11-14-2014

Learning Disabilities and Delinquent Behaviors among Adolescents: A Comparison of Those with and without Comorbidity

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To cite this article: Mary K. Evans, Samantha S. Clinkinbeard & Pete Simi (2015) Learning Disabilities and Delinquent Behaviors among Adolescents: A Comparison of Those with and without Comorbidity, Deviant Behavior, 36:3, 200-220, DOI: https://doi.org/10.1080/01639625.2014.924361

Research is inconclusive on whether adolescents with learning disabilities (LD) engage in more delinquency than adolescents without such deficits. Mixed results may result from a failure to account for the effects of co-occurring disabilities. Using the National Longitudinal Study of Adolescent Health, this study examines delinquency among adolescents without disabilities to youth with LD, Attention Disorder Symptoms (ADS), and comorbid LD/ADS. Results indicate no significant differences in property offenses, or alcohol, tobacco, and marijuana use; however, youth with LD reported significantly more violence than non-disabled youth. Findings illustrate the heterogeneous effects various disabilities have on delinquent behavior. Future research and policy implications will be discussed.

Roughly 2.1 million individuals under 18 years of age were arrested in 2008 (Puzzanchera 2009), and at any given time approximately 150,000 youth are confined to juvenile correctional facilities across the United States (Puzzanchera 2009). The characteristics of arrested and detained youth not only reflect a growing number of females, but are also disproportionately male, racial and/or ethnic minorities, and are often from disadvantaged socioeconomic backgrounds (Puzzanchera 2009). Researchers have examined why such groups are overrepresented in the justice system, however, one marginalized segment of society that has been examined to a lesser degree are youth with disabilities, specifically those who have been deemed to have a learning disability (Burrell and Warboys 2000; Shelton 2006).

Learning disabilities are a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities[1] (IDEA 2005). Estimated prevalence rates of youth with learning disabilities in juvenile correctional facilities range from 30 to 70% (Brier 1989; Burrell and Warboys 2000; Casey and Keilitz 1990; Morris and Morris 2006; Nelson and Rutherford 1989; Quinn et al. 2005; Shelton 2006). Despite variability, these estimates are noticeably higher than the roughly 5% of school- aged children in the United States with a learning disability (U.S. Department of Education 2009). Coupled with anecdotal evidence from teachers, parents, and clinicians, this overrepresentation suggests that youth with learning disabilities are more likely to engage in delinquency than their counterparts without such disabilities. Another possibility is that the disproportionate number of youth with learning disabilities in correctional facilities is a consequence of the differential treatment they receive throughout their life by parents, peers, teachers, and law enforcement officials.

[1] It should be noted that learning disabilities should not be confused with the construct of academic achievement, as they are qualitatively two distinct concepts (Fuchs et al. 2001). The authors should also clarify that their definition of learning disability is from the U.S. context. The term *learning disability* means something very different in the context of the United Kingdom and European nations as it refers to what we term in the United States as intellectual disability (formally mental retardation) per the DSM (*Diagnostic and Statistical Manual*).

Research indicates the most frequently co-occurring disability for youth with learning disabilities are symptoms related to attention deficit hyperactivity disorder (ADHD) (Stanford and Hynd 1994). In fact, rates of comorbidity have been reported between 24 and 27% and as high as 92% (Barnard-Brak, Sulak, and Fearon 2011; Biederman, Newcorn, and Sprich 1991). The body of literature that focuses on the relationship between ADHD-related issues and delinquency is currently much larger than that focused on learning disability and delinquency (Moffitt et al. 1994). Frequently cited in the criminological literature as a risk factor for delinquency, ADHD is one of the most prevalent developmental disorders characterized by short attention span, hyperactivity, and impulsivity (APA 1994). These deficits in behavior are thought to help explain why children with ADHD related symptoms have higher rates of delinquency, arrest, and incarceration compared to youth without such deficits (Loeber 1990; Moffitt and Silva 1988; Pratt et al. 2002). Despite the high rates of comorbidity, the majority of research thus far does not account for this comorbidity nor does it try to tease apart the various subgroups of disabilities. To that end, it is vital for researchers to examine how attention disorder symptoms influence the relationship between learning disabilities and delinquency. Failure to do so may produce inflated estimates of the relationship between learning disabilities and delinquency.

The current study explores how delinquent behaviors differ between youth without disabilities, youth with only a learning disability, youth with only attention disorder symptoms, and those youth with both a learning disability and attention disorder symptoms. Comparing delinquency across these groups is important because if rates differ then criminologists need to explain why this may occur and to what effect, if any, co-existing disorders have on delinquent behavior. Answers to these interdisciplinary questions will highlight avenues for future research and also advance the literature on the role co-existing disabilities have on delinquent behaviors.

THEORETICAL FRAMEWORK

Several contemporary theories offer insight into why youth with learning disabilities may exhibit patterns of delinquent behavior and subsequent interaction with the justice system (Brier 1994; Keilitz, Zaremba, and Broder 1979; Murray 1976). First,

the school failure hypothesis suggests

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that learning disabilities produce poor academic achievement, which in turn results in negative attitudes toward youth from parents, peers, and school officials. This negative interaction results in a lack of school connectedness, which can lead to associations with others who are also experiencing academic failure and are disenchanted with school. Academic failure is thought to result in truancy, additional school-related problems, and delinquency (Fink 1990; Murray 1976). In contrast, the susceptibility theory stresses that learning disabilities create physical and personal problems that make a child predisposed or prone to delinquency. Children who possess such characteristics may engage in disruptive behavior in organized settings leading to additional rule violations, such as delinquent behavior (Kavale and Forness 1996; Keilitz and Dunivant 1986). Alternatively, the differential treatment theory suggests that youth with disabilities are no more likely than their non-learning disabled peers to engage in delinquency, but are more likely to be treated differently than their counterparts at every stage in formal juvenile justice processing, resulting in an overrepresentation in correctional facilities (Burrell and Warboys 2000; Demuth 2003; Doren, Bullis, and Benz 1996; Dunivant and Keilitz 1986; Keilitz et al. 1979; Steffensmeier and Demuth 2001; Steffensmeier, Ulmer, and Kramer 1998).

