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Childhood maltreatment and anger expression during adulthood: an exploration of the impact on mortality risk across 15 years

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Childhood maltreatment is linked to increased mortality risk. Underlying mechanisms that may explain this relation are unclear. Childhood maltreatment has also been linked to anger expression in adulthood. This preregistered study examines if anger expression subtypes are an indirect mechanism linking childhood maltreatment and all-cause mortality. The Midlife in United States 2 Biomarker Project included 1,010 participants, 54.7% female, age *M* = 58.18, *SD* = 11.58. Childhood maltreatment was measured as abuse (physical, emotional, and sexual abuse) and neglect (physical and emotional). Anger expression subtypes included Anger-In, Anger-Out, and Anger Control. Mortality risk was defined as attained age with follow-up over a 15 year period. Childhood maltreatment was associated with an increase in mortality risk (HR = 1.021, *B* = 0.021, *p* = 0.005, 95% CI [0.006, 0.034]). This was robust to adjustments and sensitivity analyses. Childhood maltreatment was associated with Anger-In (*B* = 0.053, *p* < 0.001), Anger-Out (*B* = 0.042, *p* < 0.001), and Anger Control (*B* = -0.023, *p* = 0.001). Anger expression subtypes were not significant indirect links between maltreatment and mortality (all *p's* > 0.22). Childhood maltreatment was associated with anger expression and mortality risk. However, anger expression subtypes were not indirect pathways in the maltreatment-mortality relation. Our study did not find evidence that anger expression during adulthood is part of the reason why maltreatment during childhood is linked with longevity.

Keywords Anger, Childhood maltreatment, Mortality, Adverse childhood experiences, Adversity

Adverse childhood experiences such as childhood maltreatment have been associated with all-cause mortality[1,2]. For example, Brown and colleagues'[3]) longitudinal study of adults reported that when participants had six or more adverse childhood experiences there was a greater all-cause mortality risk. More specifically, those with childhood trauma died twice as early as non-abused peers. More recently, cumulative adverse childhood experiences, and particularly physical abuse, were reported to be predictive of greater all-cause mortality risk (D'Arcy-Bewick et al.[4]). One specific subtype of childhood adversity is childhood maltreatment. This refers to the experience of abuse and neglect, which can be physical, emotional or sexual in nature (World Health Organization[3]. The trend of increased risk of all-cause mortality remains true also for childhood maltreatment[4,5]. This presents a challenge to the global healthcare system with regards to intervention and prevention. The pathway from maltreatment to increased mortality risk likely permeates through a broad range of biobehavioral health factors. The field of research has become increasingly focused on identifying the psychological factors that potentially explain the indirect mechanisms that enhance or undermine the link between childhood adversity and mortality risk (e.g., O'Súilleabháin et al.[6,7]; Curtis et al.[8]). As such, it may prove fruitful to uncover potential mechanisms that may be important to generate awareness and the targeting or earlier interventions.

Studies examining behavioral, social, economic, and psychological factors[9–12] have confirmed that factors such as childhood adversity and negative affectivity are significantly associated with poorer health and mortality risk. Given that childhood maltreatment is established as having such a noxious effect, it is critical to understand

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the indirect mechanisms that impact mortality risk in those who have experienced childhood maltreatment. For example, personality factors[6,13], and perceptions of control[14] can support clinicians and healthcare systems in identifying individuals at greater risk[15]. One potential indirect mechanism that has not yet been explored within this context is anger expression, which refers to how people express anger and can be thought of as the behavioral element of the emotion[16]. There are typically three subtypes of anger expression: Anger-In (i.e. suppression), Anger-Out (i.e. towards others or the environment), and Anger-Control (i.e. effort made to regulate / attenuate how anger is communicated).

