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To cite this article: Joanne Savage & Megan Z. Crowley (2018) Physical Abuse Victimization and Violence in the Transition to Adulthood: The Mediating Role of Alcohol and Drug Use, Journal of Aggression, Maltreatment & Trauma, 27:9, 1022-1040, DOI: [10.1080/10926771.2017.1405313](https://doi.org/10.1080/10926771.2017.1405313)

To link to this article: <https://doi.org/10.1080/10926771.2017.1405313>



Published online: 20 Dec 2017.



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Physical Abuse Victimization and Violence in the Transition to Adulthood: The Mediating Role of Alcohol and Drug Use

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ABSTRACT

In the present paper we examine the association between physical abuse victimization in childhood and violent criminal behavior in the transition from adolescence to adulthood (TAA). Of central interest is whether that association is indirect, through the impact of abuse victimization on alcohol and drug use. We employ a statistical test for indirect effects, using a design that also applies Savage and Wozniak's (2016) "differential etiology of violence" standard. The data suggest that the effect of physical abuse on violence in the TAA is partially indirect, mediated by alcohol and drug use. A control for nonviolent offending is applied to build confidence that the dynamic between abuse victimization and substance use is a differential predictor of violence.

ARTICLE HISTORY

Received 14 June 2017
Revised 25 September 2017
Accepted 11 November 2017

KEYWORDS

Violence; Physical Abuse;
Differential; Etiology;
Substance Use; Alcohol

What are the mechanisms that mediate the association between abuse and violence? This has remained an open question for some time (e.g., Haapasalo & Pokela, 1999). Widom, Weiler, and Cottler (1999) outline the theoretical mechanisms to explain the link between physical abuse victimization and later violent behavior among victims. Their narrative describes the painful realities of child abuse victimization, the need for coping strategies, and the abuse of alcohol and drugs to self medicate and escape. The self-destructive coping strategies arise from poor self-esteem and self blame. Savage and Wozniak (2016) bolster this argument with a discussion of abuse and negative emotionality, among an array of problems, that lead the victim on a path toward their own violent behavior. The theory is sound, and most lay people, and perhaps many social scientists, probably assume that this dynamic has been confirmed by empirical research.

A consensus about the extent to which alcohol use mediates the association between abuse victimization and later violence has not been achieved. Several analyses of data collected by Widom and her colleagues suggest that alcohol abuse may have mediated the association between maltreatment (abuse/neglect) and later violent arrests in her data. These analyses suggested

that it did so fully for females (meaning that the association between maltreatment and violent arrests was no longer significant when the model included a control for alcohol abuse), and partially for males (Widom, Schuck, & White, 2006). In another analysis, alcohol abuse also partially mediated the relationship between early maltreatment and later *intimate partner violence* (White & Widom, 2003). Widom's recent conclusions about the association between child abuse and alcohol abuse affirm that the association has best been demonstrated in women, and her conclusions about the mediating effect of alcohol remain tentative (Widom & Hiller-Sturmhofel, 2014). In addition, in a latent class analysis of a national sample of adolescents, Reid and Sullivan (2012) did not identify a "physical abuse–substance use–violent offender" class as our hypothesis might have predicted. Their "abused-substance use" class of offender had experienced some physical assault, and sexual and psychological abuse, but these offenders' non-substance-related crimes tended to be nonviolent and minor. A small group of victim-offenders (6% of the sample) had been subject to a wide variety of assault and victimization, and their offending spanned many forms of anti-social behavior. Their substance use was also high. Testing this association in other data sets would forward our understanding of this issue.

In Widom's data, the evidence that *drug* use mediates the association between abuse and violence has also been inconsistent, which is likely due to the fact that the maltreated boys in her sample were not more likely than nonmaltreated boys to abuse drugs later in life (Widom & White, 1997). In other data, the association between childhood physical abuse victimization and later physical abuse perpetration was wholly mediated by the participants' substance use (including alcohol and drug use) problems (Appleyard, Berlin, Rosanbalm, & Dodge, 2011). In some studies, the effects of child abuse on violence have been dramatically attenuated when analysts have controlled for substance abuse (e.g., Ehrensaft et al., 2003). Again, to understand the extent of mediation, analyses of more data are required.

