



Pathways linking childhood maltreatment and adult physical health[☆]

Meeyoung O. Min^{a,b,*}, Sonia Minnes^a, Hyunsoo Kim^a, Lynn T. Singer^b

^a Mandel School of Applied Social Sciences, Case Western Reserve University, Cleveland, OH, USA

^b Environmental Health Sciences and Department of Pediatrics, School of Medicine, Case Western Reserve University, Cleveland, OH, USA

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ABSTRACT

Objectives: This study examined whether a self-reported history of childhood maltreatment (physical, emotional, and sexual abuse and physical and emotional neglect) is related to poor adult physical health through health risk behaviors (obesity, substance dependence, and smoking), adverse life events, and psychological distress.

Methods: Two hundred and seventy nine (279) women aged 31–54, primarily poor, urban, and African American with a history of substance use during pregnancy, were assessed for perceived physical health status using the Health Status Questionnaire (SF-36) and any reported chronic medical condition. Hierarchical multiple and logistic regression were used to test mediation, as well as to assess relative contributions of multiple mediators on physical health.

Results: More than two-thirds ($n = 195$, 70%) of the sample reported at least 1 form of childhood maltreatment, with 42% ($n = 110$) having a lifetime history of substance dependence and 59% ($n = 162$) having a chronic medical condition. Controlling for age, education, and race, childhood maltreatment was related to increased likelihood of lifetime history of substance dependence ($OR = 1.19$, 95% $CI = 1.01–1.39$), more adverse life events ($\beta = .14$), and greater psychological distress ($\beta = .21$). Psychological distress and adverse life events partially mediated the relationship between childhood maltreatment and perceived physical health, accounting for 42% of the association between childhood maltreatment and perceived physical health. Adverse life events accounted for 25% of the association between childhood maltreatment and chronic medical condition.

Conclusions: Our findings provide additional evidence that the ill health effects associated with childhood maltreatment persist into adulthood. Adverse life events and psychological distress were key mechanisms shaping later physical health consequences associated with childhood maltreatment among relatively young urban women with a history of substance use.

Practice implications: Health care providers should be aware that childhood maltreatment contributes to adult health problems. Interventions aimed at preventing child maltreatment and addressing life stress and psychological distress will improve long-term physical health among abused children, adults with such histories, as well as children who are likely to be affected by maternal history of childhood maltreatment.

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* Corresponding author at: Mandel School of Applied Social Sciences, Case Western Reserve University, 11235 Bellflower Road, Cleveland, OH 44106-7164, USA.

Introduction

Child maltreatment is a serious public health problem, with nearly 3 million children or 1 child in every 25 in the United States affected in 2005–2006 (Sedlak et al., 2010). A recent community survey involving a large nationally representative sample reported that approximately 32% of girls aged 14–17 had experienced at least 1 form of maltreatment (Finkelhor, Turner, Ormrod, & Hamby, 2009). Several prevalence studies have estimated that between 26% and 32% of women have been sexually abused in the general female population (Briere & Elliott, 2003; Kendler et al., 2000; MacMillan et al., 2001).

A growing body of literature has documented associations between childhood maltreatment and poor physical health in adulthood in both population-based community samples and clinical samples (Goodwin & Stein, 2004; Greenfield, 2010; Wegman & Stetler, 2009). A history of childhood maltreatment is associated with higher rates of medical problems (Sachs-Ericsson, Blazer, Plant, & Arnow, 2005; Shaw & Krause, 2002), such as bronchitis and ulcers (Springer, 2009), liver disease (Dong, Dube, Felitti, Giles, & Anda, 2003), poor self-rated health (Bonomi, Cannon, Anderson, Rivarad, & Thompson, 2007; Thompson, Arias, Basile, & Desai, 2002), inflammation (Danese, Pariante, Caspi, Taylor, & Poulton, 2007), cardiovascular disease (Batten, Aslan, Maciejewski, & Mazure, 2004; Goodwin & Stein, 2004), chronic pain symptoms (Chartier, Walker, & Naimark, 2007; Davis, Luecken, & Zautra, 2005; Walsh, Jamieson, MacMillan, & Boyle, 2007), functional disability (Chartier et al., 2007), and, thus, higher health care utilization in adulthood (Chartier et al., 2007; Walker et al., 1999).

Findings from physiological research suggest that childhood maltreatment may adversely affect the volume and functionality of brain structures including the hippocampus, corpus collosum, and amygdala. Additionally, childhood maltreatment appears to alter neuroendocrinological mechanisms involved in mediating the stress response such as the hypothalamic–pituitary–adrenal axis (Nemeroff, 2004). These early changes predispose vulnerability for developing disorders and health problems in adulthood (Felitti et al., 1998; Hertzman, 1999). Yet, childhood maltreatment may also act indirectly as a catalyst for an array of behavioral, emotional, and social problems that are more proximal causes of morbidity in adulthood (Kendall-Tackett, 2002; Springer, 2009).