In areas of social and organizational psychology, anger suppression and expression have been associated with poorer outcomes, such as poorer well-being, insecure attachment in romantic relationships, powerlessness, and poor social impressions[17–20]. In health-related studies, anger expression has been linked to physical issues, including blood pressure, poor sleep quality in coronary heart disease patients, and reduced cortisol awakening response in healthy young adults[21–24]. Elsewhere, both Anger-Out and Anger-In were associated with all-cause mortality risk[10], and cardiovascular mortality[25]. Models that attempt to understand the relationship between biopsychosocial factors and mortality risk have taken the conceptual approach of looking at the cumulative effects of childhood maltreatment on health across the lifespan, as well as childhood being a critical period in which harm can have long lasting impact (see discussion by[26]. Indeed, children who have experienced maltreatment often develop emotional difficulties with expressing anger[27–29] which may be underpinned by models of behavioral learning theory and adaptive survival responses to stressful environments (see review by Cichetti[30]). While studies of anger expression variations and health present one view of the relationship between these variables, inconsistencies have previously been reported with regards to the significance of associations between demographic, health behavior factors, and all-cause mortality risk with anger expression subtypes[31,32].

In a previously conducted meta-analytic review of the literature, we found a potential link between childhood maltreatment and both Anger-In and Anger-Out in adult samples[28]. In this review, we observed that quite often research outcomes focused on predisposing factors (e.g. genetics, mental health disorders) of childhood maltreatment and behavioral consequences (e.g. perpetration of violence, aggression, drug use) which related to adult anger expression. This means that the long-term health impacts remain unclear. We also noted that there is limited research examining associations between childhood maltreatment and subtypes of adult anger expression. Anger expression becomes dysregulated in children and adolescents who experience childhood maltreatment (see review by[27], thus it follows that this is an important area to explore with regards to long-term development and health. Recent research has outlined the possibility that similar biobehavioral factors may explain indirect pathways between childhood adversity and mortality risk (e.g. O'Súilleabháin[7] and illustrating the need for further research in this area.

In the current study, we examined whether childhood maltreatment is related to different types of anger expression in adulthood and whether anger expression is an indirect pathway in the relationship between childhood maltreatment and mortality risk. As such, this preregistered study we utilized a large archival dataset with measures of childhood maltreatment, anger expression subtypes, and fifteen years of follow-up data on mortality.

Methods

Pre-registration

This study was pre-registered on Open Science Framework (OSF), available at: https://osf.io/v4x7d/?view_only=f265b7c74c6f48daa18470d8d0ec0e60. The data used within this study are publicly available through the Inter-University Consortium for Political and Social Research (ICPSR) https://www.icpsr.umich.edu/web/ICPSR/series/203.

Participants

MIDUS is a longitudinal survey-based study of more than 7,000 Americans (aged 25 to 74) that began in 1994. The study aimed to investigate the role of behavioral, psychological, and social factors in understanding age-related differences in physical and mental health. Several follow-ups have been done at intervals corresponding with MIDUS 2, MIDUS 3, and more recently MIDUS 4. Data for the present study was obtained from the MIDUS 2- Project 4 Biomarker[33], a cohort of N = 1,255 participants that provided both psychometric and biological data. Psychometric measures data was missing for some participants, resulting in a final sample of N = 1,010, (n = 168 deceased; n = 842 alive). Descriptive statistics are provided in Table 1. Compared to those alive on final update, those who were deceased were more likely to be male (χ^2 = 6.326, p = 0.012), not married / widowed (χ^2 = 44.757, p < 0.001), were older at baseline (t = 15.955, p < 0.001), had more chronic illnesses (t = 6.199, p < 0.001), and had lower scores for both Anger-In (t = -2.682, p = 0.007) and Anger-Out (t = -3.105, p = 0.002).

Measures

Childhood maltreatment

The Childhood Trauma Questionnaire (CTQ[34] is a measure of childhood physical abuse, emotional abuse, sexual abuse, physical neglect, and emotional neglect. Each subscale was measured by 5 items. Items were scored on a 5-point scale ranging from 1 ("*never true*") to 5 ("*very often true*"). A total score was calculated by summing each subscale. This measure was administered during the MIDUS-2 data collection with adult participants from 2004. Reliability and validity of the scale in the data documentation by the MIDUS team[35] for this sample were reported to be good (Cronbach's alphas ranging from 0.70 to 0.94). This scale has also previously demonstrated acceptable validity and reliability in other research[36]. Notably, in this sample, the average score was not particularly high for cumulative maltreatment experiences (M = 37.59, SD = 13.64, range 25–114).

