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## Psychiatric Disorders and Gun Carrying among Adolescents in the United States

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### Abstract

**Objectives**—To estimate associations between psychiatric disorders and gun carrying among adolescents and to estimate the total number of adolescents in the US who have psychiatric disorders and report carrying guns.

**Study design**—We used cross-sectional data from the National Comorbidity Survey – Adolescent Supplement, a nationally representative sample of adolescents age 13–18 years (N = 10123; response rate = 75.6%). Psychiatric disorders were assessed using the Composite International Diagnostic Interview. Gun carrying in the 30 days prior to the interview was assessed by self-report. We used multivariable Poisson regression to test for associations.

**Results**—The analytic sample included 10112 adolescents, 2.4% of whom reported carrying a gun in the prior 30 days. The prevalence of gun carrying was greater among adolescents with conduct disorder (adjusted prevalence ratio [APR] = 1.88, 95% CI 1.38, 2.57), drug use disorders (APR = 1.91, 95% CI 1.05, 3.45), and specific phobias (APR = 1.54, 95% CI 1.07, 2.22) compared with adolescents without these disorders. We estimated that 1.1% (95% CI 0.77, 1.48) of adolescents with a disorder associated with self- or other-directed violence also carry guns. Nationally, that is approximately 272 000 adolescents with both risk factors.

**Conclusions**—Specific psychiatric disorders are associated with an increased risk of gun carrying among adolescents, but the vast majority of adolescents with psychiatric disorders did not report gun carrying. Targeted efforts to assess access to and use of firearms in mental healthcare

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and other clinical settings are important, as are efforts to identify population approaches to prevention.

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Adolescents experience higher rates of violence perpetration and victimization than do those in any other age group.<sup>1-4</sup> Violent crime commission rates peak during late adolescence,<sup>3</sup> and firearm homicide and suicide are ranked as the second and fourth leading causes of death among adolescents and young adults age 15–24 years.<sup>5</sup> Firearm victimizations are also frequent in this age group, with nearly 145 000 such victimizations occurring in 2016.<sup>6</sup>

Among the risk factors for violence are some psychiatric and substance use disorders<sup>7,8</sup> and firearm access.<sup>9-11</sup> Schizophrenia conduct disorder, and substance use disorders, for example, are associated with an increased risk of self- and other-directed violence.<sup>7,8,12</sup> Access to a firearm may facilitate attempts to cause harm as well as increase their lethality, and firearm carrying may be an indicator of even greater and more imminent risk.

Federal law prohibits youth under age 18 years from purchasing or possessing firearms, but this prohibition is not entirely effective at preventing access. According to the Youth Risk Behavior Survey, 5.3% of students in 2015 reported carrying a gun in the previous 30 days. This percentage increases with year in high school.<sup>13</sup> The percentage of gun carriers among youth in inner-city schools and alternative schools is frequently much higher (25% of boys in 1 study,<sup>14</sup> 21% in another<sup>15</sup>). Finally, a study of incarcerated juveniles estimated 84% had carried a gun in their lives.<sup>16</sup>

In a previous population-based study of adults, 8.9% of respondents reported they both had a gun in the home and exhibited impulsive angry behaviors.<sup>17</sup> The co-occurrence of gun carrying and impulsive angry behavior in the population was 1.4%. This translates to 8865 people with guns in the home and impulsive angry behaviors, and 1488 people who carry guns and report impulsive angry behaviors, per 100 000 US residents. In another study, adolescents with a mental disorder were as likely as adolescents without a mental disorder to live in homes with a firearm.<sup>18</sup> Whether these results generalize to gun carrying among adolescents and other mental disorders remains unknown.

The primary objective of this study was to estimate the associations between specific psychiatric and substance use disorders and gun carrying among adolescents (age 13–18 years). The secondary objective was to estimate the size of the adolescent population that has a psychiatric or substance use disorder and reports carrying guns.

## Methods

The National Comorbidity Survey-Adolescent Supplement (NCS-A)<sup>19</sup> is a cross-sectional, nationally representative survey of 13- to 18-year-old adolescents in the US carried out from 2001 to 2004.<sup>20</sup> The NCS-A extends from the National Comorbidity Survey-Replication (NCS-R), a nationally representative survey of adults in the US.<sup>21</sup> Adolescents in the households originally selected for inclusion in the NCS-R were interviewed for the NCS-A.<sup>20</sup> This household sample was supplemented by an additional sample of schools in NCS-R counties.<sup>20</sup> Interviews with adolescents were completed in person. Weights were calculated

to account for differing probabilities of selection and differences in population-level geographic and sociodemographic distributions based on the 2000 US census.<sup>20,21</sup>

Written informed consent was obtained from parents/guardians and assent from the adolescents. Adolescents received \$50 for their participation in the study. The human subjects committees of Harvard Medical School and the University of Michigan approved all recruitment and consent procedures. The Human Subjects Committee of the University of California, Davis approved the current study.

