HHS Public Access

Author manuscript

J Trauma Stress. Author manuscript; available in PMC 2016 February 01.

Published in final edited form as:

J Trauma Stress. 2015 February ; 28(1): 41–48. doi:10.1002/jts.21983.

Associations Between Motor Vehicle Crashes and Mental Health Problems: Data From the National Survey of Adolescents-Replication

Joah L. Williams, **Alyssa A. Rheingold**, **Alice W. Knowlton**, **Benjamin E. Saunders**, and **Dean G. Kilpatrick**

Department of Psychiatry and Behavioral Sciences, Medical University of South Carolina, Charleston, South Carolina, USA

Abstract

Motor vehicle crashes (MVCs) are a leading cause of physical injuries and mortality among children and adolescents in the United States. The purpose of this study was to examine associations between having an MVC and mental health outcomes, including posttraumatic stress disorder (PTSD), depression, and drug and alcohol misuse in a nationally representative sample of adolescents. A sample of 3,604 adolescents, aged 12–17 years, was assessed as part of the 2005 National Survey of Adolescents-Replication (NSA-R) study. Data were weighted according to the 2005 U.S. Census estimates. Within this sample, 10.2% of adolescents reported having at least 1 serious MVC. The prevalence of current PTSD and depression among adolescents having an MVC was 7.4% and 11.2%, respectively. Analyses revealed that an MVC among adolescents aged 15 years and younger was independently associated with depression (*OR* = 2.17) and alcohol abuse (*OR* = 2.36) after adjusting for other risk factors, including a history of interpersonal violence. Among adolescents aged 16 years and older, an MVC was associated only with alcohol abuse (*OR* = 2.08). This study was the first attempt to explore adverse mental health outcomes associated with MVCs beyond traumatic stress symptoms among adolescents in a nationally representative sample.

Motor vehicle crashes (MVCs) are a leading cause of fatal and nonfatal injuries among children and adolescents. In 2011, 13% of drivers involved in accidents reported to the police were young drivers between the ages of 15 and 20 years old, despite representing only 6% of all licensed drivers in the United States (U.S. Department of Transportation, National Highway Traffic Safety Administration, 2013). Recent data collected as part of the National Young Driver Survey of 9th through 11th grade students further revealed that, across their lifetimes, nearly one in four adolescents have been passengers in an MVC where someone sustained an injury requiring medical attention (Winston et al., 2007). Together, these accidents carry a sizable economic burden such that MVC-related injuries and deaths among adolescents ages 15 through 19 years cost roughly $14 billion annually in lost

Correspondence concerning this article should be addressed to Joah Williams, National Crime Victims Research and Treatment Center, Department of Psychiatry and Behavioral Sciences, Medical University of South Carolina, MSC 861, 67 President Street, Charleston, SC 29425. wiljoah@musc.edu.

productivity (including household work days lost and permanent disability productivity loss) and medical care (Naumann, Dellinger, Zaloshnja, Lawrence, & Miller, 2010). Despite data clearly documenting the adverse impact of MVCs on child and adolescent health, much less is known about the extent to which having an MVC places adolescents at risk for poor mental health outcomes.

To date, only a few studies have explored the psychological impact of surviving a serious MVC among children and adolescents in the United States, and these studies have generally focused on acute and chronic stress symptoms (i.e., posttraumatic stress disorder [PTSD]) associated with surviving an MVC. The historical research emphasis on the association between MVCs and PTSD may be due to the fact that many MVCs are sudden and violent in nature, and often involve actual or perceived life threat to self or others. Rates of current PTSD reported across existing studies, however, are somewhat variable, ranging from 6% to 25% of children and adolescents injured in MVCs (de Vries et al., 1999; Kassam-Adams & Winston, 2004; Keppel-Benson, Ollendick, & Benson, 2002). Consistent with these rates, epidemiological data from the National Comorbidity Survey Replication Adolescent Supplement suggests that approximately 13% of adolescents who report surviving an MVC meet lifetime criteria for PTSD (McLaughlin et al., 2013). Nevertheless, the psychological toll of MVCs does not appear to be limited to traumatic stress reactions. Keppel-Benson and colleagues (2002) noted that a number of children also met criteria for additional current psychiatric diagnoses, including major depressive disorder (MDD).