In this article, we will test whether childhood physical abuse has an effect on violent offending in the transition to adulthood, using a large national sample (Add Health). We will specifically test the mediating effect of alcohol on this relationship. Though disadvantages of the Add Health measures are outlined below, a very important advantage of using Add Health data is that the sample comes from the general population, so the findings are not vulnerable to problems found in studies of clinical populations such as small sample sizes and selection effects. Another is that the influence of interventions is also expected to be smaller, since, in the nonclinical population, not all of those reporting abuse will have been known to the authorities at the time. In addition, our analysis will impose constraints recommended by Savage and Wozniak (2016) to ensure that our analysis is focused on the differential etiology of violent behavior, above and beyond nonviolent

criminality. Savage and Wozniak argue that studies estimating correlations between exogenous variables and a measure of violence should use techniques, such as controlling for nonviolent antisocial behavior, to establish that the estimated correlation reflects the association between the exogenous variable and violence, *per se*, and is not biased by an association between the exogenous variable and a general antisocial tendency (which is correlated with violent behavior). This analysis has the advantage of exploiting tests of indirect effects, rather than multiple regression alone, to understand the nuances of the behavioral correlations. It also provides the next in a logical series of papers on this topic using Add Health data.

Literature review

Before testing the indirect effects outlined here, we briefly review the literature to confirm the empirical status of the connections between the theoretical components in our analysis. First, that physical abuse plays a role in the etiology of violent behavior is no longer controversial. In a recent comprehensive review, Savage and Wozniak (2016) conclude that physical abuse is clearly associated with violent offending. Other reviews have demonstrated the breadth of these findings, with measured outcomes that include adolescent aggression, male youth violence, and dating violence (e.g., Farrington, 1999; Foshee & Matthew, 2007; Malinosky-Rummell & Hansen, 1993). Skeptical reviewers remain, but they usually include studies that have combined forms of abuse, and combined forms of antisociality in their outcomes (e.g., Thornberry, Knight, & Lovegrove, 2012).

One open question is whether or not the effects of physical abuse in childhood on violent behavior *persist into adulthood*. The transition from adolescence to adulthood (TAA) has been the object of much research attention in recent years and is especially important for those interested in criminal offending. Because most offenders limit their offending to the teenage years, and those who persist in offending (“life-course-persistent offenders” using the nomenclature of Moffitt [1993]) commit a large proportion of offenses and are responsible for a large majority of violent offenses, predicting which offenders will persist into adulthood has substantial policy implications. A few authors have examined the association between abuse in childhood and offending in the TAA. A significant association between indicators of physical abuse victimization in childhood and young adult violence has been reported in studies using National Youth Survey data (e.g., Lackey, 2003) and Add Health data (Kim, 2009; Savage, Palmer, & Martin, 2014). Analyzing data from Add Health, Kim (2009) reported that those who recalled physical abuse victimization in their own childhoods were five times as likely to self report physically abusive parenting than other

participants in the young adult years. Consensus has not been reached, however, and the question remains unsettled.

Alcohol use has been consistently associated with violence in many studies and high blood alcohol levels of homicide victims and offenders have been routinely reported (e.g., Muscat & Huncharek, 1991). Many scholars have also posited that alcohol is more strongly related to violent than nonviolent crime (e.g., Boles & Miotto, 2003; Parker & Auerhahn, 1998). There is no consensus about why alcohol use is so consistently associated with violent behavior. This lack of agreement is likely due to the variety of measures of alcohol use (e.g., any use, frequent use, heavy use, intoxication) that do not further elucidate the quality of the imbibers' experience (see also Savage & Wozniak, 2016).

Many studies have found that substance use is associated with recidivism and persistent offending (e.g., Craig, Morris, Piquero, & Farrington, 2015; Hussong, Curran, Moffitt, Caspi, & Carrig, 2004; Laub & Sampson, 2003; Stoolmiller & Blechman, 2005; Stouthamer-Loeber, Wei, Loeber, & Masten, 2004) but not all studies have reported consistent patterns between alcohol use, specifically, and *violence* in the TAA. Using Add Health data, Maldonado-Molina, Reingle, and Jennings (2011) report that alcohol use in wave 1 also predicted violence in young adulthood, while violence in wave 1 did not predict problem alcohol use in the later wave. Chen and White (2004) analyzed data from the Rutgers Health and Human Development Project where problem alcohol use also associated with later intimate partner violence in young adulthood. In an earlier analysis of those data, however, White and Hansell (1998) reported that, while previous alcohol use predicted later alcohol use, and previous aggression predicted later aggression, and the two were positively correlated in every wave of data, no paths leading from alcohol use to subsequent wave aggression were statistically significant. Frequent alcohol use was not significantly associated with persistence in the Pittsburgh Youth Study either (Stouthamer-Loeber, Wei, Loeber, & Masten, 2004).

