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Conscientiousness explains the link between childhood neglect and cigarette smoking in adults from a low-income, urban area—the differential effects of sex

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Abstract

Cigarette smoking represents the leading cause of preventable morbidity and mortality in the US and understanding its risk factors remains a critical public health endeavor. Low-income individuals and individuals with a history of childhood maltreatment are at heightened risk for cigarette smoking, yet the underlying factors between this association are understudied. Conscientiousness is one construct with potential explanatory relevance to both smoking and childhood neglect. The current investigation examined the association between childhood physical and emotional neglect with smoking (i.e., self-reported cigarette smoking and breath carbon monoxide levels) via conscientiousness. The sample was comprised of 115 adults ($M_{age} = 50.46$, $SD_{age} = 5.86$; 76.4% Black) recruited from a community center serving low-income and homeless individuals. Mediation analyses showed the indirect effect of childhood emotional neglect on cigarette smoking through conscientiousness; for physical neglect, this relationship was only present among males. The current study provides preliminary evidence that conscientiousness may be a particularly important vulnerability factor when examining the association between childhood neglect and smoking.

Keywords

smoking; conscientiousness; childhood neglect; low-income

For decades, tobacco smoking has represented the leading cause of preventable morbidity and mortality in the US (CDC, 2009). Approximately 16% of the US population smokes cigarettes (Jamal et al., 2018). Relative to more affluent groups, low-income individuals tend to smoke more heavily and suffer disproportionately from tobacco-borne diseases (Campaign for Tobacco-Free Kids, 2015; Siahpush, Singh, Jones & Timsina, 2009).

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Identifying the risk factors and pathways in which they predict tobacco smoking in this subpopulation is of great public health significance to develop effective prevention and intervention smoking cessation programs.

Childhood maltreatment has been associated with increased odds of ever smoking, smoking daily, and persistent smoking into adulthood (Taha, Galea, Hien & Goodwin, 2014). A common form of childhood maltreatment is neglect, or the failure of caregivers to provide for the child's healthy development and well-being (Bellis et al., 2009). A large review pooled participants across research studies and estimated the prevalence of physical neglect at 16% and the prevalence of emotional neglect at 18% (Stoltenborgh, Bakermans-Kranenburg & van IJzendoorn, 2013). The researchers concluded that despite the high prevalence of physical and emotional neglect, these forms of childhood maltreatment are often overlooked in scientific research. Furthermore, extant investigations examining the impact of childhood neglect have oftentimes grouped this form of maltreatment with others, including physical and sexual abuse (e.g., Mersky & Topitzes, 2010; Widom, White, Czaja & Marmorstein, 2007), rendering unclear the unique contribution of neglect on negative outcomes (Mersky & Topitzes, 2010). As a result, a meta-analysis reported that no conclusions could be drawn from the state of the literature between neglect and cigarette smoking due to the limitations of the extant research (Norman et al., 2012).

Even though childhood neglect has not been evaluated as a vulnerability factor for smoking specifically, a review demonstrated its strong association with other substance use and risky sexual practices (Norman et al., 2012). Furthermore, cross-sectional and longitudinal investigations alike have shown that relative to non-neglected children, neglected children are approximately 2.5 times more likely to use illicit substances before the age 14 (Dube, Felitti et al., 2003), are more likely to consume alcohol at an earlier age, and consume greater amounts of alcohol as adolescents (Dube et al., 2006; Shin, Miller, Teicher, 2013) and adults (Shin, Miller, Teicher). When aggregating the neglect-substance use literature, there is a strong indication that childhood neglect may constitute a likely, yet understudied vulnerability factor for adult cigarette smoking that is worthy of examination.