Although each of the above theories focus on how youth with learning disabilities interact with social contexts, Moffitt's (1993) theory regarding "adolescent-limited" and "life-course persistent" offenders places greater emphasis on the neurological deficits associated with disabilities.

Moffitt (1993) suggests that individuals who engage in the adolescent-limited type of anti- social behavior are characterized as having non-problematic childhoods, the onset of delinquent behavior during adolescence, and non-delinquent behavior in adulthood. On the other hand, the life-course persistent individual is characterized as having neurological deficits, such as a learning disability, which contributes to their delinquent behavior throughout the life-course. These individuals typically engage in delinquent and/or aggressive behaviors at a much younger age, perhaps as early as age three or four (Moffitt 1993). By adolescence, the anti-social behavior of this group is more frequent and severe and is more likely to continue into adulthood (Moffitt 1993). In

sum, the neurological deficits in the life-course persistent offender are thought to be a main contributor to delinquent behavior (Moffitt 1993; Moffitt and Caspi 2001). All of the theoretical perspectives discussed are similar in they suggest that having a learning disability may somehow contribute to delinquent behavior. Despite the theoretical rationale suggesting a positive relationship between learning disabilities and delinquent behavior, findings are inconsistent at best (Cosden 2001; McNamara, Vervaeke, and Willoughby 2008).

LEARNING DISABILITIES, ADHD, AND DELINQUENCY

Some research indicates that adolescents with learning disabilities have significantly higher instances of self-reported violent acts and substance abuse compared to adolescents without such disabilities (Cosden 2001; Keilitz and Dunivant 1986; Magg et al. 1994; McCrystal, Percy, and Higgins 2007). Previous studies that have used self-reported measures to compare the prevalence of delinquency among adolescents with and without learning disabilities have found that adolescents with learning disabilities reported more alcohol (McNamara et al. 2008), tobacco, and marijuana use (Magg et al. 1994); as well as minor acts of delinquency (Keilitz and Dunivant 1986; McNamara et al. 2008).

Other research offers little to no evidence of differences in delinquency between learning- disabled and non-disabled children (Malmgren, Abbott, and Hawkins 1999; Murray 1976; Zimmerman et al. 1981). For example, Grees and Boss (1996) found no significant between-group differences in the use of alcohol, tobacco, marijuana, cocaine, and amphetamines. Similarly, researchers followed 51 fifth-grade students with learning disabilities through their adolescent years and found the presence of learning disabilities was not a significant factor in delinquent behavior (Malmgrem et al. 1999). With the lack of consensus between studies, it is difficult to conclusively establish whether children with learning disabilities engage in more delinquency than children without learning disabilities (Cornwall and Bawden 1992). Yet, in the criminological literature having a learning disability is widely considered to be a risk factor for delinquency (Loeber 1990) and a main characteristic of life-course persistent offenders (Moffitt 1993).

The findings linking ADHD to delinquency are more consistent than those regarding learning disabilities and delinquency (Pratt et al. 2002). Numerous studies have pointed toward increased rates of delinquency among adolescents with ADHD. In one sample of adolescent delinquent boys, almost 27% had been diagnosed with ADHD, whereas only 4% of the non-delinquent group had ADHD (Moffitt 1990). Studies have found that individuals with ADHD are more likely to commit both minor delinquency (Barkley et al. 1993) and crimes that result in institutional confinement (Harpin 2005).

Rarely, however, does research focus on delinquency among youth who exhibit both learning disabilities and attention deficit symptoms related to ADHD.[2] This is an important caveat because, as mentioned earlier, a fairly large percentage of children with learning disabilities also have attention deficit symptoms. Previous research that found a positive relationship between learning disabilities and delinquency did not account for the possibility of comorbidity (Cornwall and Bawden 1992; Cosden 2001; Keilitz and Dunivant 1986; Magg et al. 1994; Malmgren et al. 1999; McCrystal et al. 2007; Murray 1976; Zimmerman et al. 1981). To that end, it may be that learning disabilities in and of themselves have very little to do with adolescent delinquency unless symptoms related to ADHD are present.

The question of whether there are between-group differences in delinquency among youth with comorbid learning disabilities (LD) and ADHD, learning disabilities

only, and no disabilities was recently explored. McNamara et al. (2008) used students from 25 high schools in a school district in a southern Ontario region of Canada and compared the delinquent behavior of those with LD, with comorbid LD/ADHD, and without LD or ADHD. Delinquent behaviors included alcohol use, nicotine and drug use, engagement in acts of major and minor delinquency, and engagement in acts of major aggression. McNamara et al.'s (2008) findings suggested the adolescents with comorbid LD/ADHD reported more nicotine and marijuana use, and participated more often in acts of minor delinquency and acts of direct aggression. This study shows the importance of examining comorbidity among a sample of youth and also provides evidence that disabilities should be treated as separate and unique contributors to delinquent behavior among

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[2] The authors acknowledge that attention disorder symptoms are also linked to conduct disorder; however, conduct disorder is not controlled for the present analysis since that would be controlling for our dependent variable, delinquency. Previous research that has measured conduct disorder using the Add Health Data have used a majority of the same items used in delinquency research also conducted with Add Health Data (see, e.g., Anderson and Hughes 2008; Haberstick et al. 2005).

youth. The current study builds on existing literature, including McNamara et al. (2008), by utilizing a national sample of adolescents from the United States and uses explicit measures of violence, property crime, and truancy, alcohol, tobacco, and marijuana use. Due to low numbers of individuals with disabilities living in the community, this is the largest known study on these relationships of interest to date.

