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Serial Indirect Effects From Childhood Maltreatment to Adult Chronic Health Conditions Through Contemporary Family Relationships and Mental Health Problems: Inquiry Into Sleep Disturbances and Stress

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Objective: Childhood maltreatment accelerates biological aging, leaving adults vulnerable to chronic health problems. There is robust evidence that social relationships, including those with family members, may influence chronic health problems through psychological pathways, but there is little research considering stress and sleep problems, especially among adults who experienced childhood maltreatment. Furthermore, longitudinal research is lacking related to maltreatment and chronic health problems. The current study examined familial support and strain and subsequent sleep problems and stress in a serial mediational model linking childhood maltreatment to chronic health problems over time. ***Method:*** Using three waves of data from the study of Midlife Development in the United States ($N = 859$; 55.8% female), structural equation modeling was used to examine familial support, strain, stress, and sleep problems in serial mediational model linking maltreatment to the number of chronic health conditions over a 9-year period. ***Results:*** Childhood maltreatment was indirectly associated with a number of chronic health conditions through familial support and strain through subsequent reports of stress. Although family support was associated with fewer sleep problems, the bootstrapped indirect effect was not significant. Simple indirect effects from maltreatment to the number of chronic health problems were significant through both sleep problems and stress. ***Conclusion:*** Contemporary family relationships and psychological problems are possible points of prevention and intervention reducing the number of chronic health conditions among adults who were maltreated in childhood. Focusing on familial relationships and stress processes may be particularly fruitful.

Clinical Impact Statement

The current study identified that contemporary familial relationships are important social relationships in understanding the interplay between childhood maltreatment, sleep problems, stress, and chronic physical health conditions over time. Both positive and negative familial interactions appear to play a role in linking maltreatment to the number of chronic physical health conditions through stress. Focusing prevention and intervention efforts on contemporary family relationships may reduce future stress thereby reducing the development of chronic health conditions while also enhancing the management of existing health problems.

Keywords: childhood maltreatment, familial relationships, sleep, perceived stress, physical health, chronic health conditions

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Childhood maltreatment is a public health problem potentiating risk for chronic health conditions across the life course (Fitzgerald & Notice, 2022). Numerous theoretical perspectives contend that early adversity becomes biologically embedded and produces chronic health problems (e.g., Miller et al., 2011). Following these theories, researchers have sought to test mediating pathways linking childhood maltreatment to health (Kendall-Tackett, 2002). This is of critical importance due to the personal and economic costs of the health of adults who were maltreated in childhood (Peterson et al., 2018). Chronic health problems are a leading cause of disability, functional impairment, and early mortality in the United States (Centers for Disease Control and Prevention [CDC], n.d.). There is a substantial economic burden associated with chronic health conditions, which are defined as conditions that last 1 year or longer and require ongoing medical treatment. For example, the CDC estimates

that the financial cost of chronic health conditions is an estimated 3.8 trillion dollars per year with over 90% of that cost going directly to treatment (CDC, n.d.).

Relational and psychological health have been proposed to be mediating pathways linking maltreatment to chronic health conditions (Kendall-Tackett, 2002; Priest et al., 2019; Springer, 2009). Because childhood maltreatment is most often perpetrated by family members (Sedlak et al., 2010), current-day relationships with family members have been shown to be more strained and less supportive among adulthood (Kong et al., 2019; Kong & Moorman, 2016). Psychological distress often stems from dysfunctional familial relationships (Fitzgerald & Gallus, 2020; Kong et al., 2019) and is associated with physiological dysfunction and health endpoints (Priest et al., 2018; Woods & Denton, 2014). More specifically, sleep problems and stress are known correlates of poor health and could be extensions of positive and negative aspects of familial relationships, as well as childhood maltreatment (Fitzgerald et al., 2020; Poon & Knight, 2011). Consequently, familial relationships may be linked to future health problems through sleep problems and stress. The current study examined the associations between childhood maltreatment and the number of chronic health conditions over a 9-year period through familial support and strain, and subsequent sleep problems and perceived stress.