To follow through on our reasoning for this article, it is important to also further establish that abuse victimization and later substance use are linked. In numerous studies, child abuse has been correlated with later alcohol and drug problems in victims (e.g., Dembo, Dertke, Borders, Washburn, & Schmeidler, 1988; Ireland, Smith, & Thornberry, 2002; Silverman, Reinherz, & Giaconia, 1996; Stein, Leslie, & Nyamathi, 2002). Authors of numerous studies have found that physical maltreatment was associated with both common drug use and hard drug use (Robertson, Baird-Thomas, & Stein, 2008; Thornberry, Henry, Ireland, & Smith, 2010). Lynch et al. (2006) provide a genetically-informed test with additional controls for sex, age, socioeconomic status, and other factors, and report that harsh punishment, but not corporal punishment alone, was significantly, positively associated with drug and alcohol use. The genetically-informed design is particularly important because abusive parents frequently have alcohol or drug abuse problems (e.g., Murphy et al., 1991), so

the link between physical abuse and alcohol or drug abuse in victims might be explained by genetics shared with parents (causing the parents to be antisocial as expressed in abusive behavior) and their children (causing them to be antisocial as expressed in substance abuse and violence; see more about higher order factors and genetic “pleiotropy” in McAdams et al. [2014]).

There is also an undismissible set of studies that have not found a significant association between abuse victimization and nonalcohol substance problems (Bailey, Hill, Oesterle, & Hawkins, 2009; Kim & Williams, 2009; Salomon, Bassuk, & Huntington, 2002; Simons, Ducette, Kirby, Stahler, & Shipley, 2003). Widom et al. have reported conflicting results on this point (e.g., Schuck & Widom, 2001; White & Widom, 2008; Widom et al., 1999; Wilson & Widom, 2009). This suggests that there may be important caveats, probably related to abuse type, severity of abuse, measures of drug abuse, and age of the participants.

Finally, in a recent comprehensive review, Savage and Wozniak (2016) propose the “differential etiology of violence” thesis, and include a chapter on abuse victimization. They find “resounding support” that physical abuse has a special relationship with violent offending in particular (see also Margolin & Gordis, 2000). They apply a three-pronged approach to reviewing the literature. First, they look at studies of violence, where some form of nonviolent offending is controlled. Second, they look at studies where violent and nonviolent offending are analyzed separately, to compare coefficients across findings. And third, they look at studies where violent offenders are compared to nonviolent offenders. We will emulate that test, in part, herein. In one direct test of the role of abuse victimization in the differential etiology of violence, using Add Health data, Savage et al. (2014) found that physical abuse was not significantly associated with violent behavior in the TAA when frequency of nonviolent offending was controlled. Those authors did not include alcohol or drug use in their model.

Method

Data

We analyzed data from the National Longitudinal Study of Adolescent Health (Add Health). Collection of Add Health data began with participants in grades 7 through 12 in the United States during the 1994–95 school year (Harris & Udry, 1994–2002). The Add Health cohort has been followed over time using in-home interviews. In the present analysis, we relied on Wave 3 self-report data. In Wave 3, most participants were between 19 and 25 years old; thus, this is the best wave to use for outcomes related to the “transition to adulthood.” The number of participants with full data for all variables in our analysis was $N = 4,531$. To give the reader some idea about attrition in

Table 1. Sample characteristics.

Age (18–28)		
Mean	21.8	
Median	22	
Gender		
Female	<i>N</i> = 2,347	51.8%
Male	<i>N</i> = 2,184	48.2%
Race/Ethnicity		
Disadvantaged minority	<i>N</i> = 1,637	36.1%
Other	<i>N</i> = 2,894	63.9%
Physical abuse		
No incidents (0)	<i>N</i> = 3,321	73%
One or more incidents (≥1)	<i>N</i> = 1,210	27%
Mean	0.74	
Median	0	
Alcohol use wave 3		
Mean	2.21	
Median	2.0	
Drug use wave 3		
No incidents (0)	66%	
One or more incident (≥1)	34%	
School wave 3		
Enrolled in school	61.5%	
Not enrolled	38.5%	
Employed wave 3		
Currently employed	30.7%	
Not employed	69.3%	
Married and living with spouse wave 3		
Married	15.8%	
Not married	84.2%	
Violent behavior wave 3		
No incidents	<i>N</i> = 3963	87.5%
≥1 incident	<i>N</i> = 568	12.5%
Mean	0.264	
Median	0	

N = 4,531 for this analytic sample, selected so that all cases included data for each variable used in all analyses.

the Add Health data, there were over 6,440 participants who answered questions about violent conduct in wave 1.