To date, only two studies (Chartier, Walker, & Naimark, 2009; Springer, 2009) have examined the specific mechanisms through which the experience of childhood maltreatment affect adult physical health, and there is limited understanding of the underlying mechanisms linking childhood maltreatment and adult health (Leserman, 2005; Whitaker, Lutzker, & Shelley, 2005). Further, previous studies have failed to assess the relative importance of different pathways that may be reciprocally interrelated over time. Given the pervasive effects of child maltreatment across multiple life domains, identifying salient intermediate variables that lie in the causal path between child maltreatment and adult physical health could provide critical points of intervention and, thus, improve prevention efforts aimed at reducing the lifelong burden of childhood maltreatment.

Life-course model and mediators linking childhood maltreatment to adult physical health

The life-course model provides a framework to understand the link between childhood maltreatment and later adult health by incorporating biological, behavioral and psychosocial pathways operating across an individual's life course in determining adult health (Ben-Shlomo & Kuh, 2002; Braveman & Barclay, 2009). From the life-course model, childhood maltreatment may be linked to adult health through behavioral strategies to cope with maltreatment (i.e., substance use), psychological responses (i.e., depression and anxiety), and subsequent secondary stressors that were triggered by childhood maltreatment (i.e., interpersonal problems; Pearlin, 1989; Springer, 2009), and these various behavioral, psychosocial factors influence health independently, cumulatively, and interactively (Ben-Shlomo & Kuh, 2002; Hertzman, 1999). Converging evidence from prospective and retrospective studies suggests that child maltreatment increases the risk of smoking (Chartier et al., 2009; Spratt et al., 2009), alcohol problems (Gilbert et al., 2009; Horwitz, Widom, McLaughlin, & White, 2001; Lown, Nayak, Korcha, & Greenfield, 2011) and illicit drug use (Min, Farkas, Minnes, & Singer, 2007; Widom, Marmostein, & White, 2006), all of which have been independently associated with poorer health outcomes (Hall & Degenhardt, 2009; Minnes et al., in press; Nolen-Hoeksema, 2004; Strandberg et al., 2008). Increased risk for developing obesity has also been linked with childhood sexual abuse (Chartier et al., 2009; Noll, Zeller, Trickett, & Putnam, 2007), physical abuse (Springer, 2009), and neglect (Lissau & Sorensen, 1994). Obesity is a well-known risk factor for poor health and has been related to multiple health problems, poor self-rated health, disability, high emergency department use, high use of health professionals (Chartier et al., 2009) and a variety of medical diagnoses (Springer, 2009).

Childhood maltreatment is also associated with increased exposure to adverse life events, including interpersonal difficulties (Cook et al., 2005), family instability (Collishaw, Dunn, O'Connor, Golding, & the ALSPAC Study Team, 2007), and revictimization (Arata, 2002), all of which contribute to additional ongoing life stress (Pearlin, Schieman, Fazio, & Meersman, 2005). Stress is responsible for the etiology and progression of disease and contributes to overall vulnerability to illness by producing a cascade of neuroendocrine, cardiovascular, and immunological changes (Baum & Posluszny, 1999; Kiecolt-Glazer, McGuire, Robles, & Glaser, 2002; McEwen, 1998). Few prior studies have examined how subsequent adverse life events and stressors shape the later physical health consequences of childhood maltreatment. Mental health is another possible pathway through which childhood maltreatment can cause adult health problems. Extensive studies have documented an association between childhood maltreatment and a wide range of psychological symptomatology (e.g., Callahan, Price, & Hilsenroth, 2003; Min et al., 2007) and psychiatric disorders (e.g., Bryer, Nelson, Miller & Krol, 1987; Horwitz et al., 2001; Kendler et al., 2000). Population-based studies reported that depressive symptoms (Springer, 2009) and lifetime occurrence

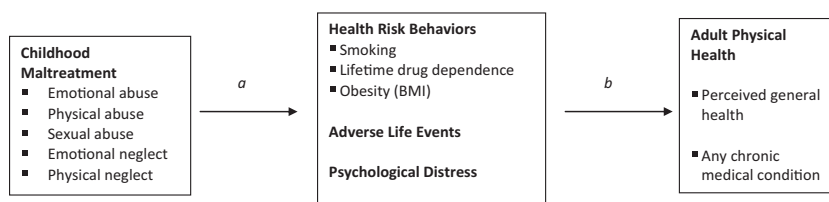


Fig. 1. Hypothesized model of the impact of childhood maltreatment on adult physical health mediated by health risk behaviors, adverse life events, and psychological distress.

of psychiatric disorders (Chartier et al., 2009; Sachs-Ericsson et al., 2005) substantially explained the effects of childhood maltreatment on various indicators of adult physical health. A review by Kiecolt-Glazer et al. (2002) suggested distress-related immune dysregulation as one core biological mechanism explaining health risks associated with negative emotions.