	Deceased ($n = 168$)	Alive ($n = 842$)	Complete Sample ($N = 1,010$)
	Mean (SD) / %	Mean (SD) / %	Mean (SD) / %
Age at baseline	69.82 (11.17)	55.86 (10.19)	58.18 (11.58)
Age attained	78.51 (11.18)	70.58 (10.34)	71.90 (10.88)
Sex (Female)	45.83%	56.41%	54.7%
Race (White)	98.21%	93.11%	94%
College degree or higher	48.21%	56.65%	55.4%
Marital Status			
Married	68.45%	70.31%	70%
Separated	0.60%	1.54%	1.4%
Divorced	10.71%	13.66%	13.2%
Widowed	16.67%	4.16%	6.2%
Never Married	3.57%	7.96%	7.2%
Living w/ partner	0	2.38%	2%
Chronic Conditions	2.93 (2.05)	1.89 (1.53)	2.07 (1.67)
CTQ Total	7.48 (3.71) 37.44 (14.37)	37.62 (13.50)	37.59 (13.64)
Emotional Abuse		8.02 (4.14)	7.93 (4.08)
Physical Abuse	6.39 (2.29)	6.87 (2.92)	6.79 (2.83)
Sexual Abuse	6.59 (4.05)	6.39 (3.55)	6.42 (3.64)
Emotional Neglect	9.88 (4.98)	9.66 (4.33)	9.70 (4.44)
Physical Neglect	7.10 (2.80)	6.68 (2.62)	6.75 (2.65)
Anger-In	13.83 (3.81)	14.75 (4.10)	14.60 (4.07)
Anger-Out	12.09 (2.95)	12.91 (3.17)	12.78 (3.15)
Anger Control	10.00 (2.41)	10.11 (2.17)	10.09 (2.21)

Table 1. Descriptive statistics of sample.

Anger expression subtypes

The State-Trait Anger Expression Inventory (STAXI[37] was used during Wave 2 of the MIDUS study. The STAXI subscales of interest for the current study were the Anger-In, Anger-Out, and Anger Control scales. Items were scored on a 4-point scale ranging from 1 ("*almost never*") to 4 ("*almost always*"). Anger-In was measured by 8 items such as "*I pout or sulk*", "*I keep things in*". Anger-Out was measured by 8 items such as "*I slam doors*", "*I argue with others*". Anger Control was measured by 4 items such as "*I control my temper*", "*I calm down faster*". Where one item was missing, a mean imputation was performed at the time the data was collated by the MIDUS team. Reliability and validity of the scale in the data documentation by the MIDUS team for this sample was reported to be good (Cronbach α ranging from 0.69 to 0.82[35]. This scale has also previously been shown to have acceptable validity and reliability in other research[38]. In the current sample Anger-In was scored $M = 14.60$, $SD = 4.07$, range = 8–31; Anger-Out was scored $M = 12.78$, $SD = 3.15$, range = 8–28; and Anger Control was scored $M = 10.09$, $SD = 2.21$, range = 4–14.

All-cause mortality

Information on deaths was obtained from the National Death Index combined with closeout phases as part of sample maintenance. Survival time was defined by age attained at most recent follow-up (censored on 12/31/2021) or age at death. Attained age was used as it is a natural metric in observational studies and it also accounts for age (Pencina et al[7,39].

Covariates

Sex (male/female), education (levels varying from "1 no school" to "12 PhD"), race (White, Black / African American, Native American, Asian, Pacific Islander, Multi-racial), marital status (married, separated, divorced, widowed, never married, living with partner), and number of chronic conditions (total number of diagnosed medical conditions, including hypertension, heart disease, diabetes, cancer, stroke; see Supplementary Material for complete list) were included as covariates in this study. Inter-correlation matrix for all variables is also available in Supplementary Materials.

Statistical analysis

Descriptive statistics were computed in SPSS version 29.0.1. Assumptions checks were completed in R, with the examination of indirect pathways which incorporated cox proportional hazards modelling within a structural equation modelling framework being conducted in Mplus Version 8[40]. This approach is consistent with other existing research (e.g., Curtis[8]. Assumption of linearity was met. Schoenfeld's residuals analysis suggested that CTQ Total scores were in violation of proportionality ($\chi^2 = 4.711$, $p = 0.03$). To correct this, we followed the interaction method[41] by creating an additional covariate to represent the interaction between CTQ Total score and attained age. This also improved model fit (Model 1 AIC = 24435.204; BIC = 24631.912; to Model 2 AIC =