Theoretical Underpinnings: Biological Embedding of Childhood Adversity Model and Biobehavioral Family Model

The Biological Embedding of Childhood Adversity Model (BECAM; Miller et al., 2011) offers a conceptual framework from which to understand how childhood maltreatment leads to chronic health problems in adulthood. The BECAM suggests that childhood adversity, including maltreatment, potentiates a physiological stress response that becomes biologically embedded. Adversity creates a physiological inflammatory response increasing proinflammatory cytokines such as interleukin 6 that are associated with risk of developing future health conditions (Danese et al., 2007; Renna et al., 2018). While the BECAM emphasizes physiological processes that link childhood maltreatment to chronic health problems, it gives little attention to the social environment, which also elicits physiological responses (see Birmingham & Holt-Lundstad, 2018; Robles et al., 2014 for reviews). Familial relationships are a particularly compelling pathway linking maltreatment to chronic health conditions because family members are often the perpetrator of the maltreatment, knowledgeable that maltreatment occurred but did not intercede, downplayed the impact of maltreatment, or did not believe children's disclosures of maltreatment. Furthermore, childhood victims of maltreatment often remain in contact with the perpetrator into adulthood (Kong & Moorman, 2016; Wuest et al., 2010).

The Biobehavioral Family Model (BBFM) is a biopsychosocial model that focuses on the intersection between familial relationships and physiological processes that help explain the development, course, and maintenance of disease (Wood, 1993). Familial relationships are thought to influence physical health through psychobiologic pathways, defined by how and the extent to which family members emotionally, behaviorally, and physiologically engage with each other (Wood et al., 2000). Emotionally supportive interactions (e.g., warmth) decrease psychological and physiological dysregulation (Priest et al., 2019; Wood et al., 2021) while emotionally strained interactions (e.g., criticism) potentiate psychological and physiological activation (Gottman & Notarius, 2000; Wood et al., 2021). For example, Priest et al. (2019) found that the relationship between family support and strain and health was mediated by physiological (e.g., hypothalamic–pituitary–adrenal [HPA] axis) and psychological pathways (depression, anxiety). Due to the interdependent nature of familial relationships (Wood et al., 2021), family members may simultaneously be a source of distress and whom adults seek out during times of distress. Having the source of support be the person who is critical or hostile increases psychological and physiological arousal and also precludes reception of support, leaving the individual in a prolonged state of arousal due to the lack of social resources that aid in regulation (Beckie, 2012). Taken together, the BECAM highlights how early adversity can shape physiological processes that potentiate health problems and those same physiological processes are also influenced by familial relationships and psychological processes outlined in the BBFM.

Childhood Maltreatment and Health

Childhood maltreatment affects millions of children each year and is a risk factor for distal health consequences. More than one in three adults report maltreatment in childhood, or abuse and/or neglect prior to the age of 18 (Stoltenborg et al., 2015). Abuse is an act of commission where the perpetrator intentionally inflicts psychological or physical harm onto a child, whereas neglect represents an act of omission, or a caregiver's failure to act that causes harm. Most often, the perpetrators of maltreatment are family members, and parents specifically. For example, approximately four out of five children reported to child protective services were maltreated by their biological parents (Sedlak et al., 2010).

Indeed, empirical research has found that childhood maltreatment is consistently associated with chronic health conditions across the life course. Adults who were abused or neglected in childhood report greater physiological dysfunction such as allostatic load (Widom et al., 2018) and inflammation (Renna et al., 2021) as well as specific health conditions including cardiovascular disease and type II diabetes (Basu et al., 2017). Recently, childhood maltreatment has been linked to obesity, hypertension, chronic obstructive pulmonary disease, and myocardial infarction (Clemens et al., 2018). The prevalence of health problems associated with maltreatment also indicates that adults who were maltreated may be at enhanced risk for reporting multiple chronic health conditions (England-Mason et al., 2018; Fitzgerald & Notice, 2022; Springer, 2009).