The present study

The purpose of the current study is to examine whether health risk behaviors (obesity, drug dependence, and smoking), adverse life events, and psychological distress explain the link between childhood maltreatment and poor adult health (Fig. 1). Using a community-based sample of minority women with low socio-economic status (SES) and substance use history, our study allows investigation of life-course pathways in an understudied population, complementing previous population-based studies (Chartier et al., 2009; Springer, 2009). Incidence of child maltreatment has been documented to be greater in this low SES, substance using population of women (Kubiak, 2005). In the context of low SES and coincident stressors, long term consequences may be greater as well. By applying the life course model to this more traumatized yet underserved group of women, our study will attempt to identify the salient factors unique to this population which can then be used to develop targeted interventions. In a prior study (Min et al., 2007), we demonstrated that childhood maltreatment was a common correlate explaining the association between psychological distress and substance use in adulthood. We hypothesized that women with more severe childhood maltreatment would be prone to morbid obesity, excessive tobacco use, substance dependence, subjected to more adverse life events, and experience higher levels of psychological distress, with these factors compromising their physical health. We also explored the relative contribution of multiple mediators on physical health, since health risk behaviors, adverse life events, and mental health problems may be reciprocally interrelated over time.

Methods

Participants & procedure

This study included 279 women drawn from a cohort recruited at childbirth from a large, urban, county, teaching hospital between September 1994 and June 1996. They were participants in a longitudinal prospective study examining the effects of prenatal cocaine exposure on child development (Singer et al., 2004). Pregnant women considered to be high risk for drug use due to lack of prenatal care, behavior suggesting intoxication, history of involvement with the Department of Human Services, or self-admitted drug use, were given drug toxicology screenings at infant birth. Women with a psychiatric history, low intellectual functioning, HIV-positive status, or chronic medical illness were excluded. A total of 404 birth mothers and their newborns were enrolled at birth. Childhood maltreatment was assessed once at 4 years post-partum for 302 birth mothers. Of the 302 women, only those women who also attended the 12 year post birth assessment were included, resulting in the current study sample of 279. Urine, infant meconium analyses or self-report indicated 244 (87%) women used at least 1 substance during pregnancy; 135 (48%) used cocaine; 199 (71%) cigarettes; 182 (65%) alcohol; 73 (26%) marijuana; and 184 (66%) used 2 or more substances during pregnancy. The 279 participants were more likely to be African American (84% vs. 73%, $p = .01$) and were less likely to use cocaine during pregnancy (48% vs. 60%, $p = .03$) compared to the 125 women who were not included. No other socio-demographic and drug use differences were found.

Women and their children were seen at the research laboratory for approximately 5 h at each follow-up visit. Data in the present study were taken from interviews conducted when the children were 4, 6, 11, and 12 years of age. All participants were given a monetary stipend for participation, along with lunch and transportation costs. The Institutional Review Board of the participating hospital approved the study. Written, informed consent was obtained. A Certificate of Confidentiality (DA-98-91), exempting the study from legislative, judicial, or administrative attempts to obtain confidential information, was obtained from the Department of Health and Human Services.

Measures

Childhood maltreatment was assessed at the 4 year post-partum assessment using the Childhood Trauma Questionnaire (CTQ; Bernstein & Fink, 1998), a 28-item self-report inventory assessing maltreatment in 5 areas: emotional, physical and

Table 1
Medical condition checklist.^a

	<i>n</i>	%
Any chronic condition	162	58.91
Diabetes type I	3	1.09
Diabetes type II	17	6.18
Osteoarthritis	25	9.09
Fibromyalgia	2	0.73
Rheumatoid arthritis	8	2.91
Seizure	1	0.36
Thyroid disease	7	2.54
Gastrointestinal problems	19	6.91
Irritable bowel syndrome	6	2.18
Gastritis/colitis	5	1.82
Other gastrointestinal problems	8	2.91
Pulmonary diseases	56	20.36
Asthma	45	16.36
Chronic obstructive pulmonary disease	5	1.82
Other pulmonary disease	6	2.18
Liver disease	4	1.45
Kidney disease	1	0.36
Chronic pain syndromes	58	20.79
Stroke	4	1.43
Cancer	9	3.23
Active cancer	1	0.36
History of cancer	8	2.91
Cardiovascular diseases	75	26.88
Hyperlipidemia	24	8.73
Palpitations	2	0.73
Hypertension	64	23.27
Congestive heart failure	1	0.36
Arrhythmia	1	0.36
Myocardial infarction	1	0.36
Infectious diseases	13	4.66
Sexually transmitted disease	3	1.09
Hepatitis B	1	0.36
Hepatitis C	8	2.91
Other infectious disease	1	0.36

^a *n* = 275.

