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Exploratory analysis of mediators of the relationship between childhood maltreatment and suicidal behavior

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ABSTRACT

Introduction: Suicide is a major public health concern. One consistently cited risk factor for suicide is childhood maltreatment, which also may play a role in the transition from suicidal ideation to suicidal behavior.

Method: The current study aimed to examine the relationship between childhood maltreatment and suicide attempts during adolescence (N = 4834; 52.1% female; 67.5% Caucasian). Data from the U.S. National Longitudinal Study of Adolescent Health were utilized. Forty-six theoretically-relevant risk factors were explored as potential mediators of this relationship using an exploratory mediation data analytic method.

Results: Results demonstrated a significant childhood maltreatment - suicide attempt relationship only among females. After considering demographics and suicidal ideation, having received counseling in the previous 12 months was the most influential mediator, followed by having a friend attempt suicide in the previous 12 months.

Conclusions: These findings highlight potential gender differences in the relationship between childhood maltreatment and later suicide attempts, and, moreover, the importance of assessing for recent exposure to peer suicidal behavior in suicide risk assessments.

1. Introduction

Suicide is a major public health problem. It is the second-leading cause of death among 15–25 year olds within the United States (US), with approximately 5500 individuals aged 10–24 dying by suicide each year (Center for Disease Control [CDC], 2014). Furthermore, it is believed that for every suicide in this age group, there are between 100 and 200 suicide attempts (SAs) (Goldsmith, Pellmar, Kleinman, & Bunney, 2002). Recent statistics also have suggested that these rates may be increasing: from 1999 to 2016, rates increased between 6 and 57% across all states within the US, with 25 states having at least a 30% rate increase (CDC, 2018). This highlights the need for further examination of SAs during this developmental period, because SAs not only have potential detrimental consequences, but also are related to several prospective negative outcomes. For example, SAs during adolescence are predictive of later psychopathology, poorer adjustment, risky sex, and psychiatric treatment in adulthood (Brière et al., 2014). As such, a rich literature has focused on identifying risk factors for suicidal behavior among adolescents.

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One important risk factor for suicidal behavior is the experience of childhood maltreatment (CM). Unfortunately, CM is widespread (e.g., an estimated 3.2 million children were investigated for suspected maltreatment; U.S. Department of Health & Human Services, 2016), and the presence of CM is associated with increased odds of SA. Indeed, the experience of any CM has been found to account for a substantial proportion of variance in predicting SA presence: 50% among women and 33% among men (Afifi et al., 2008). Furthermore, CM was found to be cross-sectionally and longitudinally predictive of adolescent SAs in both psychiatric and community samples (Miller, Esposito-Smythers, Weismoore, & Renshaw, 2013; Neumann, Houskamp, Pollock, & Briere, 1996; Paolucci, Genuis, & Violato, 2001; Rind, Tromovitch, & Bauserman, 1998; Salzinger, Rosario, Feldman, & Ng-Mak, 2007). Importantly, CM has been found to be more common among individuals with SAs compared to those with only suicidal ideation (Burke, Ammerman, Knorr, Alloy, & McCloskey, 2017; May & Klonsky, 2016), suggesting it may have a significant role in acting on one's suicidal thoughts (Joiner, 2005; Klonsky & May 2015), and thus, represents an important area of inquiry to reduce suicidal behavior. The significant relationship between CM and SAs is in line with several theories of suicide, most notably the Interpersonal Psychological Theory of Suicide (IPTS; Joiner, 2005) and the Three-Step Theory of Suicide (3ST; Klonsky & May 2015). The IPTS suggests that suicidal ideation results from the interaction of thwarted belongingness and perceived burdensomeness, whereas the 3ST suggests that suicidal ideation results from the experience of psychological pain and hopelessness, and that a lack of connectedness can escalate suicidal ideation. These theories converge in suggesting that in addition to experiencing a desire for suicide (i.e., suicidal ideation), it is necessary for an individual to have acquired the capability to enact suicidal behavior, defined as having habituated to both the fear and pain necessary to enact lethal behavior (Joiner, 2005; Klonsky & May 2015). CM appears to play a powerful role in the etiology of suicidal behavior, likely through contributing to one's capability to engage in suicidal behavior (e.g., Ammerman et al., 2017; Nock & Kessler, 2006); however, many individuals exposed to CM do not attempt suicide, highlighting the need to better understand factors that may influence the relationship between CM and attempted suicide.