	Model 1			Model 2		
	Estimate	*p*	95% CI	Estimate	*p*	95% CI
Sex	− 0.289	0.09	− 0.663, 0.001	− 0.264	0.13	− 0.639, 0.043
Race	− 0.49	0.79	− 8.064, − 0.094	− 0.492	0.79	− 7.973, − 0.107
Education	0.024	0.45	− 0.032, 0.101	0.021	0.51	− 0.037, 0.093
Marital Status	− 0.034	0.59	− 0.166, 0.083	− 0.038	0.55	− 0.168, 0.078
Chronic conditions	0.057	0.19	− 0.020, 0.149	0.048	0.29	− 0.037, 0.146
Childhood maltreatment	0.022 (†1.023)	0.000***	0.009, 0.035	0.021 (†1.021)	0.005**	0.006, 0.034
Anger-In (indirect)				0.002	0.22	− 0.001, 0.004
Anger-Out (indirect)				− 0.001	0.62	− 0.004, 0.002
Anger Control (indirect)				0.001	0.54	− 0.002, 0.003
AIC	7371.249			22655.153		
BIC	7440.097			22856.779		

Table 2. Model output for basic and indirect pathway models. Model 1 contains covariates only Model 2 contains covariate and indirect pathways † Hazard ratio * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

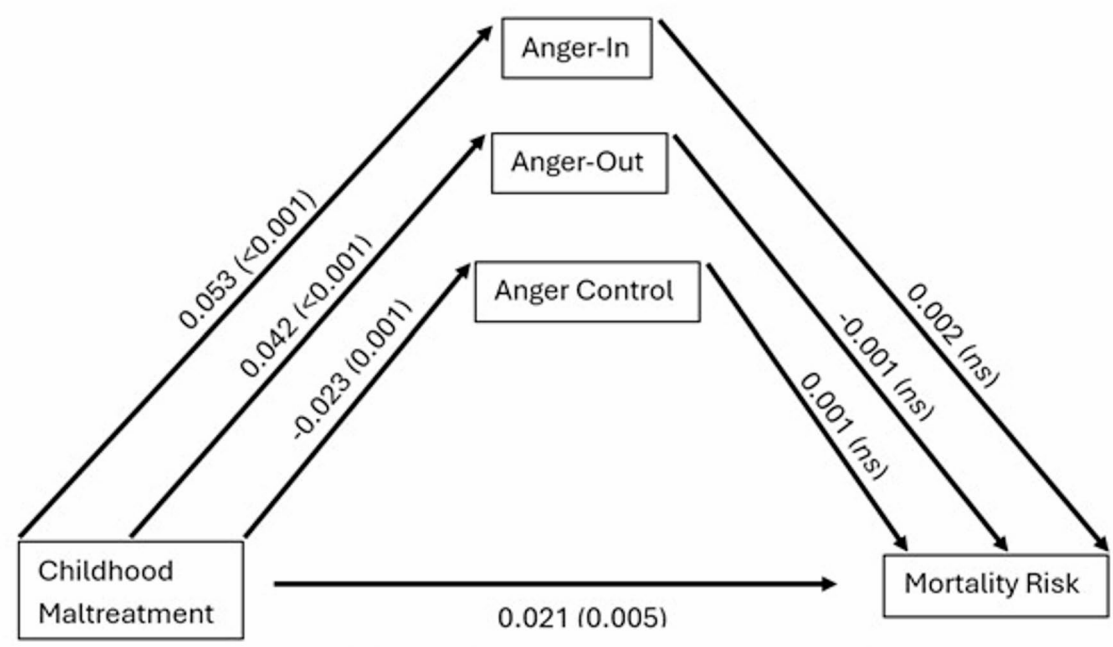


Fig. 1. Model summary.

22655.153, BIC = 22856.779). Indirect effects were assessed using bias-corrected 1000 bootstrapped thresholds. All confidence intervals (CI) are reported to 95% thresholds. Anger expression subtypes were entered into the model simultaneously to account for any associations between them in the models, as recommended elsewhere when working with models of this nature (e.g., Turiano et al.[42]. Bias-correction was also very important as it reduces the possibility of introducing skew that may bias estimates, particularly those focused on indirect pathways (Grogan et al., 2023[7].