sexual abuse, and emotional and physical neglect. Items are rated on a 5-point scale according to their frequency of occurrence (1 = *never true* to 5 = *very often true*), and summed to yield a total score for each maltreatment type, ranging from 5 to 25, with higher scores indicating greater severity. The reliability coefficients (α) ranged from .69 on physical neglect to .94 on sexual abuse. Since CTQ subscales were substantially inter-correlated with each other (e.g., $r = .74$ between physical abuse and emotional abuse, $r = .52$ between sexual abuse and emotional abuse), we categorized respondents as “maltreated” or “not maltreated” on each of the five CTQ scales based on threshold scores reflecting moderate to severe levels of maltreatment (Walker et al., 1999): ≥ 10 for emotional abuse, ≥ 8 for physical abuse, ≥ 8 for sexual abuse, ≥ 15 for emotional neglect, and ≥ 8 for physical neglect. A maltreatment summary score was computed by adding the number of subscales for which threshold was exceeded, producing a possible range of 0–5. This continuous score captures the cumulative effects of multiple forms of maltreatment.

Physical health status (PHS) was measured at the 12 year assessment using 2 indicators: physical component summary score (PCS) from the Short Form 36 Health Survey (SF-36; Ware, 2000; Ware, Kosinski, & Dewey, 2000) and any chronic medical condition obtained from a checklist of major medical conditions developed by this study based on a review of the health outcome literature. The SF-36 is a widely used 36-item self-report questionnaire assessing the respondent's physical and mental health in the last 4 weeks. Eight health domain scale scores (physical functioning, role limitation due to physical problems, bodily pain, general health perceptions, vitality, social functioning, role limitation due to emotional problems, and general mental health) and a separate physical (PCS) and mental health summary (MCS) scores are obtained. Strong psychometric properties have been reported with evidence for high reliability ($\alpha > .90$) as well as significant evidence of content, concurrent, criterion, construct and predictive validity (Ware, 2000; Ware et al., 1993). Each subscale and summary score ranges from 0 to 100, with higher scores indicating better health based on population norms (mean of 50 and standard deviation of 10).

The medical condition checklist (see Table 1) was completed by the maternal interviewer to ensure respondent comprehension. Respondents were asked if they had any of the listed medical conditions. Respondents were coded 0 (no) or 1 (yes) for each health problem, and any chronic condition reported was coded 1 (yes).

Obesity was assessed using Body Mass Index (BMI; weight (kg)/height (m)²). Height and weight were self-reported at the 12 year assessment. Obesity was defined as BMI ≥ 30 as recommended by the Centers for Disease Control and Prevention (CDC).

Lifetime history of substance dependence was assessed at the 6 year assessment using the Diagnostic Interview Schedule-Computer version (DIS-C; Jensen & Edelbrock, 1999), a structured interview based on the criteria in the *Diagnostic and Statistical Manual of Mental Disorders, Revised Fourth Edition* (American Psychiatric Association, 1994). Lifetime history of drug dependence was coded 1 (yes) if participants met DSM-IV criteria for lifetime alcohol, cocaine, or marijuana dependence. Current tobacco use was assessed at the 12 year assessment using the Maternal Post-Partum Interview and Update (Singer et al., 2004). Frequency and number of cigarettes were collected to compute a summary score indicating the average number of cigarettes smoked per day.

Life stress was assessed at the 11 year assessment using the Family Inventory of Life Events and Changes (FILE; McCubbin, Patterson, & Wilson, 1991), a self-report checklist assessing potentially adverse life events such as intra-family strains (e.g., family member having emotional problems), marital strains (e.g., divorce, affair), pregnancy and childbearing strains (e.g., unwanted pregnancy, abortion), finance strains (e.g., went on welfare), work-family transitions and strains (e.g., losing a job), illness and family care strains (parent/spouse/child became seriously ill and disabled), losses (e.g., death), and family legal violations (e.g., family member went to jail; arrested) in the past 12 months (71 questions) and prior to the past 12 months (34 questions). A count of the number of adverse life events endorsed by respondents was used as an index of life stress. The numbers of recent adverse life events (i.e., life event in the past 12 month) and distal adverse life events were substantially correlated ($r = .68$) in this sample. Distal life stress was used in multivariate analyses to secure a temporal relationship.

Psychological distress was measured at the 12 year assessment with the Brief Symptom Inventory (BSI; Derogatis, 1992), a 53-item self-report questionnaire assessing the experience of nine primary psychiatric symptoms: somatic complaints, obsessive-compulsive behavior, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. Items were rated on a 5-point scale (0 = not at all to 4 = extremely) with higher scores indicating greater distress. The global severity index (GSI), the average rating of all 53 items, was used to measure psychological distress. Scores > 90th percentile ($\geq .78$) indicate the borderline/clinical range. The ($\alpha = .95$).

Data analysis

Data that were positively skewed were normalized using a log transformation (GSI and current smoking) or square root transformation (FILE) prior to analyses. Means and standard deviations (SD) were reported by the variables' original distribution, with transformations used in analyses. Dichotomized variables (i.e., GSI and BMI) were used for descriptive purposes, while the continuous forms were used in analyses. Zero-order Pearson correlations were estimated to examine relationships between study variables. Age, education, and race were used as covariates since they were correlated ($p < .10$) with childhood maltreatment and/or health outcomes.