Measures

See [Table 1](#) for descriptive statistics.

Dependent variables

The Add Health data set has been used to study violent and delinquent behavior in many published studies after which we model our measures of violent and nonviolent offending. In Wave 3, participants in the Add Health sample were asked to report how often they had committed a series of violent acts within the past 12 months (see [Table 2](#)). Because the responses were

Table 2. Offending items from add health.

Serious Violent Offending	Nonviolent Offending
<i>Wave 3</i>	<i>Wave 3</i>
"In the past 12 months how often did you ..."	"In the past 12 months how often did you ..."
Use or threaten to use a weapon to get something from someone?	Damage property
Take part in a physical fight where a group of your friends was against another group?	Steal something worth >\$50
Hurt someone badly enough in a physical fight that he or she Needed care from a doctor or nurse?	Go into a house or building to steal
Use a weapon in a fight?	Steal something worth <\$50
How many fights were you injured and needed doctor/nurse care?	Buy, sell, or hold stolen property
	Use someone else's credit card, bank card, or ATM card without permission

categorized as "never, once, more than once," or "never, 1–2 times, 3–4 times, 5+ times" the scale does not estimate the total number of acts; rather the resulting additive scale reflects both variety and frequency. Because the items do not include less serious violent acts such as simple hitting, slapping, or even punching or throwing things, we refer to this measure as *Serious violent offending* in wave 3. It was computed by summing responses to items indicative of violent behavior (see Table 2). The indicators for this scale are "formative" and therefore the additive computation was used (see, e.g., Brown, 2006). For formative scales, where the causal flow is from the indicators to the construct, no Cronbach's alpha is reported.

Independent variables

Physical abuse

To measure physical abuse, we used the following item: "By the time you started 6th grade, how often had your parents or other caregivers slapped, hit, or kicked you?" The response categories were coded: 0 = "This has never happened," 1 = one time, 2 = two times, 3 = three to four times, 4 = six to 10 times, 5 = more than 10 times, so the variable truncates the actual frequency but a high number still reflects more frequent abuse. This item has been used in other published studies (e.g., Hahm, Lee, Ozonoff, & Van Wert, 2010; Savage et al., 2014).

Most participants did not report any hitting; however, approximately 27% of participants overall (males and females) reported being hit at least once.

Alcohol use

We use an indicator of alcohol use provided in wave 3. Participants were asked, "During the past 12 months, on how many days did you drink alcohol? The responses varied on a 6-point scale from "never" (0) to "every day/almost every day" (6).

Drug use

Participants were asked in wave 3 whether or not they had used marijuana, cocaine, crystal meth, or “other” illegal drugs since their last interview, approximately 1 year before. We created a 4-point scale, 1 point for each of these categories. Thus, a score of 4 indicates the participant had used all four types of drugs in the past year.

Control variables

Demographic characteristics

Demographic characteristics associated with violent behavior and frequently employed as control variables in other studies include age, gender, and race/ethnicity. We coded gender as 1 = male, 2 = female (as originally done by the Add Health investigators). To code for race/ethnicity, we examined the associations between measures of violence and being Hispanic, Black, American Indian, or Asian, and found that a dummy code indicating whether or not the participant was from a disadvantaged minority group (Hispanic, Black, or American Indian) performed best.

Income

Income is another important control variable in studies of violence, and a potential confounding factor in estimated associations between physical abuse and violent behavior. Income was measured as self-reported total household income before taxes reported in wave 3. We use the natural log to correct for heteroskedasticity in this variable. Substantial controversy in the literature exists about whether physical abuse is associated with later violence when controls for poverty are imposed (Jonson-Reid, 1998).

Nonviolent offending

Nonviolent offending was computed for wave 3 as an additive scale analogous to the violent offending scale described above; it included crimes such as deliberately destroying property, stealing, going into a building to steal, etc. (see Table 2).