The association between maltreatment and adult mental health, in comparison to physical health, is more established. Survivors of maltreatment often experience higher levels of stress and sleep problems in adulthood. Biological processes involved in stress regulation are negatively impacted by maltreatment (Heim et al., 2001; van der Kolk, 2003), leaving adults more vulnerable to the effects of stress, appraising benign events as stressful, and experiencing a greater number of stressors (Kong et al., 2021). For example, childhood maltreatment has been linked to daily stress processes (Weltz et al., 2016), perceptions of stress (Hong et al., 2018), and experiencing a greater number of stressful life events (Young-Wolff et al., 2012). The negative physical health implications of stress are well established with studies documenting a positive association with a greater number of physical symptoms (Smith et al., 2018), more frequent

engagement in health services (Prior et al., 2018), greater physical morbidity (Richardson et al., 2012), and increased mortality (Chiang et al., 2018).

Regarding sleep problems, adults who were maltreated in childhood have documented sleep problems (Gelaye et al., 2015). A recent study used a latent class analysis of child maltreatment to identify subgroups of maltreatment and found that each of the identified classes demonstrated sleep problems (Mishra et al., 2020). More recently, Fitzgerald (2022a) found that childhood maltreatment severity was positively associated with greater sleep disturbances. Using a sample of midlife adults, childhood maltreatment was associated with numerous sleep disturbances, including global sleep problems, poorer subjective evaluations of sleep, decreased sleep latency, increased use of sleep medications, and more sleep disturbances (Greenfield et al., 2011). Adults who report a greater number of sleep problems are at enhanced risk for health problems (e.g., Ong & Williams, 2019). More specifically, adults' sleep quality has been negatively associated with self-rated evaluations of physical health (Hale et al., 2010), greater physical impairment (Mishra et al., 2020), and development of specific health conditions (e.g., metabolic syndrome; Hall et al., 2008). For example, Lee et al. (2009) investigated the associations between sleep problems and adult physical health in a sample of midlife and older adults. They found that roughly 29% of adults reported one sleep-related issue and 10% reported severe sleep issues. Furthermore, they found that sleep problems were associated with numerous health issues, including decreased physical functioning, increased bodily pain, and poorer general health (Lee et al., 2009).

Mediating Role of Contemporary Familial Relationships

Childhood maltreatment is a historical factor that leaves adults more vulnerable to more negative and less supportive relationships with family members across the life course (Kong et al., 2019). Childhood abuse perpetrated by family members is associated with lower quality relationships with family members in adulthood (Kong & Moorman, 2016). For example, Savla et al. (2013) found that childhood abuse was associated with less emotional closeness with family members using data from the study of Midlife Development in the United States (MIDUS). Research has noted that familial relationships mediate the association between child maltreatment and adult mental health (Kong et al., 2019), which then contributes to poorer physical health (Priest et al., 2018). Although prior research has noted that interpersonal relationships are critical following traumatic events, sources of support have been conflated together (e.g., family and friends; Coleman et al., 2016), which provides only an overall indicator of social support and cannot identify relationship-specific effects on health that have been recently found (Fitzgerald & Gallus, 2020; Woods et al., 2020). Thus, the unique contributions of familial support and strain to mental and physical health over time remain unclear among those maltreated in childhood. Furthermore, there are few studies examining the prospective association between maltreatment and changes in physical health over time (see Renna et al., 2021 for exception).