Although the existing body of literature shows links between childhood neglect and substance use, investigators have noted the crucial need to identify mediators that can explain the association between these constructs (Norman et al., 2012). Conscientiousness is one underlying construct with potential explanatory relevance to both cigarette smoking and childhood maltreatment. Conscientiousness is defined as individuals' propensity to adhere to social norms in exercising self-control, delaying gratification, planning, and engaging in goal-directed behavior (Roberts, Jackson, Fayard, Edmonds & Meints, 2009). Various meta-analyses have concluded that lower levels of conscientiousness are strongly associated with cigarette smoking (Bogg & Roberts, 2013; Malouff, Thorsteinsson & Schutte, 2006) and a burgeoning body of research is now showing negative correlations between maltreatment and conscientiousness. In small and large research samples, victims of emotional neglect, individuals with a posttraumatic stress disorder, individuals who experienced physical and emotional abuse, and individuals who experienced parental neglect all endorsed lower conscientiousness scores (Lee & Song, 2017; Mathews, Kaur, Stein, 2008; Jaksic et al., 2012; Fletcher, Schurer, 2017).

Moreover, neglect appears to impact psychological and personality factors during childhood and early adolescence (Hildyard & Wolfe, 2002), mirroring critical periods for the development of conscientiousness (Tackman, Srivastava, Pfeifer & Dapretto, 2017). Conscientiousness during early and middle adolescence, in turn, has been shown to predict the trajectory of cigarette use (Hagger-Johnson, Bewick, Conner, O'Connor & Shickle, 2012). Considered together, this suggests that early neglect may play a critical role in the developmental cascade linking changes in conscientiousness to later smoking.

Current study

Given the evidence supporting that childhood maltreatment can lead to lower levels of conscientiousness and that these levels are in turn related to tobacco smoking, we propose that a model that examines conscientiousness as a mediator within the childhood neglect - adult smoking relationship could provide a meaningful and novel extension to the current literature. We hypothesized that childhood neglect will be related to adult current smoking. Additionally, we expected that conscientiousness would mediate the association of each type of neglect (i.e., physical and emotions) with current smoking. As an exploratory aim, we tested sex differences as a moderator of the relationship between neglect and conscientiousness. The rationale for conducting these analyses is rooted in existing research that suggests that conscientiousness differs as a function of sex across cultures (Schmitt, Realo, Voracek & Allik, 2009) and indications that childhood maltreatment may have different consequences for girls and boys (Trickett & McBride-Chang, 1995).

Method

The [Institution omitted for masked review]'s Institutional Review Board approved all procedures. This study uses data from an ongoing larger randomized control trial that began recruitment in May 2015 and that is designed to determine whether a cognitive training program is efficacious in enhancing executive functioning and lowering delay discounting. Participants were adults attending a community center in Baltimore, Maryland that serves low-income individuals, including providing free hot lunches and basic health services.

Eligibility criteria for study participation included being between 40–65 years old, not endorsing active psychotic symptoms, not meeting criteria for substance dependence according to a semi-structured clinical interview, and having a reading level at or above the 5th grade. All participants who were eligible to participate in the randomized controlled trial were included in the present analyses. The battery of questionnaires included assessments of delay discounting, cognitive abilities, emotion regulation, cigarette use, conscientiousness, and the experience of childhood neglect, and demographic information items. Data analyses were conducted only on assessments related to the study's a-priori hypotheses. Participants received \$5.00 for completing the battery of questionnaires.

Materials and Measures

Demographic Characteristics.—Participants completed a demographics questionnaire that was developed to assess participants' age, sex, race/ethnicity, education, and household income.

Emotional and Physical Neglect.—Participants reported their experiences of childhood adversity (before the age of 18) in 10 different categories introduced by the Center for Disease Control Adverse Childhood Experiences Study (Felitti et al., 1998). For this study, we will be focusing on emotional and physical neglect only. Response choices included “yes” or “no,” and frequencies such as “never,” “once or twice,” “sometimes,” “often,” or “very often.” Physical neglect was assessed with the following questions: “How often did your parents/guardians not give you enough food even when they could easily have done so?” and “Were your parents/guardians too drunk or intoxicated by drugs to take care of you?” Emotional neglect was assessed with the questions “Did your parents/guardians understand your problems and worries?” and “Did your parents/guardians really know what you were doing with your free time when you were not at school or work?” Scoring followed guidelines provided by the Adverse Childhood Experiences studies. Scores for each category of neglect were dichotomous, such that affirmative responses to physical and emotional neglect were coded as “1” and negative responses as “0.”