Studies of adult MVC survivors have similarly documented a link between surviving a serious MVC and poor mental health outcomes, especially PTSD and MDD (e.g., Blanchard & Hickling, 2004). Compared to adolescents, the rate of PTSD among adults tends to be higher, with as many as 39.2% of adults meeting criteria for current PTSD. Evidence also suggests that adults with an MVC are more likely to endorse a history of other previous traumas than those with no MVC (Blanchard & Hickling, 2004). Moreover, Blanchard, Hickling, Taylor, and Loos (1995) reported that approximately 3.2% of adults with MVC met criteria for a current alcohol or drug use disorder, and that they had higher rates of lifetime drug dependence than controls. Although these results suggest that MVC increases risk for substance misuse, remarkably little is known about substance misuse in the context of an MVC among adolescents. Indeed, no comparable estimates of current substance use disorders are available among adolescents with a history of MVC.

Given that much of what is known about the mental health correlates of MVCs among adolescents is based largely on a few studies involving injured children recruited from local and regional hospitals or with the assistance of other local resources (e.g., local law enforcement agencies), the goal of the current study was to examine the prevalence of MVCs and associated mental health outcomes in a nationally representative sample of U.S. adolescents. With this goal in mind, the current study aimed to examine whether having an MVC was uniquely associated with mental health outcomes above and beyond other known risk factors, including demographic factors and interpersonal trauma (e.g., physical and sexual assault) history (e.g., Kilpatrick et al., 2000, 2003). Furthermore, we sought to examine whether crash-related factors, including time since the crash, number of prior

MVCs, and perceived life threat during an MVC, were differentially associated with mental health outcomes.

Method

Participants

This sample consisted of a national household probability sample of adolescents, aged 12–17 years, interviewed as part of the 2005 National Survey of Adolescents-Replication (NSA-R) study. In all, 6,694 households were contacted during recruitment where parent interviews were completed and at least one eligible adolescent was identified. Of these, 1,268 (18.9%) parents refused adolescent participation. In 307 (4.6%) cases, either the adolescent refused participation or did not complete the interview. Further, there were an additional 1,505 (22.5%) cases where the identified adolescent was unreachable or not available for interview. Thus, complete parent and adolescent interviews were obtained for 3,614 adolescents, or 54.0% of eligible participants. These cases include 2,459 adolescents from the national cross-section and an oversample of 1,155 urban-dwelling adolescents that was included to more accurately reflect U.S. population demographics. Ten cases were excluded from analyses because of age at initial interview (four were under age 12 years and six were over age 17 years). Study procedures were similar to those used in the first National Survey of Adolescents (NSA; see Kilpatrick et al., 2000) and are provided in prior publications using the NSA-R along with complete demographic information for the sample (e.g., Rheingold et al., 2012).

Demographic characteristics, including age, race/ethnicity, income, and gender were assessed with standard questions used by the U.S. Census Bureau (1988). For race/ethnicity, four dummy-coded variables were created representing African American, Hispanic, Native American, and Asian American adolescents, with Caucasians coded as the reference group. Household income was assessed using 10 different categories (e.g., $5,000–$10,000, $10,000–$15,000, etc.) that were collapsed into a dichotomous variable representing poverty, defined as annual household income <$15,000. We selected this threshold based on 2004 poverty lines used by the U.S. Census Bureau (2005) where the poverty threshold for a family of two was $12,334 and for a family of three was $15,067. The final sample of 3,604 adolescents consisted of 1,804 (50.1%) males and 1,800 (49.9%) females with a mean age of 14.63 years (*SD* = 1.66). In terms of racial/ethnic identity, 2,342 (65.0%) adolescents identified as Caucasian, 554 (15.4%) African American, 407 (11.3%) Hispanic, 85 (2.4%) Native American, and 99 (2.7%) Asian American. One-hundred seventeen (3.2%) adolescents did not report race information.