Mediation was tested by examining the joint significance of paths leading to and from the mediating variables (BMI, lifetime history of drug dependence, current smoking, adverse life events, and psychological distress in this study) as recommended by MacKinnon, Lockwood, Hoffman, West, and Sheets (2002), since the traditional method of testing mediation (Baron & Kenny, 1986) has been shown to increase Type II error and does not extend to incorporate multiple mediators. MacKinnon's approach has three steps, beginning with the analysis of the association between the independent variable and the hypothesized mediator (path *a*). If path *a* is significant, association between the mediator and the dependent variable is tested, adjusting for the independent variable (path *b*). If path *b* is also significant, the last step is to compute the joint significance of the paths (*ab*). Since the distribution of the test statistic is not expected to be normal, asymmetric confidence intervals (CI) for the mediated effect (*ab*) were tested using the PRODCLIN program (MacKinnon, Fritz, Williams, & Lockwood, 2007). Mediated effects are statistically significant when CI do not contain zero. Hierarchical ordinary least square (OLS) and logistic regression analyses were used to test mediation, as well as to assess relative contribution of multiple mediators on physical health. Multicollinearity was assessed using tolerance and variance inflation factor (Allison, 1999). We also calculated percentage reduction in the strength of child maltreatment on health due to mediators using the following formula:

- (1) $(1 - (\text{unstandardized regression coefficient in mediated model} / \text{unstandardized regression coefficient in base model})) \times 100$ for OLS regression;
- (2) $(\text{Odds ratio (OR) of base model} - \text{OR of mediated model} / \text{OR of base model} - 1) \times 100$ for logistic regression (Chartier et al., 2009).

Results

Sample characteristics

Participants for the current study were 279 women who were primarily African American ($n = 233$, 84%) and of low SES ($n = 272$, 98%), measured by the Hollingshead classification IV and V (Hollingshead, 1957). Thirty-nine percent of the sample ($n = 108$) had not finished high school, with a mean of 11.8 years of education ($SD = 1.5$). At the 12 year follow-up, the age ranged from 31 to 54 with a mean age of 40.3 years ($SD = 5.3$); only a quarter of the sample ($n = 67$) were married; half ($n = 131$) were employed; and more than a quarter of the sample ($n = 73$) lost child custody.

Table 2
Descriptive statistics and correlations among study variables ($N = 279$).

	1	2	3	4	5	6	7	8	9	10	11
Childhood maltreatment	–	.09	–.22	–.11	.07	.19	.19	.27	.14	–.24	.11
Age		–	.10	.11	–.03	.29	.12	.09	–.09	–.26	.13
Education			–	.08	<.01	–.15	–.24	–.19	–.14	.13	–.02
Race, African American				–	.08	.05	–.19	–.10	.06	.07	–.002
BMI					–	–.02	–.09	.09	.09	–.26	.18
Lifetime drug dependence						–	.33	.26	.12	–.16	.02
Current smoking per day							–	.30	.06	–.19	–.03
Psychological distress								–	.37	–.42	.15
Adverse life events									–	–.22	.18
Perceived physical health										–	–.28
Chronic medical condition											–
<i>M</i>	1.9	40.3	11.8	–	31.1	–	6.27	0.45	3.3	46.9	–
<i>SD</i>	1.7	5.3	1.5	–	8.7	–	7.94	0.54	4.3	10.7	–
%	–	–	–	83.5	–	42.3	–	–	–	–	58.9

Note: $p < .10$ when $r \geq |.10|$; $p < .05$ when $r \geq |.12|$; $p < .01$ when $r \geq |.16|$.

Childhood maltreatment was prevalent among these women. About one-third (32%, $n = 88$) reported a history of sexual abuse; 45% ($n = 125$) physical abuse; 37% ($n = 103$) emotional abuse; 30% ($n = 85$) emotional neglect; and 45% ($n = 125$) physical neglect. More than two-thirds (70%, $n = 195$) reported at least 1 form of childhood maltreatment; about half ($n = 139$) more than 1 form of maltreatment; and 12% ($n = 33$) all 5 forms of childhood maltreatment. About half (48%, $n = 130$) were obese ($BMI \geq 30$). Forty-two percent (42%) of the sample ($n = 110$) were determined to have a lifetime history of alcohol (26%), marijuana (15%), or cocaine dependence (35%), and 57% ($n = 159$) reported being current smokers. On average, respondents reported 3.3 ($SD = 4.3$) distal adverse life events and 10 ($SD = 8.2$) recent (i.e., within 1 year) adverse life events. About one-fifth of the sample (19%, $n = 52$) scored above the borderline/clinical cut-point on the GSI at the 12 year postpartum assessment, with a mean of .45 ($SD = .54$). More than half (59%, $n = 162$) reported having a chronic medical condition, with 23% reporting hypertension problems and 21% reporting chronic pain syndromes (Table 1). The reported mean physical health status measured by the SF-36 (46.9) was about half a SD below the standardized mean for their age and gender (51.56, Ware et al., 2000, p. 80). Means, standard deviations, and zero-order Pearson correlations for study variables are presented in Table 2.