Results

In Model 1 (see Table 2), childhood maltreatment and covariates were entered into the model for mortality risk. This was significant, χ^2 (24) = 342.29, $p < 0.001$. Of the variables, only childhood maltreatment significantly predicted mortality risk, Hazard ratio = 1.023, $B = 0.022$, $p < 0.001$, 95% CI [0.009, 0.035]. Every one unit increase in childhood maltreatment increased mortality risk by 2.3%.

In Model 2, anger expression subtypes were entered as indirect pathways. This model was also significant, χ^2 (27) = 346.69, $p < 0.001$. As can be seen in Fig. 1, the indirect effects were all statistically non-significant, Anger-In $B = 0.002$, $p = 0.22$, 95% CI [-0.001, 0.004]; Anger-Out B = -0.001, $p = 0.62$, 95% CI [-0.004, 0.002]; Anger Control B = -0.001, $p = 0.54$, 95% CI [-0.002, 0.003].

Childhood maltreatment was associated with Anger-In $B = 0.053$, $p < 0.001$, Anger-Out $B = 0.042$, $p < 0.001$, and Anger Control B = -0.023, $p = 0.001$ (see Table 3). Anger subtypes were not associated with mortality (all

		Estimate	*p*	SE
Model 2	Total effect	0.002	0.355	0.002
Anger-In	Childhood maltreatment	0.053	< 0.001***	0.011
	Sex	− 0.436	0.10	0.265
	Race	0.038	0.82	0.169
	Education	0.075	0.15	0.052
	Marital Status	0.092	0.35	0.097
	Chronic Conditions	− 0.148	0.04*	0.071
	Mortality	0.032	0.19	0.024
	Total effect	0.023	0.002**	0.007
Anger-Out	Childhood maltreatment	0.042	< 0.001***	0.008
	Sex	− 0.146	0.45	0.193
	Race	− 0.011	0.93	0.124
	Education	0.074	0.06	0.039
	Marital Status	0.050	0.47	0.070
	Chronic Conditions	0.012	0.84	0.039
	Mortality	− 0.017	0.61	0.034
	Total effect	0.020	0.007**	0.008
Anger Control	Childhood maltreatment	− 0.023	0.001**	0.005
	Sex	− 0.147	0.29	0.138
	Race	− 0.036	0.73	0.103
	Education	0.057	0.04*	0.027
	Marital Status	− 0.074	0.12	0.048
	Chronic Conditions	− 0.096	0.03*	0.027
	Mortality	− 0.027	0.52	0.042
	Total effect	0.022	0.003**	0.007

Table 3. Direct regression values between anger expression subtypes and model 2 variables. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

ps > 0.19). All analyses were robust to sensitivity analyses which removed those who were deceased within the first two years of follow-up to further account for potential reverse causality.

Discussion

In this study, we investigated whether anger expression subtypes were an indirect pathway linking childhood maltreatment and all-cause mortality risk. We found that when adjusting for covariates, childhood maltreatment was significantly associated with all-cause mortality, increasing the risk of earlier death. This corroborates earlier work from other populations, in addition to further reaffirming the importance of examining the effects of maltreatment during childhood on longevity[9]; 2009[10,11,14]; Wegman & Stetler). While consistent with past research, the present effect size may appear modest, but it is consistent with past work in this area and consistently appears to impact a measure of notable importance, e.g., mortality. We found that childhood maltreatment was significantly associated with anger expression subtypes, such that positive associations were observed between childhood maltreatment and both Anger-In and Anger-Out. A negative association was noted between childhood maltreatment and Anger Control. These links substantially extend existing literature in this area (for review see[28]. Contrary to our preregistered hypotheses we did not find evidence that anger subtypes provide an indirect link between childhood maltreatment and mortality risk. This is also notable given the present study had adequate power. Notwithstanding that, this does need to be tested in additional samples.