## Measures

### Psychiatric and Substance Use Disorders.

Criteria corresponding to *Diagnostic and Statistical Manual of Mental Disorders-IV* (DSM-IV) diagnoses were assessed with the World Health Organization's Composite International Diagnostics Interview (CIDI), modified for use with adolescents.<sup>22,23</sup> The CIDI is a diagnostic tool administered by trained interviewers. Disorders were grouped into 4 categories following the DSM-IV disorder classes in the CIDI, as well as studied individually. Disorders and their groupings included (1) fear/anger disorders (agoraphobia, panic disorder, a specific phobia, social phobia, intermittent explosive disorder); (2) behavior disorders (attention-deficit/hyperactivity disorder, oppositional defiant disorder, conduct disorder); (3) distress disorders (post-traumatic stress disorder, generalized anxiety disorder, separation anxiety disorder, major depressive episode/dysthymia); (4) substance use disorders (alcohol and drug abuse, with or without dependence); and (5) bipolar disorders (I and II). Disorders were categorized as binary variables indicating whether or not the respondent fit the diagnostic criteria for the disorder in their lifetime. Diagnoses for major depressive disorder, dysthymia, oppositional defiant disorder, and conduct disorder were derived from both parent/guardian and adolescent responses at the symptom level based on research showing parent reports are especially important for identifying these disorders.<sup>24,25</sup> Parent and child responses were combined using an "or" rule.<sup>26</sup> With the exception of these and attention-deficit/hyperactivity disorder, which used only parents' responses,<sup>27</sup> all other disorders used only adolescent responses. In addition, all disorders were identified following DSM-IV criteria with the exception of oppositional defiant disorder, for which criteria were altered to increase clinical validity based on a reexamination of the subsample.<sup>28</sup>

### Gun Carrying.

Gun carrying prevalence was determined based on responses to the following question: "Not counting times you were hunting or shooting targets, how many days during the past 30 days did you carry a gun outside your home?" Gun carrying was assessed as a dichotomous variable (carried a gun one or more days compared with did not carry a gun), as frequent gun carrying was uncommon (78% of gun carriers reported carrying guns 5 or fewer days during the previous 30). Not all guns are firearms. We use "gun" in this article because this is the term used in the survey.

## Sociodemographics.

Sociodemographic variables included sex, age (13–14, 15–16, 17–18 years), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, Other), family income (low, 1.5 times the poverty line; low average, >1.5 to 3 times the poverty line; high average, >3 to 6 times the poverty line; high, 6 times the poverty line), parent education (<high school, high school graduate, some college, college graduate), number of parents in the home (0, 1, 2), region of the country (Northeast, South, Midwest, West), and urbanicity as defined by the Department of Agriculture's rural-urban continuum codes (metro, other urban, rural).<sup>29</sup>

## Statistical Analyses

We began by describing the sociodemographic characteristics of the study population as a whole, and by self-reported gun carrying. We estimated associations between psychiatric or substance use disorders and gun carrying using multivariable Poisson models with linearized variance estimation, including all sociodemographic variables described above. Associations were expressed as prevalence ratios with corresponding 95% CIs. To estimate the number of adolescents with a psychiatric or substance use disorder who also carry guns, we calculated the survey-weighted proportion of adolescents meeting these criteria and multiplied the proportion by the population of adolescents in the US based on 2000 census data.<sup>30</sup> We adjusted survey weights to account for missing outcome data using inverse probability weighting. Analyses were conducted in Stata v 14.2 (StataCorp, College Station, Texas)<sup>31</sup> and included the adjusted survey weights and cluster-adjusted standard errors to account for the complex survey design of the NCS-A.

## Results

Of the 10 123 adolescents surveyed (response rate = 75.6%), 10 112 respondents had complete data and were included in the analytic sample (11 were missing a response for gun carrying). For disorders incorporating parent responses, the analytic sample included 6483 respondents (response rate = 63%; of those interviewed, 11 were missing a response for gun carrying). Gun carrying was uncommon, with only 2.4% of respondents reporting carrying a gun at least 1 day in the prior month. This translates to approximately 580 000 adolescents in the US population in 2000. Notably, among adolescents reporting gun carrying, 65% had a disorder diagnosis. Sample characteristics by gun carrying status are presented in Table I.

