47	53
Divorce/separation	44	50
Exposure to interpersonal violence	39	44
Sexual abuse	30	34
Household legal trouble	29	33
Emotional abuse	28	32
Parental death	18	21
Parental separation	10	11

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Table 3

Psychosocial stressors during COVID-19

Stressor	Average (0–4)
My future	2.28
No gatherings	2.00
Feeling unsafe due to COVID-19	1.70
Financial insecurity	1.60
Unable to socialize	1.68
Fake news	1.57
Unemployment	1.36
Alcohol ban	1.22
Lack of transportation	1.17
Family issues	1.10
Cigarette ban	0.97
Food insecurity	0.94
Healthcare inaccessible	0.92
Issues with partner	0.86
Problems with ancestors	0.85
Caring for elder	0.61
Medication inaccessible	0.59
Chronic illness	0.53
Domestic violence	0.34

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Table 4

Multiple regression models of childhood adversity and COVID-19 psychosocial stress predicting adult PTSD symptoms

	Model 1	Model 2	Model 3	Model 4	Model 5
ACEs (count)	2.6 ± 0.7 ***	2.7 ± 0.8 **	2.5 ± 0.8 **	2.3 ± 0.7 **	0.7 ± 1.3
ACEs × COVID-19 stress					0.08 ± 0.5
Age (year)		6.3 ± 5.8	6.1 ± 5.8	4.6 ± 5.4	5.7 ± 5.4
Female (binary)		-3.0 ± 3.2	-2.4 ± 3.2	-2.4 ± 3.0	-1.7 ± 3.0
Assets (count)		-0.06 ± 0.8	0.04 ± 0.8	0.4 ± 0.7	0.2 ± 0.7
Educational attainment (group)		-1.0 ± 1.6	-0.8 ± 1.6	0.2 ± 1.5	0.5 ± 1.5
Partnered (binary)		-2.2 ± 3.4	-1.7 ± 3.4	-0.5 ± 3.2	-0.3 ± 3.2
Social support (score)			-0.1 ± 0.1	-0.1 ± 0.1	-0.1 ± 0.1
COVID-19 psychosocial stress (score)				0.4 ± 0.1 ***	-0.1 ± 0.4
Intercept	18.8 ± 4.7 ***	-159.1 ± 177.0	-150.0 ± 177.4	-124.0 ± 165.1	-145.6 ± 164.5
R ²	0.1153	0.1768	0.1855	0.3047	0.3234

ACEs = Adverse childhood experiences

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$