Conscientiousness.—Participants completed the Chernyshenko Conscientiousness Scales (CCS; Chernyshenko, 2003; Green, O’Connor, Gartland & Roberts, 2016) and rated their agreement to 60 items on a 4-point scale, from 1 (“Disagree strongly”) to 4 (“Agree strongly”). This scale measures six different facets of conscientiousness (order, virtue, traditionalism, self control, responsibility, and industriousness), and the overall total score was employed (study sample $\alpha = .70$). The CCS has also strong psychometric properties ($\alpha = 0.87$; Hill & Roberts, 2012) and good criterion-related validity. Previous studies utilizing the CCS have shown that it can predict student study, work and health behaviors (e.g. Gartland, O’Connor, Lawton & Ferguson, 2014). A higher score on this measure thus indicates that a participant is more conscientious.

Cigarette Smoking.—Two different assessments of cigarette smoking were utilized to measure cigarette smoking. Participants completed the Timeline Followback (TLFB; Sobell & Sobell, 1996) interview, which consists of recalling and reporting daily cigarette smoking patterns over a specified period of time. For the purposes of the current study, cigarettes smoking in the last 7 days was considered. The TLFB has demonstrated its ability to collect reliable and valid smoking information (Brown et al., 1998; Robinson, Sobell, Sobell & Leo, 2014). Additionally, participants provided a biochemical assessment of abstinence which measures breath carbon monoxide (CO) levels in parts per million.

Data Analytic Procedure

All data were entered and double-entered into SPSS (version 22) to detect and correct errors. We conducted bivariate correlations to assess the association between the study variables of interest. Figure 1 depicts the models that we tested. We estimated the indirect and conditional effects using bootstrapping with replacement (Preacher & Hayes, 2008) with the PROCESS macro in SPSS which does not assume that the distribution of the indirect effect is normal (Preacher & Hayes, 2008). PROCESS tests direct, indirect, and conditional effects using ordinary least squares-based path analytical framework (Hayes, 2013). Bias-corrected bootstrapping with 10,000 bootstrap samples was selected as has been suggested (Hayes, 2009; Preacher & Hayes, 2004). This modeling technique estimates simultaneous regression

analyses and generates bootstrapped confidence intervals around indirect effect estimates. An indirect effect is determined to be statistically significant (indicating mediation) if the confidence interval excludes zero. Finally, we used a moderated mediation approach described in Preacher, Rucker, and Hayes (2007) to test the conditional indirect effects of neglect on smoking through conscientiousness as a function of participant sex.

Results

One hundred and fifteen individuals completed the study questionnaires. Participants were 53.1% female and ranged between 40 to 65 years old ($M_{\text{age}} = 50.47$, $SD_{\text{age}} = 5.93$). Participants self-identified predominantly as Black/African-American (76.4%) and White (18.7%). Fifty-eight percent of the sample had a high school diploma or GED and 23% had completed grammar school. Sixty-eight percent of participants indicated that they had a household income of under \$9,999 and 16% reported having a household income between \$20,000 to \$9,999. The mean score for conscientiousness was 142.37 ($SD = 15.44$) out of a total of 240. Ninety-three percent of participants reported experiencing emotional neglect and 32% reported experiencing physical neglect. Additionally, participants reported smoking a mean of 28 cigarettes in the 7 days prior to the interview ($SD = 36.31$). Finally, mean CO levels were 12.26 ($SD = 9.87$). Sixty-one participants (53%) reported that they had not smoked cigarettes in the past 7 days.

Bivariate correlations showed that conscientiousness was negatively correlated with CO levels ($r = -0.21$, $p = .03$) and emotional neglect ($r = -0.32$, $p = .001$). Table 1 shows the intercorrelations among the study's constructs. As part of our exploratory aim, we also conducted these correlations with males and females separately. The results mirrored those of the bivariate correlations with the complete sample with the exceptions of a negative correlation present between physical neglect and conscientiousness for males ($r = -0.34$, $p = .02$). There were no differences in our study variables as a function of sex (p -values > 0.05).