### Associations between Psychiatric Disorders and Gun Carrying

The prevalence of gun carrying was greater among those with any disorder diagnosis compared with those with no disorder diagnosis (adjusted prevalence ratio [APR] 1.75, 95% CI 1.07, 2.87) (Table II). Specific disorders associated with gun carrying included conduct disorder (APR 1.88, 95% CI 1.38, 2.57), drug abuse or dependence disorder (APR 1.91, 95% CI 1.05, 3.45), and the category of specific phobias (APR 1.54, 95% CI 1.07, 2.22).

### Population Prevalence of the Co-occurrence of Psychiatric Disorders and Gun Carrying

The extent to which these factors co-occur in the population depends in part on the prevalence of the disorder and the prevalence of gun carrying (Figure). Approximately 397 000 adolescents have a psychiatric disorder and report gun carrying (1.6% of the adolescent

population in 2000, 95% CI 1.19, 2.09). Of these, approximately 203 000 (95% CI 142 000, 264 000) have a psychiatric disorder that is more strongly associated with interpersonal violence (conduct disorder, drug dependence or abuse, and alcohol dependence or abuse)<sup>32</sup> and approximately 101 000 (95% CI 54 000, 148 000) have a psychiatric disorder associated with suicide attempt (post-traumatic stress disorder, bipolar disorder, depression, and dysthymia).<sup>12</sup> The co-occurrence of specific phobias with gun carrying was the most frequent in the sample (0.6%, 95% CI 0.40, 0.75), followed by intermittent explosive disorder (0.5%, 95% CI 0.30, 0.70) and major depressive disorder or dysthymia (0.5%, 95% CI 0.21, 0.72). Nationally, this translates to approximately 139 000 adolescents with specific phobia, 121 000 with intermittent explosive disorder and 112 000 with major depressive disorder or dysthymia who also report gun carrying. Gun carrying was least likely to co-occur with agoraphobia (0.03%, 95% CI 0.00001, 0.06) and panic disorder (0.06%, 95% CI 0.001, 0.12). For comparison, 0.8% (95% CI 0.44, 1.07) of youth in the sample did not fit criteria for diagnosis for a psychiatric disorder and reported gun carrying, which translates to an estimated 183 000 adolescents, nationally.

## Discussion

We found that adolescents with conduct disorder or drug use disorder, both of which are important risk factors for violence, were more likely to carry guns than were youth without these disorders, including youth with other mental health diagnoses. Specific phobias were also associated with an increased prevalence of gun carrying. From a population perspective, the associations witnessed here represent a very small percentage of the adolescent population in the US, and the vast majority of adolescents with a mental health disorder did not report gun carrying. At the same time, nearly two-thirds of adolescents reporting gun carrying had a mental health disorder.

The findings here complement findings from previous, related studies. In a longitudinal study of boys who had been referred to mental health services in Pennsylvania and Georgia, gun carrying was associated with 3.9 times the incidence rate of conduct disorder.<sup>33</sup> A population-based study among Finnish adolescents found psychopathy was significantly associated with gun carrying.<sup>34</sup> Another study among criminal justice-involved youth in Arizona and Pennsylvania found psychological distress was associated with gun carrying, but the association became null when witnessing and experiencing violence were included in the model.<sup>35</sup> An NCS-A study of risk factors for suicide indicated that the prevalence of having a gun in the home was not different for those with and without a lifetime history of mental health disorder.<sup>18</sup> In conjunction with the current study, which found a statistically significant association between a lifetime history of mental health disorder and gun carrying, this suggests adolescents with and without psychological disorders have similar in-home access to guns, but different propensities to carry guns.

Although this study used rigorous methods for identifying youth with mental illness and a nationally representative sample, the measure of gun carrying has not been validated. In addition, “guns” are not always firearms and could include weapons such as air guns. Our analyses controlled for a wide range of variables, but unmeasured confounding could remain. For example, our models do not include measures of neighborhood violence or

individual exposure to violence. The NCS-A constitutes the most recently collected data available to answer the study objectives, but its age (collected 14–17 years prior to this study) and its focus on student respondents may limit generalizability. Finally, we were unable to determine the motivation for gun carrying given the data, which would have provided a more nuanced understanding of risk for different forms of violence.

Our results have important implications for healthcare providers and policymakers. Considering the increased prevalence of gun carrying among adolescents with psychiatric disorders that are also risk factors for violence, asking about access to and use of firearms in mental healthcare and other clinical settings is particularly important.<sup>36,37</sup> Methods of reducing access to firearms for youth could include improving safe storage in the home.<sup>38</sup> Emphasis of safe storage is particularly important as evidence suggests safe storage practices do not differ between households in which adolescents with and without mental illness reside.<sup>39</sup> Given the relative scarcity with which psychiatric or substance use disorders co-occur with gun carrying in the population, reducing firearm violence will also require identifying and addressing other risk factors for gun carrying and violence and implementing population approaches to prevention.