Control variables: Transition to adulthood

It is important to note that there are at least several very important characteristics of life in the transition to adulthood that will vary considerably in this age group, and which may have profound effects on any type of offending. Most studies do not take all of these into account when estimating effects. We first controlled for whether or not the participant was *In School*. Coded 1 if so, and 0 otherwise. Second, we applied a dummy code, which accounted for whether or not the participant was *Currently Employed* for more than 10 hours per week. Finally, we controlled for whether or not

the participant reported being currently *Married*. Being married may suppress violent behavior and may also be associated with alcohol and drug use. In one study, being married was strongly negatively associated with drug use and heavy drinking in women; the same pattern emerged in men but the differences between married and unmarried men were not as large (Staff et al., 2010). We coded this variable 1 if the individual reported being married and living together with the spouse, and 0 otherwise.

Analytic approach

Two sets of analyses were conducted. First, we provide an overall least squares regression analysis to estimate the association between physical abuse victimization and violent behavior in the transition to adulthood, controlling for other important factors.¹ We then test the indirect effects of physical abuse on wave 3 violent behavior, via its effect on alcohol abuse and drug use, using INDIRECT, a publicly available syntax file that allows for the testing of indirect effects using SPSS (Preacher & Hayes, 2008a, 2008b). The module uses bootstrap-estimated confidence intervals for inference testing of the indirect effects (set to 5,000 resamples; Hayes, 2013). In these indirect models, parallel or serial multiple mediation models are estimated and control variables are accounted for as in ordinary least squares regression, but an estimate is made of the indirect paths between the independent variable and the dependent variable through the mediators. Hayes (2013) has shown that this procedure results in very similar estimates to those achieved using structural equations modeling software and argues that the findings are essentially identical. The output includes familiar regression statistics such as unstandardized betas, standard errors, and R^2 .

Results

The lasting effect of physical abuse on violent behavior in the transition to adulthood

Table 3 displays the multiple regression findings. Physical abuse was positively correlated with frequency of violence in wave 3, controlling for variables in the base model (age, sex, minority status, being in school, being employed, being married, and nonviolent offending (see column 3 of the analysis). The size of the coefficient diminished slightly when controls for alcohol and drug use were employed, but the association between physical abuse victimization and violence in wave 3 remained statistically significant. Although the retrospective measure is imperfect, the reader should recall that all hypothesis tests are designed to disconfirm an expectation; this finding is consistent with the hypothesis that abuse has lasting effects on violent

behavior (we fail to reject the null hypothesis). These findings are also consistent with Savage and Wozniak’s (2016) “differential etiology” hypothesis, because violence was associated with physical abuse victimization, above and beyond their common correlation with nonviolent offending. Since the simple correlation between physical abuse victimization and violence was $r = .068$ (and statistically significant, $p < .000$), and the partial correlation in a full model with all the variables was $r = .027$, we can see that the effect of physical abuse on later violence was mediated in part by other variables in the model.

The dependent variable, frequency of violent offending, was highly skewed, with the vast majority of participants reporting a zero value, many participants reporting 1 or 2 incidents, and a long tail. Data transformations are not universally recommended (Tabachnick & Fidell, 2007), in part because the interpretability of the coefficient is lost when a logarithm is used. In addition, least squares regression estimates are fairly robust with respect to the assumption of normally distributed dependent variables (e.g., Judd & McClelland, 1989). We have opted to report tables in the original metric. We also ran the entire analysis for Table 3 using the natural log of the wave 3 violence scale, to correct for skewness of this dependent variable. The substantive findings changed little; due to the increase in statistical power associated with the logarithmic transformation, the partial coefficient for the

Table 3. The influence of potential confounds on the association between childhood physical abuse victimization and violent criminal behavior in the transition to adulthood (unstandardized beta coefficients are displayed with their standard errors).

	Base Model	Base Model Including Nonviolent Offending	Physical Abuse Base model	Control for Alcohol Use	Control for Drug use
Age	-.042** (.008)	-.030** (.008)	-.031** (.008)	-.035** (.008)	-.028** (.008)
Sex	-.008 (.027)	.012 (.026)	.014 (.026)	.012 (.026)	.013 (.026)
Disadvantaged minority	.140** (.028)	.134** (.027)	.132** (.027)	.165** (.028)	.147** (.027)
In school wave 3	-.204** (.030)	-.203** (.028)	-.205** (.028)	-.212** (.028)	-.199** (.028)
Currently employed	-.095** (.030)	-.069* (.028)	-.073** (.029)	-.085** (.028)	-.070** (.028)
Married	-.192** (.038)	-.143** (.037)	-.143** (.037)	-.101** (.037)	-.117** (.037)
Nonviolent offending		.240** (.011)	.236** (.011)	.226** (.011)	.224** (.011)
Physical abuse wave 3			.022* (.009)	.018* (.009)	.017* (.009)
Alcohol use wave 3				.103** (.031)	
Drug use wave 3				.016+ (.009)	.153** (.028)
R ²	.028	.117	.119	.125	.124

$N = 4531$. + $p \leq .10$; * $p \leq .05$; ** $p \leq .01$.

association between physical abuse and violence remained statistically significant (with a much lower p value). In addition, we ran one additional test of the robustness of the association. Many researchers have pointed to the importance of a control for income or poverty. We tested the full model controlling for wave 3 income. This variable is not displayed because of significant attenuation of sample size. In the model with the control for income, the coefficient for physical abuse remains positive and statistically significant.