Present Study

The current study aimed to expand knowledge by considering the role familial relationships, sleep, and stress play in understanding the association between child maltreatment and the number of chronic health conditions over time among midlife adults. Specifically, the current study examined family support and strain and subsequent reports of stress and sleep problems in a serial mediational model linking child maltreatment severity to the number of chronic health problems over a 9-year period using three waves of data. It was hypothesized that childhood maltreatment would be associated with higher levels of family strain and lower levels of familial support, and would also be directly associated with greater perceptions of stress and more sleep problems. Prior research has noted that interpersonal relationships only partially mediate the relationship between maltreatment and mental health (Fitzgerald & Gallus, 2020). Familial support was expected to then be associated with fewer sleep problems and less stress while familial strain was expected to be associated with greater sleep problems and stress. Family support and strain were not expected to be directly associated with the number of chronic health conditions. Stress and sleep problems were hypothesized to be associated with a greater number of chronic health conditions. Finally, it was expected that the serial indirect effects would be significant where maltreatment is associated with chronic health conditions through familial support and strain and subsequent reports of sleep problems and stress.

Method

Data are from the study of the MIDUS study. The MIDUS study (MIDUS 1) comprised a national sample of 7,108 English-speaking adults assessed in 1995–1996 via telephone interview and self-administered questionnaire (SAQ), which was mailed to participants and returned. The sample comprised individuals from four subgroups: (a) a national random digit dialing (RDD) sample ($n =$ 3,487); (b) city oversamples in the United States ($n = 757$); (c) siblings of individuals from the RDD sample ($n = 950$); and (d) a national RDD sample of twin pairs ($n = 1{,}914$). In 2004–2005, the first follow-up study was conducted (MIDUS 2) and data collection methods mirrored those of MIDUS 1. MIDUS 2 also included a biomarker follow-up project (2005–2009) that was comprised of 1,054 participants drawn from the MIDUS 2 sample. In addition, 201 racial minorities who did not participate in MIDUS 1 were recruited. The third wave of data collection (MIDUS 3) occurred between 2013 and 2015 and mirrored the data collection methods of MIDUS 1 and 2. Data for the current study were drawn from MIDUS 2 (family support, family strain, and the covariates), MIDUS 2 biomarker (child maltreatment, stress, and sleep quality), and MIDUS 3 (number of chronic health conditions). Although maltreatment was measured at the second wave, given the retrospective nature and the weaknesses of the MIDUS 1 measure of maltreatment (see Fitzgerald, 2022b for a more detailed discussion), it was evaluated to be of minimal threat to the reliability and validity of the results. Data are publicly available and deidentified, thus IRB approval was not required.

Participants

Participants were included in the current study if they participated in MIDUS 2, MIDUS 2 biomarker study, and MIDUS 3. The analytic sample included 859 adults. Regarding sample characteristics, 626 adults (72.9%) were married with the balance being single, separated, divorced, or widowed. The sample tended to be female ($n =$

479, 55.8%) and European American ($n = 798$, 92.9%). The average household income for participants was $78,356 ($SD = $63,000) and participants reported a mean age of 54.63 ($SD = 10.94) at MIDUS 2, 57.45 ($SD = 10.79) at the MIDUS 2 biomarker follow-up and 63.74 ($SD = 10.96) at MIDUS 3. Regarding education, 52% of the sample reported not having a college degree, 24.2% reported having a bachelor's degree and the balance of participants reported at least some graduate education. For attritional analyses within the MIDUS data, readers are referred to papers by Radler and colleagues (Radler & Ryff, 2010; Song et al., 2021). Within the current study, logistic regression was used to analyze the covariates and study variables as predictors of participation at MIDUS 3. Only two predictors significantly influenced participation at MIDUS 3, and they were stress ($B = -.08$, $OR = .93$, 95% CI [.890, 963]) and age ($B = -.07$, $OR = .94$, [.917, 956]) such that older adults and those who reported more stress were less likely to participate.

Measures

Childhood Maltreatment

Childhood maltreatment was assessed using the Childhood Trauma Questionnaire (CTQ; Bernstein et al., 2003). The CTQ is a 25-item scale that was used to measure childhood physical, sexual, and emotional abuse and physical and emotional neglect prior to the age of 18. Items were scored on a 5-point Likert scale, ranging from (1) *never* to (5) *very frequently*. The CTQ has been found to be a valid and reliable scale (Bernstein et al., 2003). A severity score was used for the study where the five subscales were summed together for an indicator of maltreatment severity. Maltreatment was measured at the MIDUS 2 biomarker study. Higher scores reflect greater severity of maltreatment. Cronbach's $\alpha = .92$.