THE CURRENT STUDY

Previous studies of learning disabilities and juvenile delinquency have produced mixed results. The high prevalence of comorbidity between learning disabilities and attention disorder symptoms complicates this relationship further, as studies that found a positive relationship between learning disability and delinquency may have unknowingly included youth who display attention disorder symptoms in their sample of youth with learning disabilities. The purpose of the current study is to explore the relationships between learning disabilities, attention disorder symptoms/learning disability comorbidity, and delinquency.

Specifically, we ask the following two questions: (1) Are youth with learning disabilities more likely to participate in various delinquent behaviors than youth without learning disabilities? And (2) does the relationship between learning disabilities and delinquency hold once we disaggregate according to comorbidity status? The first question essentially combines all those with learn- ing disabilities (with or without attention disorder symptoms) into one group, which is similar to previous empirical research. The analysis for the second question allows for simultaneous comparison of youth with a learning disability but without attention disorder symptoms, youth with both attention disorder symptoms and a learning disability, and youth with neither attention disorder symptoms nor a learning disability. We explore these questions separately for alcohol, tobacco, marijuana use, truancy, property crime, and violence (i.e., fighting). Finally, we build on previous research by utilizing a nationally representative sample of adolescent youth in the United States.

The current study also controls for a number of variables that previous research has failed to take into account. For example, higher rates of social deprivation

among youth with learning disabilities may account for differences in delinquency (Douma et al. 2007). More specifically, rather than the learning disability being directly associated with increased rates of delinquency, adolescents with a learning disability may be more likely to experience a variety of other risk factors (e.g., lower socioeconomic status) known to be associated with delinquency (Dickson, Emerson, and Hatton 2005). Many scholars examining a possible link between disabilities and delinquency, however, often fail to control for variables such as gender, race, parental structure, and socioeconomic status. As a result, findings that tend to indicate a positive relationship may not be significant after controlling for variables known to contribute to both disability status and delinquency (Broder et al. 1981). In addition to controlling for the above-mentioned demographic characteristics, we also account for depressive symptoms, a variable which has been linked both to delinquency and disability (Bender and Wall 1994). Without controlling for depression, would cause a potential spurious relationship between the link disability status and delinquency and show a relationship when in fact it may be mediated by depression (Bender and Wall 1994). Similarly, youth with disabilities are more likely to be raised in single-parent households, which have been shown to increase delinquency (Burt, Simons, and Simons 2006) and thus studies should control for this variable.

If relationships under study hold after controlling for known relevant factors that influence disability and delinquency then the findings will suggest that learning disabilities and/or attention disorder symptoms have an impact on adolescent delinquency. If the relationships do not hold after controlling for these factors, the theoretical relevance of neurological factors such as learning disabilities need to be reconsidered and research questions may need to shift from a differential offending to a differential treatment focus to understand the overrepresentation of youth with such disabilities in correctional facilities across this nation.

DATA AND METHODS

Sample

Data for the current study are derived from the National Longitudinal Study of Adolescent Health (Add Health) conducted by the North Carolina Population Center at the University of North Carolina. Wave I includes a prospective nationally representative sample of adolescents who were in grades 7 through 12 between September 1994 and December 1995 (Udry 2003). Using unequal stratified sampling techniques; a total of 80 high schools and 52 middle schools in the United States were selected for the study. The study was designed to ensure that the sample was representative of schools with respect to region of the country, urbanicity, school size, school type, and ethnicity (Harris et al. 2003). The overall study consisted of data collected from a number of sources, including: an in-school student questionnaire, a school administrator questionnaire, an in-home student interview, and a parent questionnaire. In-home interviews were also conducted in 1996 (Wave II), 2001–2002 (Wave III), and 2007–2008 (Wave IV).[3]

Roughly 90,000 students completed the Wave 1 in-school questionnaire, which asked students about demographics, various behaviors, home-life, and social relationships. More in-depth information was subsequently obtained from the in-home interview portion of the study that was conducted with a randomly selected subsample of students identified through school rosters. During the in-home portion of the study, interviewers used laptop computers to gather data from adolescents (n = 20,745) and their respective caregivers (n = 17,700; Harris et al. 2003). The in-home instrument

asked questions about the adolescent's delinquent behaviors, sexual relationships, relationships with family members, and various other topics. Answers to sensitive topics during the in-home component were recorded via an audio computer-assisted self-interview (CASI) system.

Most of the data for the current study comes from the Wave I in-home adolescent and caregiver interviews, with attention disorder symptom information coming from the Wave IV interviews. A number of respondents had missing data on weight variables (*n* = 5,972) and had to be excluded from the final sample. Approximately 1,800 cases were removed because they were missing care- giver data and thus no information was available regarding the existence of a learning disability at Wave I. After removing these cases, and additional cases with missing data on one or more of

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[3] Although the first wave of the Add Health is now twenty years old it is still considered a premier data source for the exploration of adolescent development resulting in over 4500 journal articles, presentations, manuscripts, and dissertations thus far (http://www.cpc.unc.edu/projects/addhealth/publications). Data for the current study were taken both from Wave I (1994–1995) and from Wave IV (2007–2008).

the variables, the final sample consisted of approximately 10,200[4] adolescents. Throughout the analysis, appropriate sample weights were utilized to ensure that the final sample was a national representation of American adolescents (see Chantala and Tabor 1999). The final sample was 53% female and ranged in age from 11 to 18 (*M* = 15.55, *SD* = 1.67). The sample was primarily white (64%) and non-Hispanic (84%).