The research protocol was reviewed and approved by the Medical University of South Carolina's institutional review board. Telephone interviews were conducted in English or Spanish, based on participant preference, by trained interviewers at Shulman, Ronca, and Bucuvalas, Inc. (New York, NY), a survey research firm. A multistage, stratified, random-digit dial procedure was used to select participants within each region of the United States. A highly structured interview was conducted via telephone using computer-assisted telephone interviewing technology such that questions appeared on a computer screen to be read verbatim by highly trained interviewers. This format facilitated complex skip patterns,

reduced data entry errors, and insured that questions were asked as written. Two steps were taken to increase the likelihood that participants answered questions honestly and with a reasonable degree of privacy. First, the interviewer specifically asked whether participants were in a location where they could be assured of privacy and could answer freely. If participants indicated that they could not, the interviewer offered to call back at another time when privacy was more likely. Second, the interview was designed primarily with closed-ended questions, enabling participants to respond to questions with a simple yes or no, or other one-word or one-phrase answers. Thus, anyone listening to a respondent's answers would be unlikely to hear anything that would place the respondent at risk. Participants received a $5 incentive by mail for completing the interview. See Kilpatrick et al. (2000) for additional information on participant protection.

Measures

A series of behaviorally specific questions regarding physical assault, physical abuse, and sexual assault were used to assess interpersonal violence history. Here, physical assault was defined as experiencing an attack with or without a weapon in which the participant was badly injured or beaten up, and/or being threatened with a dangerous weapon (i.e., gun or knife). Physical abuse was defined as having an adult or caregiver throw the participant across the room or against a hard surface; beat, hit, or kick, and/or choke the participant. Sexual assault was defined as forced and/or unwanted anal, vaginal, and/or oral sex; digital penetration and/or foreign object penetration; and/or touching of genitals. A continuous variable was created summing the total number of events endorsed by participants, where a score of zero indicated no interpersonal violence history and a score of three indicated that the adolescent had a history of physical assault, physical abuse, and sexual assault. Behaviorally specific questions used in this project had been used in prior studies of trauma exposure in adolescence (e.g., Kilpatrick et al., 2000).

Involvement in a serious MVC was assessed by the following question: "Have you ever been in a serious motor vehicle accident in a car, truck, or motorcycle?" Participants were also asked how many times they had been involved in MVCs, and responses were categorized as *one occasion only*, *two different occasions*, and *three or more different occasions*. Age at the time of the accident was queried by asking, "How old were you when this happened (the first time)?" Peritraumatic threat was assessed by the yes/no question, "Did you ever think you might be killed or seriously injured during this (these) event(s)?"

Current (i.e., past 6 months) PTSD was assessed using the National Women's Survey (NWS) PTSD module (Kilpatrick, Resnick, Saunders, & Best, 1989). The NWS PTSD module is a structured diagnostic interview that assesses the presence of each PTSD symptom according to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., *DSM-IV*; American Psychiatric Association [APA], 1994) via dichotomous yes/no response options. PTSD was assessed in those that met Criterion A (exposure to a traumatic event) but symptoms were not tied to a specific event. This module has shown good psychometric properties in prior studies with adolescents (e.g., Kilpatrick et al., 2003) and demonstrated good internal consistency reliability in this sample ($\alpha = .88$).

Current (i.e., past 6 months) major depressive episode (MDE) was assessed using the NWS Depression module. The NWS Depression module assesses each *DSM-IV* symptom via dichotomous yes/no response options, and participants were classified as meeting criteria for a current MDE if they met *DSM-IV* criteria during the 6 months prior to being interviewed. The Depression module has shown good psychometric properties in nationally representative samples of adolescents (e.g., Kilpatrick et al., 2003) and demonstrated acceptable reliability in this sample ($\alpha = .82$).