Research aimed at directly examining potential mediating factors of the CM-SA relationship (e.g., Sarchiapone et al., 2009) has been very limited. Given this, it may be helpful to consider theoretically and empirically important risk factors for SA that may constitute relevant underlying mechanisms between CM and SAs. Working within the previously discussed theoretical frameworks, and considering recent reviews of the literature (e.g., Bryan et al., 2015; Franklin et al., 2017; May & Klonsky, 2016; Victor & Klonsky, 2014), several factors may be particularly important to consider as potential underlying mechanisms of the CM – SA relationship. The IPTS and the 3ST theories of suicide both suggest interpersonal factors (e.g., quality of parent, peer, and school/community relationships, social support, isolation) as important in the development of suicidal ideation (Joiner, 2005; Klonsky & May 2015). Further, social support has been shown to have a significant relationship with CM (Messman-Moore & Coates, 2007), and CM may even be predictive of decreased social support (Vranceanu, Hobfoll, & Johnson, 2007), which highlights it as a potential underlying mechanism.

Beyond the direct occurrence of CM, this experience may contribute to capability for suicide by exposing an individual to other (emotionally and/or physically) painful events that may ultimately serve to reduce their fear of death or the pain involved in dying. For example, those who have experienced CM may be more likely to select friends with similar experiences (or emotional distress) or be more susceptible to the influence of peers (e.g., Jussim & Osgood, 1989). This may result in greater exposure to other's suicidal behaviors and/or general risk behaviors. Although understudied in relationship to CM, exposure to suicidal behaviors has been theoretically (Joiner, 2005; Klonsky & May 2015) and empirically (Maple, Cerel, Sanford, Pearce & Jordon, 2017) linked to SAs. Similarly, research suggests that CM has been linked to risky behavior engagement (e.g., substance use, risky sexual behaviors; Rodger, Lang, Laffaye, Satz, Dresselhaus, & Stein, 2004), which may be a product of one's social environment (e.g., Dishion & Tipsord, 2011; Prinstein, Boergers, & Sprito, 2001; Steinberg, 2007) or represent maladaptive coping strategies due to the experience of CM (Horwitz, Hill, & King, 2011; Kim, Beak, Han, Lee, & Yurgelun-Todd, 2015; Wilson et al., 1995). In turn, high levels of risk-taking behavior (e.g., increased alcohol use, promiscuous sex, violent and non-violent crimes) are associated with increased suicide risk (Pena, Matthieu, Zayas, Masyn, & Caine, 2012).

Recent reviews of the literature linking CM and SAs (e.g., Bryan et al., 2015; Franklin et al., 2017; May & Klonsky, 2016; Victor & Klonsky, 2014) suggest that CM may lead to subsequent psychopathologies, such as major depression and anxiety disorders (Kim & Cicchetti, 2010; Shaffer, Huston & Egeland, 2008; Teicher & Samson, 2013), which in turn may augment risk for SAs. Indeed, a large majority of individuals who attempt suicide meet criteria for mental health diagnosis (Nock et al., 2013). Taken together, a broad range of factors, including various forms of interpersonal factors, exposure to suicidal behaviors, engagement in risky behaviors, and increased psychopathology symptomatology all may constitute mechanisms underlying the relationship between CM and SAs.

A final factor in need of consideration is gender. Rates of SAs differ between genders, particularly in adolescence (e.g., Kessler, Borges, & Walters, 1999; Lewinsohn, Rhode, Seely, & Baldwin, 2001), and risk factors may differentially relate to suicide between genders. The relationship between alcohol use and SAs has been demonstrated as stronger among males (Groves, Stanley, & Sher, 2007; McManama et al., 2014; Wong, Zhou, Goebert, & Hishinuma, 2013). It is therefore possible that the relationship between CM and SAs may be influenced by gender. It was found that depression, hopelessness, and family dysfunction mediated the childhood sexual abuse – suicidality relationship among females more strongly than among males (Martin, Bergen, Richardson, Roeger, & Allison, 2004). Better understanding how gender impacts the pathway from maltreatment to suicidal behavior may inform the development of targeted prevention efforts among adolescents exposed to CM.