Ultimately, Add Health is a community-based study and this is the trade-off of utilizing community-based versus a clinical based (or referred) data set. Clinical data sets have more detailed information regarding the participants and their diagnostic histories but usually have a smaller sample size and have the tendency to consist of more severe varieties of whatever disorder is being studied (e.g., Berkson's bias). Community-based samples usually have more a range of severity of disorder studies by including those individuals not served by a clinic and much larger sample sizes. This is a trade-off that the authors of the current study acknowledge and feel expands the current literature on this topic.

Measures

Predictor Variables

Learning disabilities. Learning disability status was based on caregiver reports during Wave I. A dichotomous variable indicated whether or not youth had a learning disability based on parent/caregiver answer to the following: "Does he/she have a specific learning disability, such as difficulties with attention, dyslexia, or some other reading, spelling, writing, or math disability?" (0 = no learning disability, 1 = learning disability). Approximately 11% of youth (n = 1,400) had some sort of learning disability, as reported by their parents. Seventy-four percent of those youth
reported to have a learning disability were also reportedly enrolled in special education classes at their schools, compared to 6% of youth without learning disabilities.

Attention disorder symptoms. Two items from Wave IV were utilized in order to identify those youth with attention disorder symptoms. During the Wave IV interview, when they were in their 20s, participants were asked: "Has a doctor, nurse, or other health care provider ever told you that you have or had attention problems or ADD or ADHD?"

They were also asked: “How old were you when the doctor, nurse, or other health practitioner diagnosed you with attention problems or ADD or ADHD?” By using both questions, we were able to determine the age at which participants were told by a doctor that they had attention problems. Participants who reported having been told that they had attention disorder symptoms prior to their age at Wave I were coded as [1] on the attention disorder symptoms variable. Because our outcome variables were all measured during Wave I our analyses excluded participants who reported having attention disorder symptoms at or after Wave I.

We briefly explored the relationship between the attention disorder symptoms variable and other relevant variables that were available in the Add Health. A little over a third of youth who self-reported having been told by a doctor that they had attention problems also were reported

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4 The overall sample size is approximate and varied between analyses as a few outcome variables had more missing data than others.

by their parents to be receiving special education classes at Wave I (compared to 7% of non- ADD/ADHD youth). As a check of concurrent validity we explored the relationship between the attention disorder symptoms variable and low self-control.[5] As expected, we found significant differences on the self-control measure between those who reported having been told by a doctor that they had attention disorder symptoms and those who had not, t (12224) = −14.26, p < .001. Specifically, those with attention disorder symptoms reported significantly lower levels of self-control.

Disability subgroups. Base models (see Analysis section) did not account for comorbidity and thus the dichotomous LD variable described above was used. Follow-up analyses, however, accounted for various sub-groups of disability status based on various combinations of the LD and attention disorder symptoms variables described above. Specifically, youth were disaggregated
into the following groups: LD only (n = 1135), attention disorder symptoms only (n = *124*) and LD + attention disorder symptoms (n = 265). Approximately 10,772 youth reported no disability.

Outcome Variables

Violent delinquency. Violent delinquency was measured as a scale of summed responses to items asking youth the number of times they engaged in the following during the previous 12 months: “get into a physical fight”; “hurt someone badly enough to need bandages or care from a doctor or nurse”; “take part in a fight where a group of your friends was against another group”; and “use or threaten someone with a weapon” (α = .73, Anderson and Hughes 2009). Categories for violent items included never (0), 1 or 2 times (1), 3 or 4 times (2), or 5 or more times (3). Higher scores represented higher levels of delinquent behavior in the past year.

Property delinquency. Property offending was self-reported and measured as a sum of responses to the following five items: “deliberately damage property that didn’t belong to you”; “take something from a store without paying for it”; steal something worth more than $50”; “go into a house or building to steal something”; and “steal something worth less than $50” ($\alpha$ = .77, Anderson and Hughes 2009). Categories for

property items included never (0), 1 or 2 times (1),
3 or 4 times (2), or 5 or more times (3). Higher scores represented higher levels of delinquent behavior in the past year.

Truancy. Truancy was measured by one item that asked youth to report for the last year: "How many times have you skipped school for a full day without an excuse?" Reports ranged from 0 to 99 (M = 1.81, SD = 6.89).

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[5] The self-control measure used in this analysis is the 5-item scale originally published in 2004 by Perrone and col- leagues and is among the most often used self-control measures in the Add Health Data (Beaver et al. 2008, 2010; Boisvert et al. 2012; Perrone et al. 2004; Wright et al. 2012). Students were asked how often they had trouble paying attention in school, trouble keeping their mind focused, trouble getting along with their teachers, trouble finishing their homework and whether they felt they did everything just right. These items are intended to tap the self-centeredness, physical activities, impulsivity, and simple tasks components of self-control (Perrone et al. 2004). All items were standardized and summed (α = .69). Higher scores represented lower levels of self-control.

Smoking tobacco. Smoking was measured by one item that asked youth to report: “During the past 30 days, on how many days did you smoke cigarettes?” Reports ranged from 0 to 30 (M = 3.75, SD = 8.99).

Alcohol. Alcohol used was measured by one item, which asked youth to report: “In the past 12 months, on how many days did you drink alcohol?” Responses choices included 0 (never), 1 (1–2 days), 2 (once a month or less), 3 (2–3 days/month), 4 (1–2 days/week), 5 (3–6 days/week), 6 (every day or almost). Approximately 47% of youth reported drinking at least once in the past 12 months (M = 1.05, SD = 1.43).