Mediated associations between childhood maltreatment and adult physical health

Table 3 presents results of OLS regression analyses testing the effects of childhood maltreatment on hypothesized mediators (path *a*). After controlling for age, education, and race, childhood maltreatment was related to a likelihood of lifetime drug dependence ($OR = 1.19$, 95% $CI = 1.01$ – 1.39 , $p = .03$), more adverse life events ($b = .08$, $se = .04$, $p = .02$), and greater psychological distress ($b = .10$, $se = .03$, $p = .0004$). However, no relationship was found between childhood maltreatment and BMI ($b = .41$, $se = .31$, $p = .19$) or current smoking ($b = .008$, $se = .04$, $p = .07$). Thus, we did not proceed with further testing of BMI or current smoking as mediators.

Table 4 presents results of hierarchical OLS regression analyses testing the effects of mediators on perceived physical health (PCS) measured by the SF-36 after controlling for childhood maltreatment and covariates (path *b*). Model 1 is a base model without any mediators. Childhood maltreatment was related to poorer perceived physical health after controlling for age, education and race ($b = -1.24$, $se = .36$, $p = .0006$). Each type of childhood maltreatment decreased 1.24 PCS scores after controlling for covariates. Models 2, 3, and 4 tested each mediator separately. Lifetime drug dependence was not related to perceived physical health, and, thus, was not a mediator (Model 2). More adverse life events (Model 3) was related to poorer perceived physical health ($b = -2.06$, $se = .58$, $p = .0004$), demonstrating a significant mediated effect (*ab*) of childhood maltreatment on perceived physical health ($.083 \times -2.06 = -.17$, 95% $CI = -.37$ to $-.02$). Greater psychological distress (Model 4) was also related to poorer perceived physical health ($b = -4.70$, $se = .69$, $p < .0001$), demonstrating a significant mediated effect of childhood maltreatment on perceived physical health ($.104 \times -4.70 = -.49$, 95% $CI = -.81$ to $-.21$). The full model (Model 5) included all significant mediators (adverse life events and psychological distress) to assess the relative contribution of multiple mediators on perceived physical health. The effect of childhood maltreatment on physical health was partially mediated by adverse life events and psychological distress, although adverse life events did not seem to have an additional independent effect on perceived physical health. Approximately 42% [$1 - (-.72/-1.24) \times 100$] of the effects of child maltreatment on perceived physical health was attenuated by the two mediators; that is, psychological distress and life stress accounted for 42% of the association between childhood maltreatment and perceived physical health.

Table 5 presents results of hierarchical logistic regression analyses testing the effects of mediators on chronic medical condition after controlling for childhood maltreatment and covariates (path *b*). Childhood maltreatment was not related to the likelihood of having a chronic medical condition ($OR = 1.12$, 95% $CI = .97$ – 1.30 , $p = .14$), as indicated in Model 1. However, when lifetime drug dependence was entered in Model 2, childhood maltreatment became significant ($OR = 1.18$, 95% $CI = 1.01$ – 1.38 , $p = .04$) indicating lifetime drug dependence suppressed the effects of childhood maltreatment on the likelihood of reporting a chronic medical condition (MacKinnon et al., 2007). Each additional adverse life event (Model 3) increased the likelihood of

Table 3
Impact of childhood maltreatment on health risk behaviors and psychosocial stress.

	BMI		Lifetime drug dependence		Amount of current smoking		Adverse life events		Psychological distress	
	<i>b</i> (se)	β	OR	95% CI	<i>b</i> (se)	β	<i>b</i> (se)	β	<i>b</i> (se)	β
Childhood maltreatment	.41 (.31)	.08	1.19 [*]	1.01–1.39	.008 (.04) [^]	.11	.08 (.04) [*]	.14	.10 (.03) ^{***}	.21
Age	-.08 (.10)	-.05	1.13 ^{***}	1.07–1.20	.03 (.01) [^]	.14	-.02 (.01) [^]	-.11	.01 (.009)	.09
Education	.10 (.37)	.02	0.77 ^{**}	0.63–0.93	-.18 (.05) ^{***}	-.22	-.08 (.04) [^]	-.11	-.08 (.03) [*]	-.15
Race	2.11 (1.48)	.09	1.32	0.64–2.75	-.61 (.19) ^{**}	-.18	.26 (.17)	.09	-.18 (.13)	-.08

^{*} $p < .05$.

^{**} $p < .01$.

^{***} $p < .001$.

[^] $p < .10$.

Table 4
Hierarchical regression analyses of perceived physical health.