2. Current study

SAs peak in adolescence (CDC, 2014) and CM confers significant risk for adolescent suicide. However, less is known about what factors mediate this relationship during this developmental period and how this may vary as a function of gender. The current study

aimed to examine the relationship between CM and SAs among adolescents, including exploring a large set of theoretically-relevant risk factors for suicide as mediating factors in this relationship, via secondary data analysis of a publicly available dataset of adolescent health. Given the potential importance of numerous, wide ranging risk factors in the relationship between CM and SAs, it is necessary to simultaneously consider multiple variables in the relationship. Past research has been unable to accomplish this due to limitations in data analytic techniques; however, we accomplished this goal through the implementation of a new exploratory mediation technique, *exploratory mediation analysis* via *regularization* (XMed; Serang, Jacobucci, Brimhall, & Grimm, 2017). This technique allows for all potentially mediating factors to be examined in the model simultaneously, and through the selection of the most important mediators, permits a better understanding of the CM – SA relationship. This technique also allowed us to adjust for covariates. Specifically, given that suicidal ideation is a significant risk factor for suicidal behavior (Nock et al., 2009), we adjusted for its presence, in addition to other demographic factors, at baseline in order to better ascertain the impact of the proposed mediators. Given the exploratory nature of these analyses, in addition to the number and array of potential mediating factors to be considered in analysis, no specific hypotheses were generated. Findings from the present study have the potential to provide practical information about how to mitigate suicide risk among adolescents who have experienced CM through the identification of mediating (modifiable) risk factors to be targeted in intervention and prevention efforts.

3. Method

3.1. Sample

Data for the present analyses come from the National Longitudinal Study of Adolescent Health (Add Health; Harris et al., 2009), comprising 7th-12th grade adolescents from 134 U.S. schools. Although other researchers have used this rich dataset to examine the relationship between early life adversity and suicide-related outcomes (e.g., Fried, Williams, Cabral, & Hacker, 2013), the current study is unique in its examination of mediators of this well-established relationship. The study design consisted of three different waves; the present analyses utilized data from Wave I, Wave II, and Wave III. The first wave (Wave I) was conducted in 1995 and was completed by 20,745 students. From Wave I, 14,738 students completed the second wave (Wave II) in 1996. The third wave (Wave III) was completed in 2001 and 2002 and consisted of 15,170 respondents from Wave I. Only participants who completed all three waves and had an observed score on the dependent variable were included in the current analyses, resulting in a final sample of 4834 participants. In the final sample, participants' ages at Wave I ranged from 11 to 21 years old (M age = 15.15, SD = 1.60; 52.1% female). The majority of the sample identified as Caucasian (67.5%), followed by African American (23.8%), Asian (4.0%), American Indian (3.8%), and "other" (6.3%; participants were allowed to identify with more than one race). Approximately 12% of the sample identified as Hispanic. There were significantly more females in the current sample as compared to the overall Wave I sample, χ^2 (1) = 20.31, $p < .001$. There were no differences between groups in the rate of SAs at Wave II, χ^2 (1) = 1.09, $p = .30$.

3.2. Items from Add Health

3.2.1. Independent variable: childhood maltreatment

Four items were used to assess several aspects of CM that occurred prior to the 6th grade as perpetrated by parents or other adult care-givers: neglect (e.g., "left you home alone when an adult should have been with you"; "not taken care of your basic needs, such as keeping you clean or providing food or clothing"); physical abuse (e.g., "slapped, hit, or kicked you"), and sexual abuse (e.g., "touched you in a sexual way, forced you to touch him or her in a sexual way, or forced you to have sexual relations"). All items were coded on a 6-point Likert scale, where 0 = *Never,* 1 = *One time,* 2 = *Two times,* 3 = *3–5 times,* 4 = *6–10 times,* 5 = *More than 10 times.* These items were asked at Wave III; however, they assessed only those experiences that happened "before the 6th grade", capturing only CM that occurred prior to the baseline (Wave I) assessment. Descriptive statistics for individual items were: neglect-home alone, $M = 1.03$, $SD = 1.57$, 27.6% reported at least one event, 19.2% reported two or more events, 7.1% reported more than five events; neglect-without basic needs, $M = .28$, $SD = .97$, 7.6% reported at least one event, 4.7% reported two or more events, 2.5% reported more than five events; physical abuse, $M = .74$, $SD = 1.45$,19.1% reported at least one event, 13.8% reported two or more events, 5.8% reported more than five events; sexual abuse, $M = .09$, $SD = .54$, 2.9% reported at least one event, 1.3% reported 2 or more events, 0.6% reported five or more events. Given the lack of variability on individual items, and precedent of utilizing a combined CM score (e.g., Childhood Trauma Questionnaire total score; Bernstein et al., 2003; Lang et al., 2008), a factor score was created using all four items and this factor score served as the independent variable in the model.