Marijuana. Marijuana use was measured by one item that asked youth to report: “During the past 30 days, how many times did you use marijuana?” Reports ranged from 0 to 150[6] (M = 1.43, SD = 7.09).

Control Variables

Depressive symptoms. Depressive symptoms were measured using 18 items from the CES-D scale (Radloff 1977). Items were reverse coded as necessary and summed to create a depressive symptoms measure (α = .86). Participants were asked how often they had experienced various conditions in the last week (e.g., “You felt depressed”; “You felt lonely”; “You felt hopeful about the future”). Items were measured on a four-point scale ranging from “rarely” to “most/all of the time” with higher scores indicating more depressive symptoms. Scale scores ranged from 0 to 53 (M = 11.08, SD = 7.28).

Demographics. Several dummy variables were created to capture sex (0 = Female, 1 = Male), ethnicity (0 = non-Hispanic, 1 = Hispanic), and race (0 = non-White, 1 = White). Respondent’s age was measured as a continuous variable that ranged from 11 to 18 and was subsequently mean-centered. An age-squared term was also included to allow for either increasing or diminishing effects of each additional year (Long and Freese 2006). A poverty variable was created based on the parent responses to the receipt of aid. Youth whose primary caregivers reported receiving Aid to Families with Dependent Children, food stamps, or a housing subsidy were coded as an affirmative on the poverty variable (0 = no poverty, 1 = poverty). Approximately 14% of youth were reported by their caregivers to be living in poverty. Finally, a variable designating

whether or not youth reported having two residential parents was created (0 = less than two residential parents, 1 = two residential parents). Approximately 69% of the sample reported living with two residential parents. See Table 1 for descriptive statistics for the primary variable used in the analyses.

Analyses

The complex nature of the Add Health design requires the implementation of survey correction procedures in order to produce unbiased estimates of variance and standard errors (Chantala and Tabor 1999). Data analyses were conducted using the "svy" commands in STATA (v. 11), a software package that includes procedures for correctly analyzing complex survey designs.

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6 Extreme outliers were trimmed from the sample.

TABLE 1
Descriptive Statistics for Primary Variables

	M	*SD*	*Min*	*Max*	%
Outcome Variables					
Violent	0.99	1.74	0	12	
Property	1.11	2.16	0	15	
Truancy	1.93	6.89	0	99	
Smoke (30 day)	4.21	9.49	0	30	
Drink (12 mo)	1.05	1.43	0	6	
Marijuana (30 day)	1.43	7.09	0	150	
Predictors (Continuous)					
Age	15.55	1.67	11	18	
Depression	11.08	7.28	0	53	
Predictors (Categorical)					
LD_{all}					11.4
LD_{only}					9.2
ADS_{only}					1.0
LD + ADS					2.2
White					66.1
Female					53.2
Hispanic					15.5
Poverty					13.5
2ResidentialParents					68.7

The first four columns list descriptive statistics (*M, SD*, Min, Max) for continuous variables. The final column indicates the percent of youth who were coded "1" on the variable of interest.

A series of survey-weighted[7] negative binomial regression models were estimated to explore the relationships between learning disabilities and a number of delinquent and substance use-related outcomes, while controlling for a variety of other factors. Negative binomial regression is used with positively skewed count data and is preferred over the Poisson model due to the overdispersed (i.e., variance greater than the mean) nature of the data (Gardner, Mulvey, and Shaw 1995; Long and Freese 2006). For each outcome, baseline models are first presented (1st column in the table under each outcome heading) exploring the relationship between LD status (absence of LD serves as the reference category) and participation in the behavior. Follow-up models were disaggregated to look separately at youth with learning disabilities with and without the addition of attention disorder symptoms compared to the reference category, non-learning disabled youth (i.e., LD only; attention disorder symptoms only; LD + attention disorder symptoms; non-LD). The disaggregation provides information about whether the relationship between learning disabilities and delinquency is consistent across subgroups of learning disabled youth. The regression

[7] Such models correct for design effects and cluster sampling procedures such as those used in Add Health. When survey weighting procedures are not used with complex survey designs, standard errors are often underestimated and thus effects or significance is overestimated (Chantala and Tabor 1999). Stata's "svy" commands were used in this analysis.

tables included in the results section include both the standard and the exponentiated regression coefficients.[8] Due to multiple comparisons across several outcome variables a Bonferroni correction was used to guard against the inflation of the probability of committing a Type I error, or discovering significance by chance. The alpha level after correction (.05⁄6 dependent comparisons) is $p \leq .008$. Tables 2 and 3 denote significance at both standard and corrected alpha levels for primary independent variables.

RESULTS

The answer to the first research question (i.e., is there a negative relationship between learning disability status and various problem behaviors, including delinquency and substance use) can be found in the correlations matrix in Table 2 and in the baseline regression models (LD All) contained in Tables 3 and 4. As seen in Table 2, learning disability status was significantly and positively correlated with violent delinquency, property delinquency, truancy, tobacco use, and marijuana use, suggesting further analysis was warranted. The subsequent regression models, which controlled for depressive symptoms and a number of demographic factors, did not show a clear and consistent pattern of higher participation in delinquency among youth with learning disabilities (see Table 3 and 4). In fact, violent delinquency was the only outcome measure on which youth with learning disabilities reported greater participation than their non-disabled counterparts. Specifically, youth with learning disabilities reported violent delinquency at a level 25% higher than those without a learning disability (reference category). With regard to alcohol, youth with learning disabilities actually reported significantly less use than their peers, though this was not significant when the Bonferroni correction for multiple comparisons was used.