	Model 1		Testing each mediator separately						Full model	
			Model 2 (life time drug dependence as a mediator)		Model 3 (adverse life events as a mediator)		Model 4 (psychological distress as a mediator)		Model 5 (all significant mediators)	
	<i>b</i> (se)	β	<i>b</i> (se)	β	<i>b</i> (se)	β	<i>b</i> (se)	β	<i>b</i> (se)	β
Childhood maltreatment	−1.24 (.36) ^{***}	−.20	−1.38 (.38) ^{***}	−.22	−1.07 (.35) ^{**}	−.17	−.75 (.34) [*]	−.12	−.72 (.34) [*]	−.12
Age	−.49 (.11) ^{***}	−.25	−.45 (.12) ^{***}	−.22	−.54 (.11) ^{***}	−.27	−.43 (.11) ^{***}	−.21	−.45 (.11) ^{***}	−.23
Education	.85 (.41) [*]	.12	.89 (.45) [*]	.12	.70 (.41) [^]	.10	.46 (.39)	.06	.42 (.39)	.06
Race	−2.25 (1.64)	−.08	−2.27 (1.70)	−.08	−1.72 (1.61)	−.06	−3.09 (1.52) [*]	−.11	−2.81 (1.53) [^]	−.10
Lifetime drug dependence			−.70 (1.35)	−.03						
Adverse life events					−2.06 (.58) ^{***}	−.20			−.83 (.59)	−.08
Psychological distress							−4.70 (.69) ^{***}	−.37	−4.31 (.74) ^{***}	−.34
<i>R</i> ²	.14		.15		.18		.26		.27	

^{*} *p* < .05.

^{**} *p* < .01.

^{***} *p* < .001.

[^] *p* < .10.

Table 5
Logistic hierarchical regression analyses of chronic medical condition.

	Model 1		Testing each mediator separately					
			Model 2 (life time drug dependence as a mediator)		Model 3 ^a (adverse life events as a mediator)		Model 4 (psychological distress as a mediator)	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Childhood maltreatment	1.12	.965–1.297	1.18 [*]	1.006–1.378	1.09	.935–1.266	1.09	.933–1.263
Age	1.05 [^]	1.002–1.103	1.07 [*]	1.010–1.123	1.07 [*]	1.014–1.119	1.05 [^]	.999–1.100
Education	.99	.832–1.166	.99	.825–1.187	1.02	.857–1.215	1.01	.851–1.204
Race	.96	.489–1.883	1.004	.497–2.028	.83	.415–1.651	1.00	.504–1.971
Lifetime drug dependence			.77	.440–1.346				
Adverse life events					1.54 ^{**}	1.178–2.019		
Psychological distress							1.35 [^]	.992–1.848
<i>Pseudo R</i> ²		.04		.06		.09		.05

^a Also, final model.

^{*} $p < .05$.

^{**} $p < .01$.

[^] $p < .10$.

reporting a chronic medical condition by 54% (OR = 1.54, 95% CI = 1.18–2.02, $p = .002$), with a significant mediated effect (95% CI = .004–.080). Psychological distress (Model 4) was not related to the likelihood of reporting a chronic medical condition (OR = 1.35, 95% CI = .99–1.85, $p = .057$), and did not mediate the effect of childhood maltreatment. Thus, only adverse life events met the qualification of being a mediator; Model 3 was also the final model for chronic medical condition. Approximately 25% $[(1.12 - 1.09)/(1.12 - 1) \times 100]$ of the effects of child maltreatment on chronic medical condition was accounted for by adverse life events.

Discussion

The present study examined multiple pathways underlying the relationship between childhood maltreatment and adult physical health in low SES, primarily African-American, relatively young urban women with a history of substance use. Guided by the life-course model, various indicators of health risk behaviors (BMI, lifetime history of drug dependence, current smoking) and psychosocial stress (adverse life events and psychological distress) were examined separately and simultaneously. Our results suggest that adverse life events and psychological distress are pathways of childhood maltreatment when physical health was operationalized as perceived overall health, while adverse life events is a pathway when physical health was operationalized as the presence of any chronic medical condition. None of the health risk behaviors emerged as mediators linking childhood maltreatment and physical health in this sample.

Our study demonstrated that adverse life events may be a key mechanism shaping later physical health consequences of childhood maltreatment among inner-city women with a history of substance use. Distal and recent life events were highly correlated among our respondents, suggesting chronicity of life stress throughout the life course. Further, adverse life events was moderately correlated with psychological distress ($r = .37$, Table 1), raising the question of how these mediators might interact with one another. For example, adverse life events may increase psychological distress, and increased psychological distress may elevate the risk of experiencing subsequent life stressors such as unwanted pregnancy, divorce, and unemployment, which affects physical health. Horwitz et al. (2001) demonstrated in a prospective study that the relationship of childhood maltreatment to adult mental health disappeared once adverse life events were taken into account, suggesting life stress as a mediator between childhood maltreatment and adult mental health. The present study demonstrated that adverse life events are also related to physical health. Future studies specifying relationships among adverse life events, psychological distress, and physical health will further clarify empirical understanding of the underlying mechanisms linking childhood maltreatment to adult physical health.