Note that all the other variables behaved as expected from other research and theory except sex of the respondent. All else being equal, males did not self report significantly more violent behavior than females. This may be due to the fact that the wave 3 measure of violence does not include minor violent acts such as hitting or slapping.

To confirm the robustness of the results, and to assuage concerns of some reviewers, we also performed a weighted analysis and the substantive findings did not change.¹ All coefficients were in the same direction, were similar in magnitude, and had the same level of statistical significance (though not precisely the same p value).

Indirect effects

Next, we tested the size and significance of the indirect effect of physical abuse on violence in wave 3 through alcohol use and drug use. We found that the indirect effect of physical abuse on violent activity in wave 3 was positive and statistically significant ($b = .003$, 95% CI [.0016, .0059]) (see Figure 1). We found that physical abuse also had a significant direct effect on violent

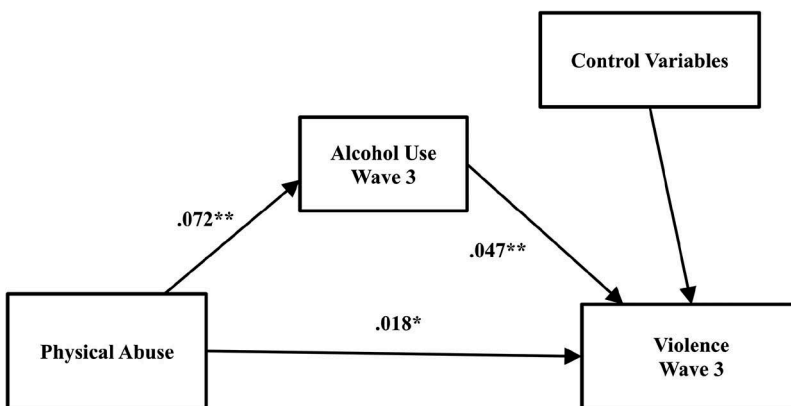


Figure 1. The indirect effect of physical abuse on violence through alcohol use in wave 3, controlling for age, sex, minority status, whether or not the participant was in school, currently employed, or married and living with spouse in wave 3, and nonviolent offending in wave 3. Unstandardized coefficients displayed. * $p \leq .05$; ** $p \leq .01$.

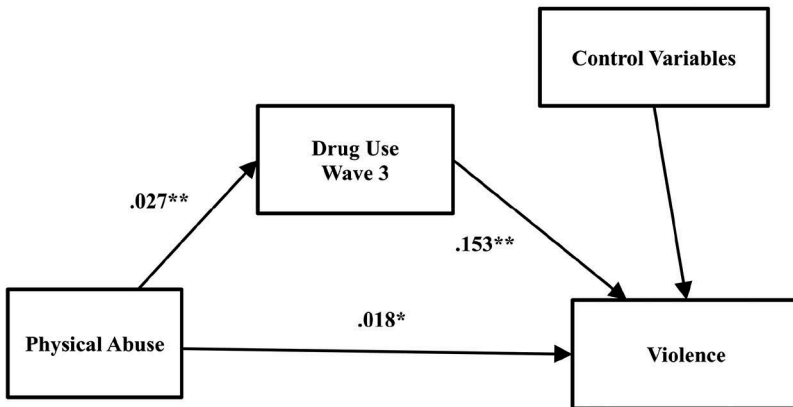


Figure 2. The indirect effect of physical abuse on violence through drug use in wave 3, controlling for age, sex, minority status, whether or not the participant was in school, currently employed, or married and living with spouse in wave 3, and nonviolent offending in wave 3. Unstandardized coefficients displayed. * $p \leq .05$; ** $p \leq .01$.

offending, which means that the association is not fully mediated by indirect effects on alcohol use (or the other control variables in the model). This indirect effect was statistically significant, but small.