The second research question asked whether or not relationships between learning disabilities and delinquency held once youth with learning disabilities were disaggregated into those with only learning disabilities and those with comorbid learning disabilities and attention disorder symptoms. Similar to that reported above, youth with learning disabilities were not significantly different from non-disabled youth on the majority of delinquency and substance use-related out- comes. Specifically, there was

no significant difference between non-disabled youth (reference category) and any of the subgroups (LD only, attention disorder symptoms only, LD + attention disorder symptoms) for property offenses, tobacco, alcohol, or marijuana. With regard to truancy, there were no significant differences in the baseline model, although once the LD youth were disaggregated into subgroups we found that youth with comorbid LD and attention disorder symptoms reported significantly more truant days in the last 12 months than youth without learning disabilities; however, youth with only attention disorder symptoms or only LD did not report more truancy than their non-disabled counterparts. Again, when the more conservative *p*-value associated with the Bonferroni correction was considered, most of these relationships were no

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8 The exponentiated coefficient is particularly helpful with regard to interpreting the strength or size of the effect. For a positive association, the exponentiated coefficient can be interpreted as a factor of increase in the dependent variable as a result of a one unit increase in the independent variable (1- e^b represents the percent increase in the dependent variable for a one unit increase in the independent variable), whereas a negative sign indicates a decrease in the dependent variable for a one unit increase in the independent variable (1- e^b represents the percent decrease in the dependent variable for a one unit increase in the independent variable).

TABLE 2
Bivariate Correlations Among Primary Dependent, Independent, and Control Variables

Variables	*1.*	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*	*9.*	*10.*	*11.*	*12.*	*13.*	*14.*	*15.*	*16.*	*17.*
1. Violence																	
2. Property	.42**																
3. Truancy	.17**	.16**															
4. Tobacco	.17**	.20**	.23**														
5. Alcohol	.23**	.29**	.21**	.39**													
6. Marijuana	.11**	.13**	.10**	.13**	.14**												
7. LD all	.10**	.02*	.03**	.05**	−.01	.02*											
8. LD only	.09**	.01	.02	.03**	−.01	.02	.89**										
9. ADS only	.05**	.02**	.02*	.04**	.03**	.02	−.04**	−.03**									
10. LD+ADS	.06**	.03**	.02**	.04**	.00	.01	.41**	−.05**	−.02								
11. White	−.08**	.01	−.02**	.18**	.10**	.00	.05**	−.02*	.04**	.07**							
12. Hispanic	.05**	.04**	.08**	−.05**	.02*	.01	−.02	.00	−.02*	−.04**	−.14**						
13. Poverty	.09**	.00	.02**	−.00	−.02*	.01	.06**	.07**	.01	−.01	−.14**	.06**					
14. 2ResParents	−.09**	−.04**	−.09**	−.05**	−.05**	−.02**	−.04**	−.05**	.00	.01	.16**	.00	−.25**				
15. Age	−.04**	−.01	.17**	.16**	.26**	.04**	.01	.02*	.00	−.01	−.04**	.07**	−.05**	−.03**			
16. Age^2	−.03**	−.06**	−.01	−.05**	−.07**	−.01	−.02*	−.01	.01	−.02	.02	−.01	−.01	.00	−.22**		
17. Depression	.18**	.17**	.15**	.16**	.16**	.05**	.09**	.08**	.02*	.03**	−.10**	.08**	.09**	−.09**	.11**	−.06**	
18. Male	.20**	.13**	.02**	.01	.05**	.06**	.11**	.08**	.05**	.08**	.02*	.00	−.03**	.03**	.04**	−.02*	−.13**

*p < .05; **p < .01.

TABLE 3

The Relationship Between LD Status and Violence, Property Delinquency, and Truancy

	Violence				*Property*				*Truancy*			
Variables	*Coef*	e^b	*Coef*	e^b	*Coef*	e^b	*Coef*	e^b	*Coef*	e^b	*Coef*	e^b
LD All	.23(.08)***	1.25			−.15(.10)	0.86			.29(.20)	1.33		
LD Only			.21(.09)*	1.23			−.19(.11)	0.82			.02(.18)	1.02
ADS Only			.42(.16)*	1.52			.07(.19)	1.08			.03(.33)	1.03
LD+ADS			.35(.12)***	1.42			.01(.18)	1.01			1.03(.45)*	2.79
Demographics												
Male	.85(.04)**	2.33	.84(.04)**	2.31	.68(.05)**	1.97	.68(.05)**	1.96	.24(.12)	1.27	.24(.12)*	1.27
White	−.17(.05)**	0.84	−.18(.05)**	0.84	.12(.08)	1.12	.11(.08)	1.12	.14(.16)	1.15	.13(.16)	1.13
Hispanic	.27(.07)**	1.31	.27(.06)**	1.32	.30(.09)**	1.36	.31(.09)**	1.36	.45(.21)*	1.56	.48(.21)*	1.62
Poverty	.26(.05)**	1.29	.26(.05)**	1.30	−.16(.10)	0.85	−.16(.10)	0.85	.28(.19)	1.32	.23(.16)	1.25
2ResParents	−.27(.05)**	0.76	−.27(.05)**	0.76	−.20(.05)**	0.82	−.22(.06)**	0.82	−.82(.17)**	0.44	−.84(.17)**	0.43
Age	−.10(.01)**	0.90	−.10(.02)**	0.90	−.07(.02)**	0.93	−.05(.02)**	0.93	.40(.04)**	1.49	.41(.04)**	1.51
Age^2	−.02(.01)**	0.98	−.02(.01)**	0.98	−.05(.01)**	0.95	−.05(.01)**	0.95	−.04(.02)	0.96	−.04(.02)	0.96
Controls												
Depression	.05(.00)**	1.05	.05(.00)**	1.05	.05(.00)**	1.05	.05(.00)**	1.05	.06(.01)**	1.07	.06(.01)**	1.07

The reference category for the primary independent variables was non-disabled youth. Coef = standard negative binomial regression coefficient. e^b = exponentiated coefficient (see Footnote 6 for further explanation regarding interpretation). The first two columns under each Dependent Variable display the regression coefficients for the models comparing LD All (i.e., LD youth with/without ADS) against non-LD youth. The third and fourth columns display regression coefficients for the disaggregated models. The disaggregated models compare subgroups of disabled youth against non-learning disabled youth.