3.2.2. Covariates

3.2.2.1. Demographics. Seven individual items assessing demographic variables were included as covariates. These items included race (five items; i.e., Caucasian, Black/African American, American Indian, Asian, and "Other"), ethnicity (one item; i.e., Hispanic), and sexual orientation (one time; i.e., same-sex sexual relationship). All items were coded as binary.

3.2.2.2. Suicidal ideation. One binary item assessed the presence of suicidal ideation at Wave I (e.g., "did you ever seriously think about committing suicide?") in the past 12 months.

3.2.3. Mediators

3.2.3.1. Mental health services. Two individual items assessed use of mental health services in the previous 12 months, one specific to

"psychological or emotional counseling" and the other to a "drug abuse or alcohol abuse treatment program." These items were coded as binary. These items were assessed at Wave I.

3.2.3.2. Parent relationships. Six individual items assessed parental relationships at Wave I. Participants were asked how close they felt to each parent, how much they thought each parent cared about them, and how satisfied they were with their relationship with each parent, resulting in three questions specific to their mother relationship and three questions specific to their father relationship. Items were answered on a 5-point Likert scale with higher scores indicating a more positive relationship.

3.2.3.3. School factors. Five individual items assessed school environment at Wave I. Four of these items assessed subjective school experiences, asking participants how close they felt to people at school, how much they felt like their teacher cared about them, how much they felt part of school, and how safe they felt at school. These items were answered on a 5-point Likert scale with higher scores indicating a more positive experience. One item asked participants if they learned about safety at home, school, or play while in a class at school, which was coded as binary.

3.2.3.4. Religion. Three individual items assessed religious beliefs and involvement at Wave I. These items included asking how important religion was to them, how often they attended religious services in the previous 12 months, and how often they attended youth religious services in the previous 12 months. These items were answered on a 4-point Likert scale, with higher scores indicating greater religious involvement.

3.2.3.5. Peer relationships. Two individual items assessed peer relationships at Wave I by asking how much the participant felt like their friends cared about them and how socially accepted they felt. These items were answered on a 5-point Likert scale, with higher scores indicating greater peer support.

3.2.3.6. Mood and health. Ten individual items assessed participants' health behaviors and mood, and potential consequences at Wave I. Two items asked about participants' health, with one asking how their health was in general (5-point Likert scale) and the other assessing if they usually got enough sleep (binary). Six items assessed participants' physical and mental health over the past 12 months, including: trouble falling/staying asleep, poor appetite, trouble relaxing, moodiness, frequent crying, and feeling tired for no reason. Two items assessed how often emotional or health problems caused them to miss school or a social/recreational activity during the past 12 months. These items were answered on a 5-point Likert scale where a higher score indicated poorer physical and mental health and more associated consequences.

3.2.3.7. Self-esteem. Four individual items assessed overall self-esteem at Wave I, including items asking how much a participant agreed that they have good qualities, a lot to be proud of, like themselves just the way they are, and feel loved and wanted. These items were answered on a 5-point Likert scale, with higher scores indicating greater self-esteem.

3.2.3.8. Drinking behavior. Five individual items assessed alcohol use behavior and potential associated consequences at Wave I. On a 7-point Likert scale, participants indicted how many days they drank alcohol in the previous 12 months. Four items assessed problems with parents, school, friends, and romantic partners due to drinking over the previous 12 months. These items were answered on a 5-point Likert scale, with higher scores indicating greater problems due to alcohol use.

3.2.3.9. Delinquent behaviors. Three individual items assessed delinquent behaviors over the past 12 months, including getting into a serious physical fight, running away from home, and lying to parents/guardians about where they were or who they were with at Wave I. These items were answered on a 4-point Likert scale, with higher scores indicating greater delinquent behavior.

3.2.3.10. Sexual experiences. Three individual items assessed participants' sexual experiences at Wave I. Two items asked for a count of how many sexual relationships and how many sexual relationships, not including romantic partners, the participants had been in during the previous 12 months. One item was coded as binary to determine the presence of having a same-sex sexual experience in the previous 12 months.

3.2.3.11. Suicide exposure. Five individual, binary items assessed exposure to suicide at Wave I. One item asked if participants learned about suicide in school. Two items asked if a friend had attempted or succeeded in trying to kill themselves during the previous 12 months. Two items asked if a family member had attempted or succeeded in trying to kill themselves in the previous 12 months.

3.2.4. Dependent variable: suicide attempt

One item assessed how many times participants had attempted suicide (e.g., "how many times did you actually attempt suicide?") in the past 12 months. This item was assessed at Wave II and was coded dichotomously (i.e., presence vs. absence).