Indirect Effects of Neglect and Cigarette Smoking

Emotional Neglect—The main effect of emotional neglect on conscientiousness suggested that emotional neglect accounted for 10% percent of the variability ($R^2 = 0.10$, $F(1,98) = 10.74$, $p = 0.002$). The full model, with CO level as the criterion variable, was also significant ($R^2 = 0.07$, $F(2,97) = 3.45$, $p = 0.04$). There was a significant effect of conscientiousness on CO levels ($B = -0.19$; $SE = 0.07$; $t = -2.62$; $p = 0.01$); however, when conscientiousness was included in the model, emotional neglect was no longer a significant predictor of CO levels ($p = 0.31$). As expected, the test of the indirect effects indicated that emotional neglect was related to CO levels indirectly, through the effect of conscientiousness (indirect effect = -3.06 , $SE = 1.48$; 95% CI [0.81 , 6.80]).

A similar pattern was observed for cigarette smoking assessed by the TLFB, although in this case, the full model with TLFB cigarette smoking as the criterion variable was not significant ($R^2 = 0.05$, $F(2,96) = 2.67$, $p = 0.07$). When conscientiousness was included in the model, emotional neglect became a non-significant predictor of TLFB cigarette smoking ($p = 0.88$). As hypothesized, the test of the indirect effect indicated that emotional neglect

was related to TLFB cigarette smoking indirectly, via conscientiousness (indirect effect = 8.05, $SE = 0.79$; 95% CI [0.79, 19.69]). Exploratory results suggested that gender did not moderate the relationship between emotional neglect and conscientiousness ($p = 0.31$), suggesting that conscientiousness mediates the relationship between emotional neglect and smoking among both men and women.

Physical Neglect

In the models that included physical neglect as the predictor variable, there was no evidence of an indirect effect of neglect and cigarette smoking via conscientiousness [CI (−0.002, 2.593)]. In this model, conscientiousness was independently related to TLFB smoking ($B = -0.56$; $SE = 0.25$; $t = -2.30$; $p = 0.02$) and CO levels ($B = -0.13$; $SE = 0.06$; $t = -1.96$; $p = 0.05$).

The model built to examine our exploratory aim of the moderated mediation model was significant ($R^2 = 0.12$, $F(3,89) = 3.94$, $p = 0.01$). The interaction of physical neglect and participant sex was significant ($B = 12.53$; $SE = 6.29$; $t = 1.96$, $p = 0.05$). The results also revealed that the indirect effect of physical neglect on cigarette smoking through conscientiousness was significant for men (indirect effect = 6.32, $SE = 3.94$; 95% CI [0.84, 16.86]) but not women (CI [0.65, −1.66]). In other words, the indirect effect of physical neglect on cigarette smoking through conscientiousness depended on participant sex. This analysis revealed that the effect of physical neglect on conscientiousness was dependent on being male, with the interaction accounting for 7% of the variance in conscientiousness. Table 2 shows the main results.

Specificity Analyses

In order to strengthen the interpretation of the results, we created models that alternated the order of conscientiousness for each model that was tested as recommended by Preacher and Hayes (2004). In these models, conscientiousness was the predictor, childhood neglect was examined as the indirect variable, and cigarette smoking constructs (TLFB and CO levels) remained as the outcome. The indirect effects of this model were not statistically significant in any of the cases.

Discussion

The primary aim of the investigation was to examine whether prevalent, yet understudied forms of childhood maltreatment such as emotional and physical neglect, predict adult smoking via conscientiousness. As hypothesized, physical and emotional neglect predicted current cigarette smoking in adults. Consistent with the established literature, smoking and conscientiousness showed negative correlations. The current study also extended a growing body of literature to suggest an association between neglect and conscientiousness. The results of the mediation analyses suggested that conscientiousness explained the relationship between childhood emotional neglect and adult smoking. For physical neglect, this relationship was only present among males.