We found a similar structure to the data when we looked at the indirect effect of physical abuse on violence via drug use (see Figure 2). The indirect and path through drug use was positive and statistically significant ($b = .004$, 95% CI [.0022, .0069]).

Conclusions

In this article, we have examined the dynamics between physical abuse victimization in childhood, later alcohol and drug use, and serious violent behavior in the transition to adulthood. These findings, taken as a whole, suggest three things. First the data are consistent with a lasting association between physical abuse and later violent behavior. Individuals who report having been physically abused in childhood are more likely to report fairly serious forms of violent behavior in young adulthood (being involved in serious fights, using weapons, etc.), controlling for a host of other factors.

Second, the association between physical abuse victimization and violent behavior in the TAA appears to operate through indirect paths via alcohol and drug use. Physical abuse victims drink more often, on average, than non-abused individuals and are more likely to take a variety of drugs. These, in turn, are correlated with serious violent behavior. As an illustration, cross tabs show that while the proportions of moderately abused participants who engage in frequent drinking (11%) and violent behavior (9.6%) are higher

than those not so abused (8.8% and 5.6%, respectively), a noticeably higher proportion of those who have been moderately abused and engage in frequent alcohol use can be categorized as moderately violent (15.5%). Thankfully, the number of individuals in this category is quite small relative to the total sample size ($n = 220$).

Third, the dynamics of the relationship between abuse and violence in the transition to adulthood withstand the “differential etiology” test. We accounted for the possible confounding influence of nonviolent antisocial behavior, so we can say that the estimated associations are specific to serious violent behavior, and not wholly due to a common association between physical abuse and nonviolent antisocial conduct. Although physical abuse and both alcohol and drug use were associated with nonviolent criminal activity, they had an independent effect on serious violent behavior above and beyond that association.

These findings add to the literature by expanding our understanding of the links between abuse, substance use, and later violence. They support propositions made, but not consistently empirically supported, in papers by Widom and her colleagues (e.g., Widom et al., 2006). The line of reasoning holds that coping through self-medication is a result of abuse victimization, and alcohol and drug use in turn influence violent behavior. The data we have analyzed are consistent with this proposition, however, for just a small minority of abuse victims.

It is important to note that, in these data, the indirect effects are statistically significant but small in magnitude. They are consistent with the contention that for some abused individuals, alcohol and drug use may be the “reason” for violent behavior. Nonetheless, this analysis suggests that there is a substantial remaining impact of physical abuse on violent behavior not due to substance use. Further research systematically addressing indirect effects would be helpful to fully understand the dynamics.

It is also important to note that we have not provided any additional information about why those who are abused drink alcohol more frequently, and take a greater variety of drugs. Although the data are consistent with the idea that troubled individuals use substances as medication, there are alternative hypotheses that were not tested.

This study has several limitations that should be addressed in future research. One limitation is that the measure of physical abuse included only one item. One-item scales are vulnerable to reliability problems, which increase random error, and subsequently, the risk of a type II error (missing the effect), which was not a problem in this analysis. The item that was used performed largely as expected when testing this research question, and has been used in published work before, but a stronger measure would be desirable. We believe the advantages of exploiting a national sample outweigh

this weakness; few such data sets include any questions about abuse victimization.

The measure of physical abuse was also retrospective. Although we took some care to examine methodological artifacts, it is possible that the retrospective measure of physical abuse used here has a biased association with self-report wave 3 violence. It could be proposed that wave 3 circumstances influence both the “memory” of abuse and the behavior, or inclination to report the behavior. Thus, additional replications are important. We did probe the data a little bit further to test this possibility. Reasoning that if wave 3 relationships with parents could influence ratings of “physical abuse prior to 6th grade” reported in wave 3, we looked at the correlation between wave 3 ratings of parental warmth and attachment and reports of physical abuse. We found that while physical abuse reported in wave 3 was not significantly associated with attachment in wave 1, it was significantly, negatively associated with an indicator of attachment and an indicator of parental warmth in wave 3. This is consistent with the possibility that measures of physical abuse are influenced by later wave relationships. In order for wave 3 attitudes about parents to *confound* the association between the retrospective measure of abuse and the current indicator of violence, however, those attitudes must also be associated with wave 3 violence. As it happened, the association between attachment in wave 3 and violent behavior in wave 3 was negative, but not statistically significant ($p = .22$). The association between parental warmth in wave 3 was significantly negatively associated with violent behavior in wave 3 ($r = -.039$), making it a candidate as a confound. When we added all three measures to the multivariate model (attachment in waves 1 and 3, warmth in wave 3), they did not attenuate the association between physical abuse and violent behavior at all, though the association between parental warmth in wave 3 and violent behavior was negative and statistically significant.