3.3. Exploratory mediation analysis

Exploratory mediation analysis refers to a set of methods used to identify a subset of potential mediators in the absence of strong a

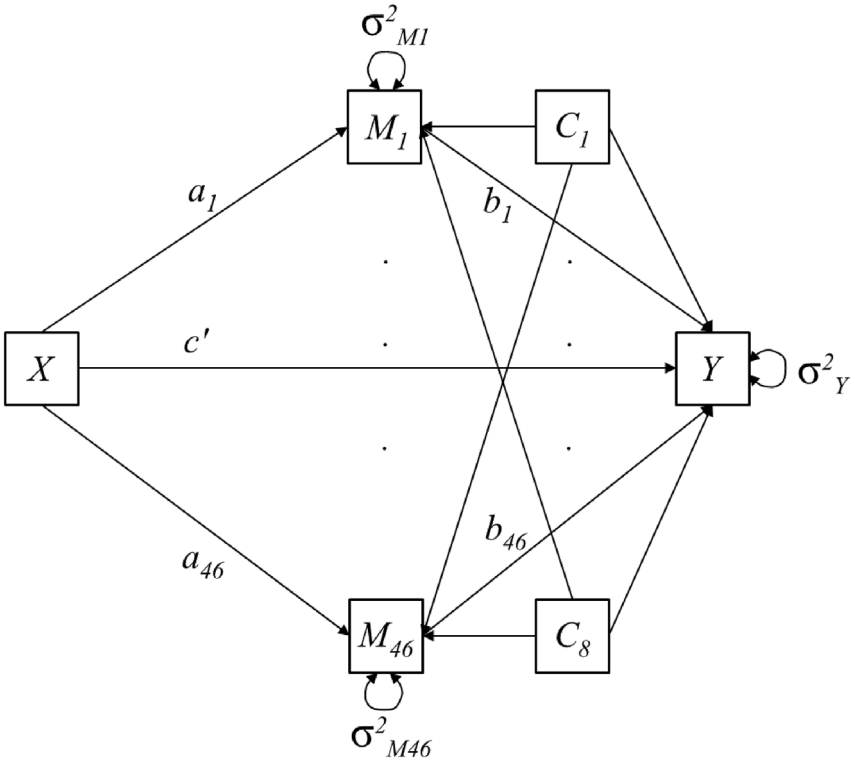

Fig. 1. Example XMed Model. *Note:* X = independent variables; M_1 = mediator 1, and so on; C_1 = Covariate 1, and so on; Y = dependent variable.

priori theory. Compared to more commonly used confirmatory approaches that test theory-driven hypotheses, exploratory mediation analysis is more appropriate for circumstances in which one's goal is simply to pare down a list of potential mediators, thereby narrowing the focus of future research.

Given the inclusion of categorical variables, we used a variation of the XMed approach proposed by Serang and colleagues (Serang et al., 2017; also see, Serang & Jacobucci, 2017). This approach proceeds according to the following two-stage process. In the first stage, a multiple mediator model is specified including all potential mediators of interest. Next, the model is fit imposing the least absolute shrinkage and selection operator (or lasso) penalties on the parameters associated with specific indirect paths, typically known as *a* and *b* parameters. The lasso imposes a penalty on parameters with the intention of forcing estimates of null parameters toward zero. If either the *a* or *b* parameter for a given mediator is zero, the specific indirect effect for this mediator (defined as their product) will also be zero. Thus, only mediators with non-zero specific indirect effects will be considered selected, forming the desired subset of mediators. However, because the parameters associated with these mediators will have been penalized, the specific indirect effects will have been drastically underestimated. To address this, the second stage consists of refitting the model without any penalties using only the subset of selected mediators. This provides unbiased estimates of the specific indirect effects, thereby painting a more accurate picture of the influence of each mediator. See Fig. 1 for an example XMed model.

XMed differs from traditional mediation analysis in the way that mediators are selected or deemed to have non-zero effects. Whereas traditional mediation analysis relies on statistical significance, determined by whether a *p*-value falls below a certain threshold or a confidence interval contains zero, XMed uses the lasso, and thus, considers all mediators with non-zero effects to be selected. This has two important implications. First, standard errors, *p*-values, and confidence intervals are not relevant in these analyses, as they are unnecessary in making decisions about which mediators to retain in the model. Second, because the specific indirect effects are calculated by taking the product of the individual paths between the independent variable, mediator, and dependent variable, any mediator with a non-zero specific indirect effect has, by necessity, a non-zero relationship both between the independent variable and mediator as well as between the mediator and dependent variable.