Although research has found previously a relationship between other forms of childhood maltreatment, such as sexual and physical abuse with cigarette smoking (Norman et al.,

2012), this is the first study to suggest that exposure to both emotional and physical childhood neglect are related to smoking. Furthermore, this is the first study to examine the mechanisms by which childhood neglect may lead to smoking behavior in adulthood. Although the reasons for lower levels of conscientiousness as a result of maltreatment remain uncertain, this finding is in line with research suggesting that individuals who experienced trauma and meet criteria for posttraumatic stress disorder endorse lower scores in conscientiousness relative to those without the diagnosis (Stevanovi , Fran iškovi , oli , Vidakovi , 2011. Neglectful family environments in childhood may affect children's development of emotional, behavioral, social, and biological mechanisms that weaken their ability to regulate stress; this dysregulation is believed to lead to long-term physical health outcomes. In fact, relative to non-maltreated individuals, those who have experienced maltreatment show differences in brain areas that are related to executive functioning (i.e., planning behavior), which also associate to conscientiousness (e.g. Kern et al., 2009; Petersen & Feit, 2014). The discrepancy in executive functioning between maltreated and non-maltreated children could be a result of allostatic load; in environments in which children experience chronic stress, exposure to such stress changes key brain areas in functionality and structure (McEwen & Stellar, 1993). For example, maltreated children have shown decreased brain volume in prefrontal cortex areas, which leads to poorer executive functioning. These brain abnormalities have been associated with behavioral disorders that are prevalent in maltreated populations (Danese & McEwen, 2012), such as smoking. Another reason for the lower levels of conscientiousness in individuals who experienced childhood neglect that is plausible but warrants research to support it, is that living in chaotic environments in which the future was uncertain taught these children that delaying gratification, planning, or engaging in goal directed behavior with future goals was not feasible or productive within their context. As a result, conscientiousness was either underdeveloped or overridden by the importance of meeting more immediate needs for survival, a pattern that may persist well into adulthood.

The moderated mediation findings revealed that conscientiousness mediated the relationship of emotional abuse and cigarette smoking regardless of participant sex. This finding is consistent with previous research that demonstrated that one protective factor in abused children that contributes positively to their resilience is feeling connected to their family and the belief that family members care and are concerned about them (Chandy, Blum & Resnick, 1996). Therefore, emotional neglect may serve as a risk factor for lowered conscientiousness, and in turn, smoking for both men and women. In contrast, the indirect effect of physical neglect through conscientiousness was only applicable to men. Therefore, it appears that men are uniquely at higher risk for cigarette smoking through conscientiousness than women if they have experienced physical neglect. Research has shown that men and women differ in the outcomes that stem from childhood maltreatment. As an example, men who are abused tend to involve in greater externalizing antisocial behaviors such as vandalism, physical violence, and substance use (Chandy, Blum & Resnick, 1996) in comparison to women. Therefore, it is not surprising that their responses to physical neglect also differ.

The results of the present study have important clinical ramifications. Specifically, conscientiousness may be a particularly important target for preventative and clinical

interventions for individuals who underwent childhood neglect. Therapeutic settings may opt to use interventions that have received empirical support in systematically increasing conscientiousness, such mindfulness-based approaches (Krasner et al., 2009) and social skills training (Piedmont, 2001) among children who grew up in neglectful family environments. A proactive and preventative intervention would be to implement parent interventions to minimize the likelihood of potential of neglect. Multisystemic therapy has shown success in restructuring parent-child relations and interactions among neglectful families (Brunk, Henggeler, & Whelan, 1987).