Past year nonexperimental drug use was assessed via several items targeting a range of substances, including marijuana, cocaine, opioids, hallucinogens, inhalants, and club drugs (e.g., ecstasy, GHB[gamma-hydroxybutyric acid]). Participants were classified as meeting criteria for past year drug use if they endorsed using a particular substance on four or more occasions, including one or more times in the past year. To assess alcohol abuse, participants were asked a series of closed-ended questions mapping onto the *DSM-IV* symptoms for alcohol abuse. Participants were categorized as meeting criteria for past year alcohol abuse if they met *DSM-IV* criteria for abuse.

Data Analysis

Bivariate analyses comparing adolescents with and without a serious MVC history on various demographic factors and mental health outcomes were conducted using a series of χ^2 analyses and independent samples *t* tests. Logistic regression analyses were conducted to explore the association between MVCs and mental health outcomes after accounting for variance attributable to demographic factors and interpersonal violence history. Adolescents with a history of MVC with and without mental health diagnoses were also compared on several MVC-related factors using a series of χ^2 analyses and independent samples *t* tests. For these analyses, we computed a variable reflecting time (in years) since the crash by subtracting the adolescent's age at the time of the crash from their age at the time of the interview. Based on a total of three tests (examining time since the crash, number of prior MVCs, and peritraumatic threat) per diagnostic category, the significance level with a Bonferroni correction was set at $p < .017$. Because older adolescents (i.e., those aged 16 years and older) may be qualitatively distinct from younger adolescents in that they are more likely to be driving vehicles or riding with friends than riding in a vehicle with parents or adults, we conducted analyses separately for younger and older adolescents. For all of the following analyses, data were weighted according to 2005 U.S. Census estimates on geographic stratum, age, and gender, given that adolescents in urban areas were oversampled. We should note that all *n*s and proportions reported in the results are based on weighted data except where otherwise specified. Analyses were conducted using SPSS v.22 software.

We examined each variable for missing data, and rates of missingness were generally low, ranging from 0 to 3.2% missing data. Only one variable (household income) had a missing data rate > 10% (11.1%), and those youth for whom information on household income was not available were more likely to be male, $\chi^2(1, N = 3604) = 9.97$, $p = .002$, and slightly older, $t(3602) = -3.53$, $p < .001$, than participants in the remainder of the sample. Missing data were handled such that cases were excluded analysis by analysis with tests using all

cases with valid data for each tested variable. Listwise deletion was used for logistic regression analyses.

Results

The lifetime prevalence of involvement in a serious MVC was 10.2% (unweighted *n* = 372), which equates to approximately 2.6million adolescents in the United States (based on 2005 U.S. Census estimates for ages 12–17 years). Among adolescents reporting a history of involvement in a serious MVC, 71.7% (unweighted *n* = 272) reported being involved in an MVC on one occasion only, 19.0% (unweighted *n* = 71) reported being involved in two different MVCs, and 9.2% (unweighted *n* = 29) reported being involved in three or more MVCs. On average, participants were approximately 10 years old (*SD* = 4.44) when they were involved in a serious MVC (or, among adolescents who were involved in multiple MVCs, the first time they were involved in a crash). Nearly half of all adolescent MVC survivors (48.9%; unweighted *n* = 178) reported consuming at least one alcoholic beverage in their lifetime, and of these, only 1.3% (unweighted *n* = 3) reported having ever had an accident in a car because of their drinking.

Demographic comparisons between adolescents with and without a history of a serious MVC are presented in Table 1. Because we conducted 13 tests, the significance level with a Bonferroni correction was set at $p < .004$. Adolescents with a history of MVC were more likely than those who did not survive to be older at the time of the assessment, $t(3602) = -6.82$, $p < .001$, $d = 0.38$, living below the poverty level (annual household income < $15,000), $\chi^2(1, N = 3604) = 13.40$, $p < .001$, $\phi = .07$, and to report a history of more interpersonal violence, $t(3602) = -9.11$, $p < .001$, $d = 0.44$. In terms of mental health outcomes, those with a history of MVC evidenced higher rates of PTSD, MDEs, and drug and alcohol use than adolescents with no MVC history (ϕ coefficients range from .06 to .12).