Familial Support and Strain

Support and strain were measured using items from the MIDUS study that were adapted from Schuster et al. (1990) and have been independently used in other studies (e.g., Chen & Feeley, 2014). The familial support and strain items asked about participants' perceptions of support and strain from their family members, not including their spouses. The support items were rated on a 4-point scale ranging from 1 (*a lot*) to 4 (*not at all*). Example item included "Not including your spouse or partner, how much do members of your family really care about you?" The four items were reversed coded and averaged. Higher scores reflect greater perceptions of familial support. Familial strain also consisted of four items and was scored on a scale ranging from 1 (*often*) to 4 (*never*). Items were reverse coded and averaged such that higher scores are indicative of greater levels of familial strain. An example strain item included "Do they criticize you?" Familial support and strain were measured at MIDUS 2. Internal consistency for the family support was acceptable (Cronbach's $\alpha = .80$ for both support and strain).

Sleep Problems

The current study used the Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989) to measure sleep quality. The PSQI uses 19 items to measure seven components of sleep: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep dysfunction, use of sleeping meds, and daytime dysfunction. Scores for the seven components were summed together for a composite indicator of sleep problems and scores ranged from 0 to 21. Higher scores reflect greater sleep problems. Sleep problems were measured at the MIDUS 2 biomarker project (Cronbach's $\alpha = .70$).

Stress

To measure participants' level of stress, the Perceived Stress Scale (PSS; Cohen et al., 1983) was used. The MIDUS study used a 10-item version of the PSS where the items were rated on a 5-point Likert scale ranging from 1 (*never*) to 5 (*very often*). Four positively worded items were reverse coded; the 10 items were summed together where higher scores are indicative of higher levels of stress. Stress was measured at the MIDUS 2 biomarker study. The PSS demonstrated good internal consistency in the sample (Cronbach's $\alpha = .86$).

Chronic Physical Health Conditions

The MIDUS study asked participants about the presence or absence of 28 health conditions (e.g., thyroid disease and varicose veins) and respondents responded either affirmatively or negatively. Participants' chronic health conditions were measured by summing the number of conditions endorsed by participants. Scores ranged from 0 to 28. Chronic health conditions were measured at both the MIDUS 2 (covariate) and MIDUS 3 (outcome variable) assessing identical conditions. Cronbach's α was not calculated because the measure assesses specific physical health conditions and participants' lived experiences rather than a psychological construct.

Covariates (Measured at MIDUS 2)

Age

Age was entered as a continuous variable.

Household Income

Income was measured with a single item where respondents reported their household income with values ranging from 0 to 300,000 or more. In the structural equation model (SEM) model, due to income having a large variance that resulted in model specification errors, income was measured in thousands of dollars (e.g., $76,000 = 76).

Education

Education was measured using an ordinal variable ranging from 1 (*no schooling or some grade school*) to 12 (*PhD or other professional degree*).

Statistical Analysis

Prior to the examination of the mediational model, descriptive statistics were run in SPSS Version 27. Descriptive statistics included bivariate correlations, means, and standard deviations. Following the descriptive statistics, a path analysis was conducted in Mplus. Path analysis is a form of SEM where all variables are observed (measured) and there are no latent variables. The outcome variable is a count variable, which may violate assumptions of traditional regression-based techniques; therefore, a negative binomial

regression was used. By using a negative binomial regression, traditional fit statistics commonly used in SEM are not available. The indirect (mediating) effects were tested using bias-corrected bootstrap CIs based on 1,000 bootstrapped samples, which is the preferred method for estimating indirect effects (Preacher & Hayes, 2004).