The study findings should be interpreted in light of its limitations. First, the study did not ask participants to provide information about other forms of parental maltreatment, including sexual, physical, verbal, and emotional abuse. As mentioned in the introduction, these forms of maltreatment have shown strong associations with cigarette smoking (Norman et al., 2012). Therefore, it is possible that individuals in the present study's sample may have experienced other types of maltreatment also. Future studies are warranted to isolate the impact of these other types of maltreatment from those of childhood neglect. Although research suggests that retrospective reports of childhood maltreatment have strong predictive validity (Shin et al., 2009), the results are cross-sectional in nature. Therefore, it is not possible to ascertain the timing of the constructs that we measure in the context of this study. Although unlikely, the possibility that smoking affects conscientiousness and not the other way around, cannot be eliminated. This concern may be mitigated by our specificity analyses in which we alternated the order of conscientiousness, smoking, and childhood neglect. Future research is important to determine whether the age of neglect results in greater decreases in conscientiousness, which in turn leads to greater smoking, as research indicates that if abuse occurs in school-age children, it is associated with worsened internalizing symptoms and distress relative to preschool and adolescents (Gomes-Schwartz, Horowitz & Sauzier, 2006). Another important avenue of research is to evaluate whether neglect also leads to other substance use via lower conscientiousness, which was not explored as part of the current manuscript. Finally, it is important that future research confirm the generalizability of the findings to other samples.

Despite these limitations, the study contributes to the extant knowledge in important ways: 1) the study examines the specific contribution of neglect on adults cigarette smoking and distinguishes between both physical and emotional neglect, 2) the study identified conscientiousness as a key variable in linking neglect and cigarette use, and showed that emotional and physical abuse should be examined separately, and 3) physically neglected men, but not women, exhibit lower levels of conscientiousness, which in turn impacts cigarette smoking.

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Figure 1.
Conceptual Mediation Models

Table 1.
Intercorrelations among Conscientiousness, Childhood Neglect, and Cigarette Smoking

Construct	1.	2.	3.	4.	5.	6.
1.	---					
Conscientiousness						
2. CO levels	-0.21**	---				
3. Emotional Neglect	-	-0.01	---			
4. Physical Neglect	0.32***					
5. Sex	-0.18	-0.02	0.11	---		
6. TLFB Cigarettes Smoked	0.16	-0.04	-0.03	-0.12	---	
	-0.19*	0.64**	0.07	-0.05	-0.16	---

Note.

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$; CO = Breath Carbon Monoxide; TLFB = Timeline Follow-Back.

Table 2.

Effect of Childhood Neglect on Cigarette Smoking via Conscientiousness

Criterion	Path	B	SE	LLCI	ULCI
Model Y₁					
Emotional neglect (EN) and TLFB cigarettes	a: EN → CCS	-16.27	4.87	-25.93	-6.62
	b: CCS → TLFB	-0.49	0.25	-1.00	0.01
	c: EN → TLFB	2.37	13.01	-23.45	28.18
	c' : EN → TLFB	8.05	0.79	0.79	19.69
Model Y₂					
Emotional neglect (EN) and CO levels	b: CCS → CO	-0.19	0.07	-0.34	-0.05
	c: EN → CO	-3.83	3.72	-11.20	3.55
	c' : EN → CO	-3.06	1.48	0.81	6.80
Model Y₃					
Physical neglect (PN) and TLFB cigarettes	a: PN x SEX → CCS	12.53	6.29	0.03	25.04
	b: CCS → TLFB	-0.50	0.25	-1.01	0.01
	c: PN → TLFB	-6.26	4.69	18.93	-0.12
	c' : PN (males) → TLFB	6.32	3.94	0.84	16.86
Model Y₄					
Physical neglect (PN) and CO levels	b: CCS → CO	-0.13	0.07	-0.26	0.00
	c: PN → CO	0.78	2.13	-3.45	5.01
	c' : PN (males) → CO	1.56	1.13	0.15	4.68

Note. Path *a* is only presented once in Models Y₁ and Y₃ to avoid redundancy. *N* = 103 for Model Y₁, *N* = 100 for Model Y₂, *N* = 96 for Model Y₃, *N* = 93 for Model Y₄. EN = Emotional Neglect; PN = Physical Neglect; TLFB = Timeline Follow Back; CO = Carbon Monoxide; CCS = Chernyshenko Conscientiousness Scales.