Unlike the version of XMed outlined by Serang et al. (2017), which is limited to continuous outcomes (both mediators and dependent variables), the variant of XMed used in this study seamlessly accommodates both continuous and dichotomous outcomes in the same model (Serang & Jacobucci, 2017). This is done using a regression perspective, in which multiple linear regression is used for continuous outcomes and multiple logistic regression is used for dichotomous outcomes. The lasso is still applied to each to perform variable selection. Covariates are treated as predictors in the regression equations that are not subject to penalization by the lasso. As such, their effects will always be included in the model.

3.4. Data pre-processing and analysis

For participants with missing values on any mediator, random forest imputation was performed using the mice package (van Buuren & Groothuis-Oudshoorn, 2011) in the R statistical environment (R Core Team, 2016). The CM factor model was fit in Mplus using the WLSMV estimator and Delta parameterization. With regard to the CM factor model, the resulting factor loadings for each of the four items were: neglect (home alone) = 0.604, neglect (basic needs) = 0.716, physical abuse = .619, and sexual abuse = 0.718. With regard to model fit, χ^2 (2) = 33.96, $p < .001$, resulting in RMSEA = 0.068, CFI = 0.974, and TLI = 0.921. The approximate fit indices indicated acceptable model fit. Subsequently, the factor score for CM was created using Thurstone's least squares regression approach via the psych package (Revelle, 2016) in R. In comparison to the use of a summed score, creating a CM variable allowed us to remove measurement error. For the factor score of the CM items, the mean for females was −0.10 (*SD* = 0.67) and the mean for males was −0.09 (*SD* = 0.64). A multiple group model also was used to test the invariance of maltreatment across gender. The DIFFTEST option in Mplus for the WLSMV estimator supported the notion the model was invariant across gender, χ^2 (4) = 7.56, $p = .11$. As such, we proceeded to use factor scores from the model fit to the entire sample.

Based on literature suggesting differences in SA rates between genders (e.g., Kessler et al., 1999), first the simple relationships between CM and SAs were examined by gender. Then, two separate gender-specific mediation models were fit. These models were fit regardless of statistical significance of the CM – SA relationship, given that non-zero relationships may benefit from further exploration. Furthermore, the indirect effects of the mediation models may be non-zero and meaningful, regardless of the statistical significance of the CM – SA association. Eight covariates assessed at Wave I were included in the model (five dummy coded items assessing race, one item assessing ethnicity, one item assessing sexual orientation, and one item assessing past 12-month suicidal ideation). A total of 46 potential single-item mediators assessed at Wave I were included in each gender-specific model, with each mediator falling into one of the following categories: interpersonal/social factors (parent relationships [six items], peer relationships [two items]); religion (three items); school factors (five items), exposure to suicidal behaviors (five items), engagement in risky behaviors (drinking behavior [five items); delinquent behaviors (three items); sexual experiences (three items), and increased psychopathology symptomatology (mood and health (18 items), and self-esteem (four items).

The decision to utilize individual items, as opposed to scale summed scores, was made in order to provide a more nuanced analysis of potential mediators, increasing the direct applicability of findings to risk assessment measures. Further, given the correlations between mediators (*r's* = .006 to 0.61), each item appears to represent a unique construct that would potentially be lost by aggregating items. Importantly, multicollinearity between mediators was not a concern (highest variance inflation factor [VIF] = 2.39). With regard to the exploratory mediation analysis (XMed), the first stage was performed using the xmed_cat() function in the regsem package (Jacobucci, 2017). This provides an interface to the glmnet package (Friedman, Hastie, & Tibshirani, 2010), which accommodates dichotomous outcome variables (i.e., SA at Wave II). Ten-fold cross-validation was used to select the appropriate penalties that were imposed upon the parameter estimates. To produce less biased estimates, the models were re-run using the lavaan package (Rosseel, 2012) with only the mediators selected in the first stage.

4. Results

4.1. Preliminary analyses

Of the overall sample, 4% (n = 192) reported a SA at Wave II. There was a significant difference between genders in the occurrence of SA, χ^2 (1) = 34.69, $p < .001$, with 5.6% of females and 2.2% of males reporting SA. See the Supplementary Table for descriptive statistics of all study variables by gender.

4.2. Mediation analyses: females

Among females, the simple logistic regression of SA presence on CM demonstrated a significant, positive relationship ($b = 0.19$, $p = .01$, 95% CI [0.04, 0.32]). In using the XMed procedures, of the 46 potential mediators, 11 were selected as having non-zero specific indirect effects among females. See Table 1. The estimated specific indirect effects, in addition to the direct effects of the selected mediators, were then determined.