Our findings extend the current evidence of an association between childhood maltreatment and mortality risk[4,5]. This is also broadly consistent with similar findings relating to broader adverse childhood experiences and mortality risk[1,43]; D'Arcy-Bewick et al., 2023[2]. In addition to extending the literature on the association between childhood maltreatment and anger-in and anger-out, we also observed a negative association between childhood maltreatment and anger control. This suggests that those with more experiences of maltreatment during childhood were associated with less control of the expression of anger. This would correspond to literature suggesting that individuals that have been raised in an abusive environment can have poorer stress tolerance and coping strategies in adulthood (e.g., Agorastos et al.[44], Lynch[28], Perlman[45]. Within our study, maltreatment was treated as a cumulative score of adverse experiences similar to previous research (see review by[28]. It should be noted that maltreatment research has also been moving towards differentiating between adversity that is additive / abuse versus omissive / neglect[46]. It may be helpful for future research examining anger expression in those who have experienced childhood maltreatment to consider further differentiating between these types.

Anger expression was not associated with mortality risk. Past research has also reported inconsistent evidence between anger expression types for all-cause mortality risk (Kakoo-Brioso et al., 2019[32]. It must also be noted that in this study we chose to examine the behavioral component of anger, whereas previous research has

focused on trait anger (e.g., affective component) and hostility (e.g., cognitive component) as predicting negative health outcomes and mortality risk[31,47]. Our study also did not factor in many other important factors that may be associated with anger expression subtypes and by extension impact mortality (e.g., Papp and Fitzgerald[48], Rogers[2],. Thus, there may be differences in the mechanisms through which coping with anger may or indeed may not exert its influence on future mortality risk as it pertains to maltreatment experienced during childhood.

Limitations

Whilst there are numerous strengths to our study, limitations must be noted. The effect size per unit increase for childhood maltreatment and mortality risk in this study was modest and should be considered in future research. This may be particularly important if compared to other forms of early adversity that could potentially contribute to risk (e.g. poverty, caregiver incarceration, caregiver mental health). The current sample is limited in its representativeness of the population, given most participants were white and attained relatively higher education levels. Further research is required in other samples, including different socio-economic backgrounds and across nations. This can impact studies through survival bias, meaning those with a significantly high risk of experiencing childhood maltreatment are likely to be underrepresented, in addition to those already deceased from study outset[7,49]. Maltreatment data employed in this study was based on a self-report measure and recall of past experiences, which could be considered a possible limitation due to potential recall bias. However, recall of maltreatment appears consistent over time with evidence suggestive of an under- as opposed to over-reporting in retrospective reports (Hardt & Rutter[50]). While important and informative, it must be acknowledged that measures of maltreatment are relatively blunt instruments for phenomena that are incredibly complex. Maltreatment and related adversity often continue across the lifespan, and this may have important implications for longevity (for review, see[51]. As such, observed effects may differ across the lifespan. Further, we did not construct latent variables and as such may have introduced some measurement error into the analysis which should be considered in future work. While age was adjusted for in this study, some research studies suggest lifespan differences in trait anger[52], which may also differentially impact anger expression across the lifespan. As such, future work may find it fruitful to consider changes over time in the modelling of mortality risk. Finally, whilst the anger expression measure used in the present study is well established, its items have the potential to overlap with other mental health processes that may have greater utility. This may be particularly important given childhood adversity has robust associations with other emotional processes that have consequences for mortality risk (e.g., Curtis, Luchetti, et al.[53]; Curtis, Kirwan, et al., 2025). Future research should seek to narrow distinctions between various emotional processes.

Conclusion

Our results add to the global psychological literature on anger expression, childhood maltreatment, and mortality risk. We found that childhood maltreatment appears to be associated with both all-cause mortality risk, and anger expression subtypes. Specifically, survivors of childhood maltreatment have increased mortality risk, Anger-In and Anger-Out, and lower levels of Anger Control. No indirect pathway for anger expression as a mechanism was found in this study.

Data availability

Full data is publicly available following agreement at https://www.icpsr.umich.edu/web/ICPSR/series/203.

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Author contributions

ML: Conceptualization; Investigation; Data Curation; Formal analysis; Methodology; Writing-original draft; writing- review and editing. AT; Conceptualization; writing- review and editingSH: Supervision; writing- review and editing.NT: Formal analysis; writing-review and editing. PO: Conceptualization; Supervision; Writing – review and editing.

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Declarations

Competing interests

The authors declare no competing interests.

Ethical approval

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Ethical approval was granted as part of the MIDUS, which received ethical approval from Education and Social/Behavioral Sciences and the Health Sciences IRBs at the University of Wisconsin-Madison.

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