***$p < .008$ (alpha level adjusted using Bonferroni correction for multiple comparisons); **$p < .01$; *$p < .05$.

TABLE 4
The Relationship Between LD Status and Tobacco, Alcohol, and Marijuana Use

	Tobacco				*Alcohol*				*Marijuana*			
Variables	*Coef*	e^b	*Coef*	e^b	*Coef*	e^b	*Coef*	e^b	*Coef*	e^b	*Coef*	e^b
LD All	.15(.12)	1.16			−.19(.08)*	0.83			−.03(.23)	0.97		
LD Only			.12(.14)	1.13			−.19(.10)	0.83			−.04(.26)	0.96
ADS Only			.25(.28)	1.29			.22(.15)	1.25			.19(.34)	1.21
LD+ADS			.28(.18)	1.32			−.19(.13)	0.82			.03(.35)	1.03
Demographics												
Male	.01(.09)	1.01	.00(.09)	1.00	.13(.04)**	1.14	.13(.04)**	1.14	.41(.23)	1.51	.40(.23)	1.50
White	1.41(.15)**	4.09	1.40(.15)**	4.06	.33(.06)**	1.39	.32(.06)**	1.38	−.11(.23)	0.90	−.11(.23)	0.89
Hispanic	.05(.18)	1.05	.05(.18)	1.06	.05(.07)	1.05	.05(.07)	1.05	−.07(.29)	0.93	−.06(.28)	0.94
Poverty	.18(.11)	1.20	.18(.12)	1.20	−.10(.06)	0.90	−.10(.06)	0.90	.11(.23)	1.11	.11(.22)	1.12
2ResParents	−.40(.08)**	0.67	−.40(.08)**	0.67	−.22(.04)**	0.80	−.22(.04)**	0.80	−.70(.17)**	0.50	−.70(.17)**	0.50
Age	.34(.02)**	1.40	.34(.02)**	1.40	.24(.01)**	1.27	.24(.01)**	1.27	.38(.06)**	1.46	.38(.06)**	1.46
Age^2	−.04(.02)**	0.96	−.04(.02)**	0.96	−.04(.01)**	0.96	−.04(.01)**	0.96	−.12(.03)**	0.88	−.12(.03)**	0.89
Controls												
Depression	.07(.01)**	1.07	.07(.01)**	1.07	.03(.00)**	1.03	.03(.00)**	1.03	.08(.02)**	1.08	.08(.02)**	1.08

The reference category for the primary independent variables was non-disabled youth. Coef = standard negative binomial regression coefficient. e^b = exponentiated coefficient (see Footnote 6 for further explanation regarding interpretation). The first two columns under each Dependent Variable display the regression coefficients for the models comparing LD All (i.e., LD youth with/without ADS) against non-LD youth. The third and fourth columns display regression coefficients for the disaggregated models. The disaggregated models compare subgroups of disabled youth against non-learning disabled youth.

***$p < .008$ (alpha level adjusted using Bonferroni correction for multiple comparisons); **$p < .01$; *$p < .05$.

longer significant. Finally, the relationship between disabilities and violence held up across all subgroups. It should be noted that youth who had comorbid LD and attention disorder symptoms had higher delinquency scores than LD only youth. Compared to non-disabled youth, LD only youth reported 23% more violence while a 42% increase in violence scores characterized comorbid youth.

DISCUSSION

This study explored how delinquent behaviors differ between youth with and without learning disabilities. Further, we sought to determine if the relationships between learning disabilities and delinquency held once youth with learning disabilities were disaggregated into those with only learning disabilities and those with both learning disabilities and attention disorder symptoms. Our findings not only have empirical importance but also emphasize the importance for researchers to recognize how methodological issues influence results on research examining disability and crime.

First, our results underscore the need to control for relevant factors that impact the relation- ship between learning disability and delinquency. As discussed earlier, failure to control for relevant factors can exaggerate the effect learning disabilities have on delinquency. This was a criticism leveed against most of the prior literature on the topic, which showed significant and strong relationships between having a learning disability and delinquency (Cosden 2001; Keilitz and Dunivant 1986; Magg et al. 1994; McCrystal et al. 2007). After controlling for the factors, however, one can see a significant weakening of these relationships especially among property offending, alcohol, tobacco, and marijuana use. In fact, even when LD All was disaggregated into the various LD subgroups there was no significant difference in the aforementioned delinquent behaviors when compared to their non-disabled counterparts.

One possible explanation for the lack of differences among these subgroups is that these types of delinquent behaviors may be considered normative among adolescents despite differences in learning abilities. Research has found that minor property crimes and alcohol, tobacco, and marijuana use are increasingly becoming typical adolescent-limited behaviors (Moffitt 1993). Similarly, another important facet to

consider would be to analyze these same subgroups over time into adulthood. Doing so would provide a means to assess whether certain subgroups are more likely to demonstrate continuity of offending behavior into adulthood. Moffitt (1993) suggests that delinquent behavior among adolescents with neurological deficits continues into adulthood. Future research should longitudinally examine the differences in delinquent behavior between the groups examined in this study, as there could be two distinct pathways between these minor delinquent behaviors and more violent behavior. To that end, these findings clearly suggest that when other variables, that have been known to influence both disability status and delinquency, are held constant most of the relationships disappears; however, the noted exception found is evidenced by the differences in violent behavior among youth in this study.