Another limitation rests with the measures of alcohol and drug use. Alcohol is measured as a frequency, and drug use is measured as a variety, both limited by the data collected by the Add Health researchers. Savage and Wozniak (2016) noted that measures of alcohol *intoxication* performed more consistently than other indicators of alcohol use in predicting violence and we are unable to make that distinction here. Savage and Wozniak (2016) also reported some ambiguities in their review of findings on drug use and we have not elucidated those here with the limited indicator of variety of drug use. We recommend much more nuanced indicators of drug and alcohol use in future research.

The measure of violence in wave 3 is not the same as the measure in wave 1 of Add Health. Notably, there are several items that indicate minor violence in wave 1 that are absent in wave 3. For this reason, the measure of violence

in wave 3 can be interpreted only as a measure of serious violent behavior. Individuals who merely slap or hit other people without incurring serious damage are seen as nonviolent. Thus, the findings reported here are limited to explaining variance in fairly serious violent behavior, not all forms of violence, and the coefficients may change if items related to hitting, slapping, and the like were to be included.

Note

1. The sampling design for Add Health involved a stratified cluster sample. In the public-use data set, there is no variable for REGION, so the influence of region cannot be removed. In documentation provided by the investigators, Harris and Udry (“Information for Correcting for Design Effects”) write that making no correction for region will only “minimally affect the standard errors.” To adjust for nonindependence, arising from the cluster sampling, and weighting, needed to correct for oversampling, Harris and Udry (Wave 3, “Public Use Grand Sample Weights, Data Collection Instrument and User Guide”), recommend using programs such as STATA or SUDAAN, which offer processes for correcting for survey design.

We have doubts about the extent to which weighting and corrections are needed for theory tests. The purpose of these adjustments is to make the estimation of parameters representative of the national population. Thus, for the purpose of a mere theory test, a description of the sample, and the parameter estimates can be interpreted by the reader in light of the sample used; the reader could determine whether the sample will generalize to other populations or not. This is the case in almost all other samples used to study the same research questions. But the most important reason that weighting and design adjustments are not needed in this case is that such adjustments are unlikely to result in the desired outcome. For example, in our wave 3 analytic sample, while 4,882 participants have been assigned cross-sectional sample weights (and 3,844 longitudinal weights), and 4,617 reported on violent offending, there were only 3,464 cases with both weights and data on violent offending. This comprises only 71% of the sample that was assigned weights. Given the large volume of missing data, it is unlikely that a weighted analysis will really create parameter estimates that we could say were representative of the national population of young people. Even if we were able to emulate the national population, the data in wave 3 were collected almost 15 years ago, when criminal activity was at higher levels, and when other factors of interest are likely to be more or less prevalent than they are today. Regarding the problem of nonindependence, sampling clusters of participants may result in a violation of the assumption that errors are uncorrelated. No correction for this may result in p values being lower than they should be due to the degrees of freedom being higher than they should be. Because the clustering in this case is “populous” (has a large number of relatively small clusters), “the error involved is likely to be slight” (Maletta, 2007, p. 14), and, as we shall see, estimates of p values do not change enough to make a substantive difference in this case.

That said, we decided to produce and report parameter estimates from the data set on an “as is” basis, without weighting or adjusting for cluster sampling. However, we also ran the models with weighting and adjustments for cluster sampling, and found that there were no substantive changes to our interpretation of the findings. We did this using SPSS, adjusting the gross weight variable from wave 3 (the cross-sectional

weight for analyses using only data collected in wave 3, the longitudinal weight for analyses using data from both waves 1 and 3), by multiplying the weights by n/N (the actual sample size divided by the sum of the weights, which is used as the sample size in a weighted analysis and which is inflated to many millions in this case of “scale” weighting). This computation creates adjusted weights, which sum to the actual n of the sample, so that the degrees of freedom and estimates of standard errors will not be inflated. SPSS allows for procedures such as means, correlations, and regressions to be run using the WEIGHT BY command. The correction for clusters was made by creating $k - 1$ dummy codes for all but one of the cluster units. This is essentially the exact same way that a macro by Hayes (2013) makes the adjustment, but the limit for cluster units is 20. In our analytic data set, there were 132 clusters, with a frequency of cases that ranged from 11 to 89. The approach we took can be considered conservative, as it will entail a substantial loss in degrees of freedom in inferential tests.

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