MVC history, interpersonal violence history, and demographic factors were simultaneously entered in a series of multivariate logistic regression analyses with mental health outcomes as dependent variables. A significance level of $p < .05$ was chosen a priori. Results of analyses evaluating factors associated with past 6 month (current) PTSD and MDE and past year substance misuse are presented in Tables 2 and 3. Among younger adolescents, aged 15 years and younger (unweighted *n* = 2,333), history of an MVC was not associated with PTSD or drug use above and beyond other variables including age, gender, and interpersonal violence history. Younger adolescents with a history of a serious MVC were at greater risk of meeting criteria for a current MDE (odds ratio [*OR*] = 2.17) and alcohol abuse (*OR* = 2.36) than adolescents with no MVC history.

Among older adolescents aged 16 years and over (unweighted *n* = 1,271), adolescents with a history of a serious MVC were at greater risk for meeting criteria for past year alcohol abuse (*OR* = 2.08) than older adolescents with no MVC history. As with younger adolescents, MVCs were not associated with PTSD or drug use after adjusting for other risk factors. Unlike younger adolescents, though, MVCs were not associated with greater risk for a current MDE among older adolescents.

There was no difference on time since the MVC, number of prior MVC incidents, or peritraumatic threat from the MVC between adolescents younger than 16 years who had adverse mental health outcomes (n = 187; current MDE, drug or alcohol use) and those whose outcomes did not meet criteria. Using a conventional significance level of p <.05, those with PTSD were more likely to endorse peritraumatic threat at the time of the crash than those without PTSD, $\chi^2(1, N = 187) = 4.53$, p = .033, although this did not remain significant after applying a Bonferroni correction.

Among those with a history of MVC aged 16 years and older (unweighted n = 185), meeting criteria for PTSD, drug use, or alcohol abuse did not differentiate any MVC variable compared to those with no mental health consequences. Those meeting criteria for a current MDE, however, differed from those without a current MDE on time since the crash. Those with a current MDE reported a greater amount of time since the crash (M = 6.64 years, SD = 5.28) than those without a current MDE (M = 3.99 years, SD = 4.24), $t(170) = -2.58$, p = .011, d = 0.55.

Discussion

To our knowledge, this was the first study to examine the association between having an MVC and mental health outcomes in a national sample of adolescents and represents an important contribution to the literature on the mental health consequences of MVCs. The prevalence of MVC involvement in this sample was lower than estimates reported in other samples (e.g., Winston et al., 2007). The difference in prevalence estimates may in part reflect differences in the way adolescents were asked about lifetime involvement in an MVC. For example, adolescents in the National Young Driver Survey (which found a lifetime MVC rate of approximately 25% among 9th through 11th graders) were asked whether they had ever been in a crash where someone needed medical attention, although adolescents in this survey were allowed more subjectivity in being asked whether they had been involved in a “serious” MVC. Therefore, the prevalence estimate reported here may underestimate the actual number of children and adolescents involved in serious MVCs given that other studies using more objective measures report higher prevalence. Our sample, however, was also younger than the sample in the Winston et al. study, and in our sample, the rate of MVCs among adolescents aged 16 years and older (14.9%) was closer to those reported by Winston and colleagues compared to younger adolescents (7.8%). So, differences in age across samples may also play a role in observed prevalence estimates.