Consistent with previous studies (Chartier et al., 2009; Sachs-Ericsson et al., 2005; Springer, 2009), greater psychological distress partially mediated the effects of childhood maltreatment on poor general physical health. However, when physical health was operationalized as a presence of any chronic medical condition, psychological distress was not a mediator, suggesting different sensitivity of different mediators to different indicators of physical health.

Contrary to other studies that utilized population-based samples (Chartier et al., 2009; Springer, 2009), none of the health risk behaviors emerged as mediators in our study. Our sample was recruited due to a high risk for drug use during pregnancy, representing a vast majority of women with a lifetime history of substance use. This particular sample characteristic may have failed to provide some variability in health behaviors examined. Meanwhile, the participants' relatively young age may limit the effects of health behaviors on current physical health status, which may have more pronounced effects as they age. Further, lifetime drug dependence diagnosis seems related to a lower likelihood of having any chronic medical condition in this sample. Given that chronic medical condition was collected via self-report ("do you have any of the following conditions: . . ."), this inverse relationship may indicate that women with lifetime drug dependence may not seek or receive the adequate medical attention that they need. When lifetime drug dependence entered the regression, childhood maltreatment increased the likelihood of having a medical condition, uncovering the impact of childhood maltreatment on physical health.

Several limitations in our study should be noted. First, the validity of an adult retrospective self-report measure of childhood trauma may be compromised by fallibility of memory. Although a comprehensive review by Hardt and Rutter (2004) argued that retrospective reports are sufficiently valid to be used for research purposes and that under-reporting is more common than over-reporting, lack of explicit details of the maltreatment (duration, age at which abuse first occurred, relationship to perpetrator) may not fully capture the experience of childhood maltreatment and its effect on subsequent mediators and on physical health. Further, substantial correlations among different forms of childhood maltreatment in our sample precluded the examination of the unique risk profiles and trajectories that may arise from each form of child maltreatment and as such dictated the examination of its overall, generic effect. Second, by relying on self-reported diagnoses without actual physical assessment by a health care provider, the physical health measure (any chronic condition) might be confounded with access to health care. Also, the measurement of current smoking was by self-report only, which might be subject to social desirability bias. Third, childhood maltreatment increases risk for adult revictimization (Arata, 2002), which may further undermine physical health by affecting mediators examined in this study (risky health behaviors, adverse life events, and psychological distress). Although our study did not have a direct measure of adult revictimization, number of adverse life events assessed as a mediator in the present study may capture some aspects of stressful events and disruption across the lifespan. Fourth, a causal link between childhood maltreatment and adverse life events cannot be established in

our study. Child maltreatment can be a marker of other pre-existing life stressors including family dysfunction (Belsky, 1993), which may account for both childhood maltreatment and subsequent adverse life events. Finally, the sample composition and screening criteria limit the generalizability of the findings to high risk, African American, relatively young, urban women of low SES with a history of substance use.

Despite these limitations, the present study has significant strengths. Our measurement of childhood maltreatment included cumulative, multiple types of childhood maltreatment, improving upon previous investigations that assessed limited aspects of maltreatment such as physical abuse only (Shaw & Krause, 2002; Springer, 2009) or physical and sexual abuse only (Chartier et al., 2009) despite that multiple forms of maltreatment are likely to co-occur. Several mediators representing multiple domains and physical health indicators across different dimensions (perceived health and medical condition) were carefully evaluated. The longitudinal nature of our data increased the internal validity of the study. Our sample characteristics allowed investigation of life-course pathways in an understudied population of minority women with low SES and substance use history, complementing population-based studies (Chartier et al., 2009; Springer, 2009). Adverse life events were identified as an important pathway through which childhood maltreatment influences adult physical health, which has been neglected from previous studies.

Implications

The present study provides additional evidence for the ill health effects of childhood maltreatment persisting into adulthood through adverse life events and psychological distress. Greater awareness among healthcare providers of childhood maltreatment as a potential contributor to health problems (Greenfield, 2010), especially among women living in an urban low income community, will lead to a more optimized and personalized treatment. Our study also demonstrated that childhood maltreatment may contribute to a vicious cycle of adverse life events that cannot be easily targeted by a single public health intervention, reinforcing the importance of multifaceted child maltreatment prevention efforts. Given the women's central role as the primary caregiver in fostering the emotional and cognitive development of their offspring, their children are also subject to a range of adverse life events, which may threaten optimal child development (Collishaw et al., 2007; Min, Singer, Minnes, Kim, & Short, in press). Interventions aimed at preventing and reducing child maltreatment and addressing adverse life events and psychological distress will improve long-term physical health among abused children, adults with such histories, and their children who are likely to be affected by maternal history of childhood maltreatment.

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