Results

Bivariate Results

Using cutoff scores outlined by Walker et al. (1999), prevalence rates of maltreatment are as follows: childhood emotional abuse was reported by 19.3% of adults, physical abuse was endorsed by 21.2%, 16.4% reported sexual abuse, 15.7% reported emotional neglect, and 24.6% reported physical neglect. Regarding the correlations, each of the study variables was associated with each other at $p < .001$ with the exception of family support and the number of chronic health conditions at MIDUS 3, which were not significantly correlated (see Table 1).

Path Model Direct Effects

The results of the path model are displayed in Figure 1. Childhood maltreatment severity was associated with both familial support and strain such that more severe maltreatment was associated with less familial support ($\beta = -.33$, $p < .001$) and greater familial strain ($\beta = -.24$, $p < .001$). Likewise, childhood maltreatment severity was positively associated with sleep problems ($\beta = .11$, $p = .01$) and perceived stress ($\beta = .14$, $p < .001$). Higher levels of familial support were associated with lower levels of stress ($\beta = -.09$, $p = .02$) while familial strain was positively associated with perceptions of stress ($\beta = .20$, $p < .001$). Familial support was only marginally linked to sleep problems where higher levels of familial support were associated with fewer sleep problems ($\beta = -.06$, $p = .07$) while family strain was associated with greater sleep problems ($\beta = .07$, $p = .05$). Regarding the predictors of chronic health conditions at MIDUS 3, childhood maltreatment ($\beta = .09$, $p = .18$), family support ($\beta = .09$, $p = .20$), and family strain ($\beta = .04$, $p = .52$) were nonsignificant. Sleep problems and stress were each associated with chronic health conditions. Both sleep problems ($\beta = .27$, $p < .001$) and stress ($\beta = .19$, $p < .001$) were related to a greater number of chronic health problems.

Indirect Effects

Using bootstrapping procedures, the indirect effects from maltreatment to chronic health conditions were examined (see Table 2 in the online supplementary materials). Only indirect effects that had a significant a and b pathway are reported since nonsignificant associations between the independent variable and the mediator, or the mediator to the dependent variable breaks the mediational chain. The simple indirect effect from maltreatment to physical health problems through sleep problems was significant ($\beta = .010$, 95% CI [.004, .036]). Likewise, maltreatment was indirectly associated with the number of chronic health problems through greater stress ($\beta = .017$, [.005, .036]). The indirect effect from maltreatment to chronic health problems through familial strain and subsequent sleep problems was not significant ($\beta = .004$, [.000, .009]). Regarding stress, the serial indirect effects through support ($\beta = .003$, [.001, .007]) and strain ($\beta = .004$, [.001, .008]) were both significant.

Discussion

The current study found longitudinal evidence that childhood maltreatment is associated with a greater number of chronic health problems over a 9-year period among midlife adults through familial support and strain, and subsequent reports of stress. The current findings build on existing studies by longitudinally examining familial relationships and subsequent reports of stress and sleep disturbances as pathways. Findings indicate that although the mediational chain related to maltreatment, family strain, and sleep was not broken, bootstrapped estimates indicate nonsignificant indirect effects. Stress, on the other hand, was influenced by both familial support and strain and increased the number of chronic health conditions over time among those with a history of maltreatment.

The primary contribution of the current study is examining the indirect effects of familial relationships, sleep, and stress linking childhood maltreatment to chronic health conditions over time. According to the BECAM, maltreatment accelerates biological aging through physiological process (e.g., inflammation) leaving adults more vulnerable to physical health problems (Miller et al., 2011; Renna et al., 2021; Senn et al., 2014). The BBFM notes that familial relationships have noted effects on health (Woods et al., 2020) and stress may be one pathway linking maltreatment to health. The current study provides evidence that familial relationships can increase (via strain) or decrease (via support) the amount of stress that maltreatment survivors experience. Adults who experienced more severe maltreatment in childhood also reported that their contemporary relationships with family members are more strained and less supportive, which then increase adults' future perceptions of stress. Adults who were maltreated may be angry and resentful a (Fitzgerald & Williams, in press) and they behave in congruent ways. For example, childhood maltreatment is associated with