This study revealed important differences between adolescents with and without MVC history. Those with a history were older than adolescents with no history, a finding that conceptually makes sense given that older adolescents have, by virtue of their older age, likely spent more time in motor vehicles than younger adolescents. Interestingly, those with an MVC also endorsed more exposure to other violent events and evidenced higher rates of current PTSD, MDEs, alcohol abuse, and drug use than adolescents with no history. Rates of current PTSD and MDEs among those with an MVC were comparable to those reported among adolescents exposed to parental and community violence (Zinzow et al., 2009) and homicide loss (Rheingold et al., 2012), but along with rates of alcohol and drug use are

lower than rates seen among adolescents with a history of childhood sexual abuse (Danielson et al., 2010).

After accounting for other risk factors, having an MVC was only associated with current MDEs and alcohol abuse among younger adolescents, and among older adolescents, was associated with alcohol abuse only. Previous research among adults suggests that those with PTSD are more likely than others to endorse a history of traumatic events beyond the MVC, and a history of interpersonal violence exposure may increase susceptibility to the adverse psychological effects of additional traumatic events, like MVCs (Blanchard, Hickling, Taylor, Loos, & Gerardi, 1994). These previous findings may help explain why having an MVC in the current sample was not associated with current PTSD after accounting for demographic risk factors and interpersonal violence history. For adolescents experiencing MDEs, enhanced recall of negative events among depressed individuals (see Gotlib & Joormann, 2010) may at least partly explain the association between MVCs and depressive episodes, i.e., adolescents experiencing major depressive episodes may be more likely to recall and construe a historical MVC as serious, and the increased accessibility of such negative content in autobiographical memory may confer risk for the development and maintenance of MDEs.

Alcohol use is a well-known risk factor for adolescent MVCs (e.g., American Academy of Pediatrics, Committee on Injury, Violence, and Poison Prevention and Committee on Adolescence, 2006; Jelalian, Alday, Spirito, Rasile, & Nobile, 2000), and these results certainly support research linking alcohol use with greater risk for MVCs. Although it is possible that alcohol use and abuse was a contributing factor in a subset of MVCs endorsed by adolescents in this sample, it is noteworthy that the average age of involvement in an MVC was approximately 10 years of age, and only 1.3% of MVC survivors who ever tried alcohol reported being in a crash as a result of their drinking. These findings suggest that the vast majority of these MVCs were not the direct result of alcohol use on the part of the adolescent. So, although alcohol use is associated with increased risk for being in an MVC, self-medication models of trauma and substance use suggest that exposure to potentially traumatic events like MVCs may increase risk for alcohol and other substance use during adolescence (Garland, Pettus-Davis, & Howard, 2013). Of course, the cross-sectional nature of this study precludes our ability to determine causality, and future longitudinal studies are needed to clarify the nature of the relationship between surviving an MVC and risk-taking behaviors including alcohol use.

Generally speaking, MVC-related factors including time since the crash, number of prior MVCs, and peritraumatic life threat were not differentially associated with mental health outcomes with one exception. Among older adolescents with a current MDE, those meeting criteria for a current MDE reported more time since the crash than older adolescents that did not meet criteria for a current MDE. In other words, adolescents with a current MDE experienced their first or only serious crash at an earlier age than adolescents without a current MDE. This pattern of results is in line with recent evidence suggesting that younger age at the time of trauma exposure may confer greater risk for depression than later trauma occurrence (e.g., McCutcheon et al., 2009). Further supporting the position that younger age at the time of trauma exposure may have especially deleterious effects on adolescent mental

health, younger adolescents with PTSD did, in fact, endorse more peritraumatic life threat than those without PTSD, although this finding was no longer statistically significant after correcting for multiple comparisons. In contrast, older adolescents with PTSD did not differ from those without PTSD in terms of peritraumatic life threat—a surprising finding in that life threat is a well-established risk factor for PTSD among children and adolescents (Trickey, Siddaway, Meiser-Stedman, Serpell, & Field, 2012). Indeed, studies involving adults with a history of MVC within 4 months postcrash have documented a clear association between life threat and the development of PTSD (Blanchard, Hickling, Mitnick, et al., 1995), although other studies involving adults suggest that this association weakens up to 1 year after the crash (e.g., Koren, Arnon, & Klein, 1999). Because adolescents in this sample were, on average, more than 4 years postcrash, the lack of a stronger association between life threat and PTSD may underscore the importance of timing in this relationship, such that more intense life threat increases initial risk of developing conditions like PTSD, which are then maintained by other personal and contextual factors. Beyond personal life threat, perceived life threat to others involved in the crash may be an important MVC-related factor associated with mental health outcomes that was unfortunately not assessed as part of this study.