4.2.1. Indirect effects

See Table 1 for all indirect effects. Results demonstrated that receiving psychological or emotional counseling during the previous 12 months was the most influential mediator. The next most influential mediators included: having a friend attempt suicide in the previous 12 months; greater levels of being tired for no reason during the previous 12 months; lower levels of being loved and wanted; lower levels of feeling close to their father; and lower levels of satisfaction in their relationship with their father. The remaining influential mediators included, in order of indirect effect strength: lower levels of liking oneself the way they are, having a poor appetite during the previous 12 months, lower levels of believing their mother cares about them, greater levels of having trouble falling asleep and staying asleep during the previous 12 months, and greater levels of running away from home during the previous 12 months. The total indirect effect of all mediators in the model was 0.12.

Table 1
Influential mediators of the childhood maltreatment – suicide attempt relationship among females.

Influential Mediator	Relationship with Childhood Maltreatment	Relationship with Suicide Attempt	Indirect Effect
	Estimate	Estimate	Estimate
Psychological or emotional counseling	0.11	0.18	0.020
Friend attempted to kill self	0.08	0.17	0.013
Feeling tired for no reason	0.07	0.17	0.011
Feel loved and wanted	0.08	0.14	0.011
Feel close to dad	−0.10	−0.11	0.011
Satisfied in relationship with dad	−0.11	−0.11	0.011
Like self the way you are	0.06	0.15	0.009
Poor appetite	0.08	0.11	0.009
Mother cares	−0.09	−0.09	0.008
Trouble falling/staying asleep	0.07	0.12	0.008
Run away from home	0.10	0.07	0.007

Note: All estimates are standardized estimates.

4.3. Mediation analyses: males

Among males, the simple logistic regression of SA presence on CM was not significant ($b = 0.22$, $p = .05$, 95% CI [-0.02, 0.43]). In using the XMed procedures, of the 46 potential mediators, 0 were selected as having non-zero specific indirect effects among males.

5. Discussion

The current study aimed to better understand the relationship between CM and SAs among adolescents, a population at particularly high suicide risk. Through the utilization of exploratory mediation analyses, a total of 46 mediators were examined as potentially influential factors in this relationship and considered separately for females and males. Overall, the findings of this study identified 11 influential mediating factors in the relationship for females, with having received psychological or emotional counseling in the previous 12 months and having a friend who attempted suicide in the previous 12 months emerging as the two most influential mediators. Unexpectedly, there was no significant relationship between CM and SAs among males.

In line with both theoretical and empirical (e.g., Afifi et al., 2008) research, there was a positive relationship between CM and SA among females, where a higher report of experiencing CM before 6th grade was related to an increased likelihood of a future SA. In contrast to girls, we found that CM was not associated with SAs among boys. Though surprising (e.g., Dube et al., 2001; Martin et al., 2004), this is in line with the literature suggesting that CM is more detrimental to females than males (Beitchman, Zucker, Hood, DeCosta, Akman, & Cassavia, 1992; MacMillan et al., 2001; McClellan, Farabee, & Crouch, 1997; Widom & White, 1997), and that this may be particularly true for long-term negative sequelae, like suicidal behavior (Thompson, Kingree, & Desai, 2004). (MacMillan et al., 2001; McClellan et al., 1997). Relatedly, females may be more likely to experience self-blame for their CM as compared to males, which may be related to increased levels of perceived burdensomeness, a key element in the development of suicidal desire (Van Orden et al., 2010). Self-blame also may contribute to females' relative increased risk for later difficulties (Cutler & Nolen-Hoeksema, 1991; Nolen-Hoeksema, 1990), potentially including suicidal behavior. It is also possible that retrospectively assessing CM may have impacted this study's findings (e.g. MacMillan et al., 2001; Martin et al., 2004; McClellan et al., 1997). It has been suggested that abuse may be tolerated (or cognitively appraised as normative) more by males than females, resulting in a biased comparison group (e.g., greater false negatives) among males (Widom & White, 1997), which may be exacerbated due to recall bias when assessing CM retrospectively. Future research will need to further clarify gender differences in the impact of CM and disentangle factors influencing these relationships.