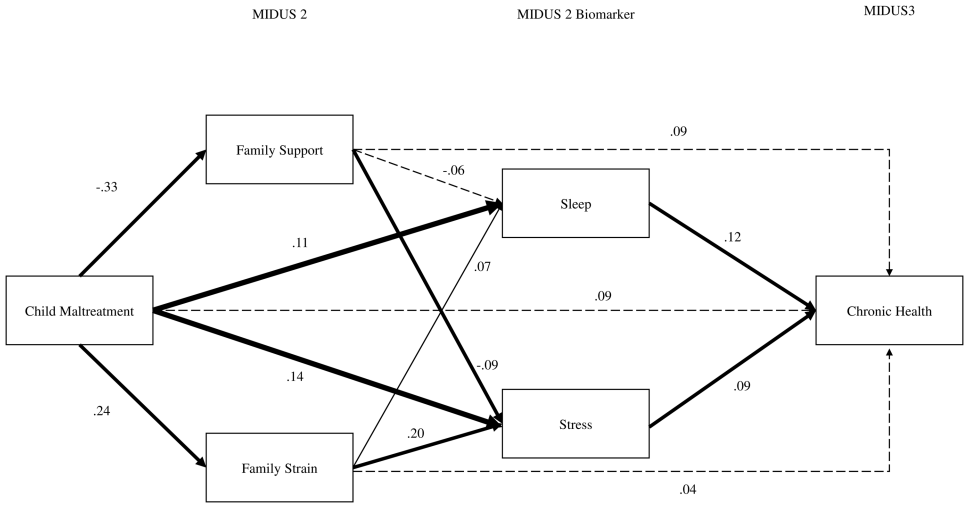
Table 1
Correlations, Means, and Standard Deviations Among Independent, Mediating, and Outcome Variables

Variable	1	2	3	4	5	*M* (*SD*)
1. Childhood maltreatment	—					37.61 (14.08)
2. Familial support	−.34***	—				3.55 (.58)
3. Familial strain	.31***	−.33***	—			2.01 (.57)
4. Sleep	.24***	−.16***	.21***	—		5.76 (3.42)
5. Stress	.29***	−.23***	.33***	.32***	—	21.29 (6.07)
6. Chronic conditions	.21***	−.06	.18***	.33***	.23***	3.19 (3.02)

***$p < .001$.

Figure 1

Results of Path Serial Mediational Model Linking Child Maltreatment to Chronic Health Conditions Through Contemporary Familial Relationships, Stress, and Sleep



Note. Associations between childhood maltreatment severity and physical health mediated by familial support and strain and subsequent sleep problems and stress. Dashed lines indicate nonsignificant pathways, solid lines indicate significant pathways but were not mediating pathways, bold lines indicate a serial indirect effect and thick bolded lines indicate simple indirect effect. Sleep problems and stress were involved in all indirect effects. Effects are presented for both significant and nonsignificant pathways.

being more critical of family members in adulthood (Fitzgerald & Morgan, 2022) and this may lead to less frequent contact and less support (Kong et al., 2019; Kong & Moorman, 2016). In other words, adults who were maltreated in childhood may currently interact with family members based on the unresolved, historical wounds, which leads to more negative and less positive sequences of interaction between themselves and their family members that culminates in greater stress over time.

There are also significant systemic processes that may inform how childhood maltreatment influences current-day familial support and strain. Perpetration of maltreatment often occurs in families where there is low cohesion, unsupportive relationships, high conflict, and other forms of violence (Stith et al., 2009). The dysfunctional family structure may remain consistent over time (Antonucci et al., 2014; Wuest et al., 2010) and shape how family members communicate with each other. For example, family members who were abusive, neglectful, or knowledgeable that it occurred may continue to be hostile, involved, or abusive in adulthood. According to the BBFM, familial strain has been shown to influence stress-induced physiological responses such as activation of the HPA axis and subsequent inflammatory responses (Beckie, 2012; Priest et al., 2019). Integrating the BECAM and BBFM together, adults who were maltreated in childhood experience greater biological dysregulation (Danese et al., 2007; Miller et al., 2011) and contemporary family strain may elicit those same physiological reactions (Priest et al., 2019), which will increase levels of stress and ultimately affect adults' physical health (Beckie, 2012; Birmingham & Holt-Lunstad, 2018; Richardson et al., 2012).