In terms of clinical implications, clinicians should screen children and adolescents after an MVC for mood and substance use problems beyond PTSD. Another important issue relevant to clinicians is whether the inclusion of more depressive symptoms in the diagnostic criteria for PTSD in the *DSM-5* (APA, 2013) now changes rates of PTSD and factors associated with PTSD among adolescents with an MVC, and clearly more research is needed to address this question. Moreover, providers working with traumatized youth should be mindful of the potentially additive toll of additional traumatic events such as MVCs.

Despite the strengths of this study, there are several limitations worth mentioning. First, this study did not assess for physical injury sustained during MVCs, an important omission given that degree of physical injury may contribute to the development of psychopathology following a crash (e.g., Keppel-Benson et al., 2002). Second, the wording of the MVC item is a significant limitation as it introduces potential bias in adolescents' judgment of a serious accident, and no information about crash involvement was available beyond the yes/no information provided in response to this question. Third, the question asking about MVC history only asked about MVCs that occurred in a car, truck, or motorcycle. Given that many children may be involved in MVCs as pedestrians or bicyclists, they may have been inclined to respond negatively to this question. Fourth, the cross-sectional nature of this study precludes our ability to make causal inferences about observed relations. Finally, given the retrospective nature of the study, response rates could be subject to recall bias in that adolescents may retrospectively construe an MVC as having been more or less serious than they actually perceived at the time of the crash. Despite these limitations, we hope that these findings will be useful to clinicians and policy makers seeking to not only help prevent MVCs, but also better understand the treatment needs of these adolescents.

Acknowledgments

The research was supported by Grant R01 HD046830. Preparation of this manuscript was supported by the National Institute of Mental Health Training Grant T32 MH18869-26. Views contained in this article do not necessarily represent those of the National Institute of Health or its associated agencies.

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Table 1

Demographic and Mental Health Variables in Adolescents With and Without Serious MVCs

	MVC		No MVC		
Variable	***n***	**%**	***n***	**%**	χ^2
Male gender	207	56.6	1,643	50.7	4.45*
Race/ethnicity					
Caucasian	228	64.8	2,256	71.8	7.61**
African American	60	17.0	402	12.8	4.99*
Hispanic	45	12.8	325	10.3	1.99
Native American	11	3.1	77	2.5	0.59
Asian American	8	2.3	82	2.6	0.14
Income < $15,000	47	14.0	232	8.0	13.40***
PTSD	27	7.4	111	3.4	13.93***
MDE	41	11.2	183	5.7	17.22***
Alcohol abuse	55	15.0	166	5.1	55.73***
Drug use	57	15.6	252	7.8	25.47***

Note. All *n*s and proportions presented in the table are based on weighted data unless otherwise specified. Valid *n* for variables with missing data ranged from 3,218 for annual income to 3,596 for alcohol abuse.

MVC = motor vehicle crash; PTSD = posttraumatic stress disorder; MDE = major depressive episode.

Annual income refers to annual income < $15,000.

* $p \leq .05$.