Participation in violence (e.g., fighting) was the most consistent finding across models. Generally speaking, youth with learning disabilities had violence scores that were 25% higher than youth without such disabilities. Interestingly, when learning disability was disaggregated to LD only, comorbid LD/ADS, and ADS only, subgroup differences (23%, 42%, and 53% respectively) in the strength of the effect were also highlighted. Such findings are concerning because

it appears that youth with disabilities are involved in more serious forms of delinquency. Higher levels of violence may be a function of frustration that stems from negative interactions with peers (Agnew 1992). For example, children with learning disabilities may “act out” in terms of fights both in and out of school due to ridicule or social isolation related to their disability.

Understanding that our findings produce no significant differences between groups on measures of minor delinquency but did so on measures of violence, a discussion regarding differential treatment and differential offending is necessary. Remember that adolescents with learning dis- abilities are overrepresented in juvenile correctional facilities across the United States. In fact, children with learning disabilities constitute roughly 30 to 70% of the juvenile correctional population, despite only comprising approximately 5% of the general population (Quinn et al. 2005; U.S. Department of Education 2009). This disparity has been offered as evidence that youth with learning disabilities offend at different rates than youth without disabilities. Our findings show that while youth with learning disabilities report higher levels of violence, a significant difference was not found for any other offense type. The higher level of violence among learning disabled youth helps explain a segment of the disproportionate number of learning disabled youth in juvenile corrections. It is unlikely, however, that this factor alone accounts for the entirety of the overrepresentation of learning disabled youth in juvenile corrections and thus future research should examine what types of offenses youth with learning disabilities commit that result in their conferment. Further research should also be conducted to determine if youth with disabilities experience legal dispositions that include confinement more than youth without such disabilities. Qualitative research would be particularly appropriate to examine this issue, as it would allow researchers to gain a more in-depth understanding as to whether parents, teachers, and actors in the justice system perceive youth with learning disabilities to be more prone to delinquency.

Given our findings concerning comorbidity, examining whether learning disabilities have a direct effect on delinquency is important to consider. Researchers should not assume that individuals with learning disabilities are a homogenous group

and should measure any disability status knowing the possibility that a co-existing disorder may be present. Similarly, studies should operationalize learning disability by clearly stating how the construct is being measured and possible limitations associated with this measurement. In light of these recommendations, the measurement of learning disability used in this study included asking the parent of the child if their child had a learning disability. A limitation with this measurement is that is it not an official diagnosis of learning disability. In addition, parents could incorrectly report disability status. With that said, this item has been used in previous literature to comprise a learning disability measure (Resnick et al. 1997).

Our measurement of attention disorder symptoms is a self-reported measure that asks the participant about whether a doctor has told them they have ADHD. Since this is a self-reported measure the authors understand that we cannot state that this is diagnostic measure of ADHD. As such, we have opted to use the term attention disorder symptoms (ADS) to describe the measure. The authors of the current study opted against using the Wave III retrospective measures for ADHD (Kollins, McClernon, and Fuemmeler 2005) due to the limitations associated with adolescents' ability to self-report retrospective attention disorder symptoms (Miller, Newcorn, and Halperin 2010; Sibley et al. 2012). Ideally, researchers should consider a triangulation method to determine whether a particular disability exists, however, the lack of consistency in terms of operationalizing disability limits this type of approach.

It could also be that learning disability or attention disorder symptoms are proxies for a number of other disadvantages (e.g., socioeconomic status, race, gender); however, after con- trolling for these factors the relationship was inconsistent. Several of our control variables also may actually mediate the relationship between learning disabilities and delinquency. Depression, for example, may result from increased stigma associated with having a learning disability thus triggering delinquent behavior as a coping mechanism (Agnew 1992). Items such as depression may suggest that the direct effects of learning disabilities on delinquency are limited; however, the indirect effects of learning disabilities may reflect a combination of factors that together significantly increase levels of delinquency. To that end, it may not be the learning disability itself that produces the tendency to engage in delinquency but other risk factors that have been stated in the literature and are highly correlated with learning disabilities and/or ADHD. It is recommended that future research examine these relationships through structural equation modeling.

In closing, the relationship between learning disabilities and delinquency is more complex given the issue of comorbidity. Previous research often fails to account for comorbidity and this study suggests that researchers should not treat individuals with disabilities as a homogenous group. As indicated by the findings in this study, it may be the case that individuals with only a learning disability may not engage in significantly more minor delinquency than someone with- out a learning disability. However, individuals with learning disabilities and comorbid LD/ADS appear to engage in more violent acts than their nondisabled counterparts. Future research needs to explore heterogeneity among coexisting disabilities in much greater detail if we wish to move this line of research forward. Finally, juvenile justice prevention and intervention programs should consider disability status and how it potentially can impact delinquency and future recidivism.

ACKNOWLEDGMENTS

The authors thank the anonymous reviewers for their constructive comments and helpful suggestions.

FUNDING

The authors thank the School of Criminology and Criminal Justice at the University of Nebraska at Omaha and The University of Southern Mississippi for providing the funding to secure the Add Health data. This research uses data from Add Health, a program project designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris, and funded by a national grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgement is due to Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Persons interested in obtaining data files from Add Health should contact Add Health, Carolina Population Center, 123 W. Franklin Street, Chapel Hill, NC 27516-2524 (addhealth@unc.edu). No direct support was received from grant P01-HD31921 for the analysis.

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