An additional proposition of the BBFM is that attachment relationships and social support may attenuate psychological and physiological reactivity (Wood et al., 2000). We found evidence that familial support was negatively associated with perceptions of stress and indirectly linked maltreatment to physical health. Prior research has focused more on chains of disadvantage linking early adversity to health (e.g., Umberson et al., 2014) and spent less time considering areas of resilience. These findings are consistent with previous research documenting the important role of social support (see Wang et al., 2018 for review; Woods et al., 2014), including those with a history of family-perpetrated maltreatment (Kong et al., 2019). Additionally, research was advanced by documenting that current-day familial relationships may be important to consider when understanding the maltreatment–health link. More generally, social relationships shape health through behavioral guidance, self-esteem, and sense of belonging and "mattering." Such factors can increase effective coping where healthy coping reduces the effects of stress and increases health-promotive behavior (Senn et al., 2014; Thoits, 2011).

Regarding sleep, childhood maltreatment was associated with greater sleep problems which have significant implications for adult physical health (Gelaye et al., 2015). While results related to sleep being a mediator were expected (Greenfield et al., 2011; Hale et al., 2010), the serial indirect effects from family support and strain, however, were not significant. Although family strain was associated with more sleep disturbances, the effect was somewhat weak, and the indirect effect was not significant. One possible reason that familial support and strain were not identified as predictors of sleep disturbance may be due to the role of marital partners. Research has found that marital strain is linked to sleep issues among adults who were abused in childhood (Poon & Knight, 2011) and may influence participants' sleep through sleep characteristics (e.g., snoring) and relational characteristics (e.g., satisfaction; Chung, 2017). Sleep issues may arise from more proximal stressors

within the romantic relationships compared to external stressors from family members. For example, numerous marital events in middle adulthood may be a source of conflict between spouses including financial stress and parenting. Additionally, if there are stressors related to family members, the relationship between familial relationships to sleep problems may be attenuated via social support from marital partners or friends. Last, it may also be that stress links the relationship between familial support and strain to sleep problems (Aanes et al., 2011).

Limitations

Findings should be considered in light of the limitations. First, participants were predominantly White and middle-class adults, which limits the generalizability to other racial and socioeconomic groups. Second, reports of maltreatment were retrospective in nature. The use of prospective reports (e.g., Child Protective Services records) and multi-informants would strengthen conclusions. Relatedly, another limitation is the exclusive use of survey methods that can introduce systematic error. The use of observational data (e.g., conflict discussion task with family members) and clinical endpoints (e.g., C-reactive protein or heart rate variability) would be beneficial. Another limitation is that the current study was unable to examine some cross-lagged associations for sleep and stress. Additionally, it is also necessary to consider the proposed associations at varying time intervals in relation to onset and duration. The current study also operationalized physical health as a summation of the number of chronic health conditions endorsed by participants and doing so limits the ability to determine if there are effects on specific biological systems (e.g., endocrine). Future research should consider both the overall diagnoses of chronic health conditions as well as biomarkers associated with the affected biological system.

Conclusion

Results of the study indicate that familial relationships and their associations with stress are a critical factor linking childhood maltreatment to adult chronic health problems over time. Both familial support and strain appear to be particularly effective in reducing physical health by enhancing or reducing stress. Clinicians working with midlife adults may want to conduct conjoint educational and clinical services that include adult children and their parents, siblings, and other close familial relationships. Clinicians, however, should consult with clients and carefully evaluate whether the inclusion of the perpetrators of maltreatment in psychological treatment would be beneficial for their clients.

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