** $p \leq .01$.

*** $p \leq .001$.

Table 2

Logistic Regression Analyses of Mental Health Outcomes by MVC History: Ages 12–15

	PTSD		Depression		Drug use		Alcohol abuse	
Variable	***OR***	**95% *CI***	***OR***	**95% *CI***	***OR***	**95% *CI***	***OR***	**95% *CI***
Age	1.65***	[1.24, 2.20]	1.43***	[1.15, 1.77]	1.70***	[1.36, 2.12]	2.01***	[1.52, 2.67]
Gender	2.44**	[1.34, 4.42]	3.41***	[2.08, 5.60]	0.74	[0.48, 1.14]	1.54	[0.92, 2.56]
Income < $15K	1.30	[0.58, 2.94]	0.86	[0.40, 1.84]	1.19	[0.60, 2.36]	1.62	[0.77, 3.41]
African American	1.34	[0.64, 2.80]	0.68	[0.33, 1.40]	0.63	[0.29, 1.35]	0.20*	[0.05, 0.80]
Hispanic	0.81	[0.31, 2.08]	0.92	[0.46, 1.85]	1.45	[0.79, 2.69]	1.94*	[1.02, 3.68]
Native American	0.23	[0.01, 3.65]	2.10	[0.84, 5.23]	3.28**	[1.44, 7.48]	2.60	[0.95, 7.08]
Asian	1.16	[0.18, 7.58]	0.33	[0.03, 3.66]	0.66	[0.12, 3.71]	0.35	[0.02, 5.27]
IPV	3.35***	[2.55, 4.40]	2.56***	[2.03, 3.23]	2.66***	[2.11, 3.35]	2.66***	[2.05, 3.45]
MVC	1.86	[0.88, 3.91]	2.17*	[1.19, 3.93]	1.46	[0.79, 2.71]	2.36**	[1.26, 4.44]

Note. N = 3,604.

MVC = motor vehicle crash; IPV = interpersonal violence. Reference categories for variables were as follows: Gender = male; Family income = > $15,000; Racial/Ethnic groups = Caucasian; IPV = presence of history of interpersonal violence; MVC = no MVC.

* $p \leq .05$.

** $p \leq .01$.

*** $p \leq .001$.

Table 3

Logistic Regression Analyses of Mental Health Outcomes by MVC History Over Age 15

	PTSD		Depression		Drug use		Alcohol abuse	
Variable	***OR***	**95% *CI***	***OR***	**95% *CI***	***OR***	**95% *CI***	***OR***	**95% *CI***
Age	0.27	[0.73, 2.19]	1.18	[0.74, 1.89]	1.98***	[1.37, 2.84]	1.73**	[1.15, 2.61]
Gender	1.85*	[1.06, 3.23]	2.63***	[1.61, 4.31]	0.72	[0.51, 1.03]	0.76	[0.51, 1.13]
Income < $15,000	1.03	[0.39, 2.72]	0.40	[0.14, 1.16]	1.21	[0.62, 2.36]	0.63	[0.26, 1.48]
African American	1.08	[0.50, 2.35]	1.42	[0.74, 2.72]	0.42**	[0.22, 0.81]	0.66	[0.33, 1.30]
Hispanic	0.64	[0.23, 1.79]	0.69	[0.29, 1.65]	0.83	[0.46, 1.52]	1.11	[0.58, 2.14]
Native American	2.25	[0.42, 12.03]	2.64	[0.65, 10.78]	3.43*	[1.13, 10.39]	2.57	[0.76, 8.72]
Asian	0.67	[0.10, 4.49]	0.78	[0.17, 3.53]	0.77	[0.23, 2.63]	1.31	[0.39, 4.44]
IPV	2.09***	[1.60, 2.72]	2.70***	[2.14, 3.41]	2.13***	[1.76, 2.57]	1.72***	[1.40, 2.12]
MVC	1.38	[0.71, 2.68]	1.31	[0.73, 2.36]	1.19	[0.75, 1.89]	2.08**	[1.30, 3.33]

Note. N = 1,271.

MVC = motor vehicle crash; IPV = interpersonal violence. Reference categories for variables were as follows: Gender = male; Family income = > $15,000; Racial/Ethnic groups = Caucasian; IPV = presence of history of interpersonal violence; MVC = no MVC.

* $p \leq .05$.

** $p \leq .01$.

*** $p \leq .001$.