In considering the mediation analyses among females, the most influential mediator in the relationship between CM and SAs, even after controlling for demographic variables and past 12-month suicidal ideation, was having received psychological or emotional counseling in the past 12 months. Having received counseling could be a proxy for general distress among those who attempt suicide, which is partially supported by the presence of influential mediators that may contribute to seeking counseling, such as not feeling loved, experiencing frequent crying, difficulty sleeping, and poor appetite, which are all indicators of depression (APA, 2013). However, despite these individuals receiving counseling, they were still more likely to later attempt suicide. This may suggest that individuals experiencing CM had elevated distress at baseline, which may have been what prompted them to seek counseling services. Indeed, if we return to the theoretical models of suicidal thoughts and behaviors, it is suggested that factors such as feeling like one does not belong and hopelessness are present in the development of suicidal ideation (Joiner, 2005; Klonsky & May 2015). These experiences have been demonstrated in previous research (e.g., Elliot, Cunningham, Linder, Colangelo, & Gross, 2005; Grilo, Sanislow, Fehon, Martino, & McGlashan, 1999), suggesting these constructs as potential targets in treatments specific to adolescents with a history of CM.

Having a friend who attempted suicide was the next most influential mediator. Consistent evidence in the literature has supported the notion of suicide contagion, particularly among youth (e.g., Bearman & Moody, 2004; Niederkrotenthaler et al., 2012). Although this relationship may represent a general transmission of distress (Mueller & Abrutyn, 2015), a recent review found increased risk for

suicidal behaviors among individuals exposed to suicide (Maple, Cerel, Sanford, Pearce, & Jordan, 2017). It is possible that the relationship between a peer's attempted suicide (versus completion) and SAs (Crepeau-Hobson & Leech, 2014) may be due to exposure to the behavior and/or communication between peers about the suicide event (e.g., the method they used). In turn, this may increase an individual's knowledge about how to carry out their own SA (Klonsky & May 2015). Another consideration is the self-selection of peers among those with CM, who may be more likely to engage in relationships with peers who have had similar past experiences (e.g., emotional turmoil). Consequently, their peers may be more likely to engage in suicidal behavior (Prinstein, Boergers, & Spirito, 2001). Past research also suggests that these factors may interact, where the magnitude of the association between peers' and adolescents' behavior (including suicidal behavior) may strengthen due to the presence of family dysfunction (Prinstein et al., 2001). Importantly, this relationship exists after considering suicidal ideation in the previous 12-months, one of the strongest predictors of suicidal behavior (Nock et al., 2009), suggesting that exposure to peers' suicidal behavior may facilitate the transition to suicidal behavior among those with a history of CM.

The next set of important indicators were items related to depressive symptomatology (i.e., tiredness, feeling loved), which also evidenced significant main effects, as expected based on previous literature (e.g., Abramson et al., 2002; Overholser, Adams, Lehnert, & Brinkman, 1995; Wild, Flisher, & Lombard, 2004). Interestingly, females' relationships with their fathers also demonstrated an important role in the association between CM and SAs. Although CM has demonstrated a negative impact on interpersonal relationships (e.g., Johnson et al., 2002; Rogosch, Cicchetti, & Aber, 1995), little of this research has focused more directly on parental relationships. Indeed, when examining the relationship between maltreatment and suicidal behavior, parental relationships often have been considered as a covariate (e.g., for review see Miller et al., 2013); however, the current findings suggest that parental relationships, particularly paternal, may serve as a protective factor for suicidal behavior among females who have experienced CM.

6. Limitations

The current study's results should be considered within the context of its limitations. First, this study is exploratory in nature. Although providing valuable information about variables important to investigate moving forward, research is needed to confirm such associations. Relatedly, variable selection can be unstable; future research should serve to confirm the current findings. Second, CM was only assessed at Wave III. Although participants were asked to report only on those maltreatment experiences occurring prior to the 6th grade (e.g., prior to Wave I), this was several years after the potential maltreatment occurred, potentially biasing responses. Third, only a single-item assessed the presence of a SA, and relationships may vary if nuances in suicidal behavior were considered, such as repeated or medically severe SAs. It is also notable that we opted to utilize a latent variable to represent the experience of CM. Finally, the current dataset was collected in the mid-1990's in a community sample; the findings presented should be replicated in an updated sample and further explored in clinical populations.

7. Clinical implications

The current study highlights factors that may be potential targets for risk assessment and for treatment among adolescents with a history of CM. First, gender may be an important factor to consider in identifying the target of treatment among those reporting a history of maltreatment. For females presenting to treatment with a history of CM, it may be particularly important for clinicians to assess recent exposure to peer suicidal behavior, recent depressive symptoms, and the quality of parental relationships, as they relate most strongly to later SAs.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.adolescence.2018.09.004.

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