## Glossary

<b>APR</b>	Adjusted prevalence ratio
<b>CIDI</b>	Composite International Diagnostic Interview
<b>DSM-IV</b>	Diagnostic and Statistical Manual of Mental Disorders-IV
<b>NCS-A</b>	National Comorbidity Survey – Adolescent Supplement
<b>NCS-R</b>	National Comorbidity Survey – Replication

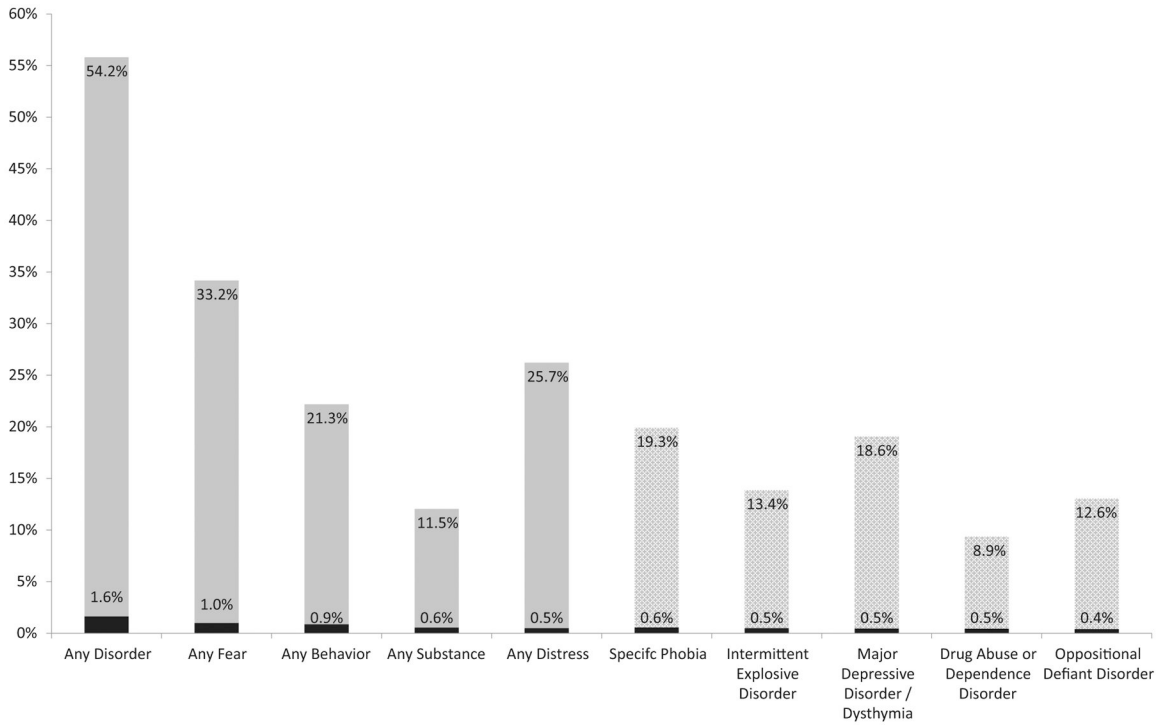
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**Figure.** Psychiatric disorder categories and top 5 most prevalent psychiatric disorder and gun carrying combinations in the US population of adolescents (N = 10 112). Height of gray bars indicates the prevalence of the disorder in the population. Height of black bars indicates prevalence of gun carrying and disorder in the population. n = 6483 for conduct disorder and major depressive disorder/dysthymia, and the categories of any behavior, any distress and any disorder due to the use of the restricted sample in which parent responses were available.

Table 1.

Sociodemographic characteristics overall and by gun carrying status (N = 10 112)

Respondent characteristics	Response	Total N (%) <sup>*</sup>	Carried gun n (%) <sup>*</sup>	Did not carry gun n (%) <sup>*</sup>	P value
Carried a gun in the last 30 d	Yes	239 (2.4)			
	No	9873 (97.6)			
Sex	Male	4953 (51.3)	200 (86.4)	4746 (50.4)	<.0001
	Female	5170 (48.7)	39 (13.6)	5127 (49.6)	
Family income	Lowest	1717 (14.7)	37 (11.3)	1679 (14.8)	.508
	Highest	2023 (19.1)	51 (21.2)	1970 (19.0)	
Age category, y	13,14	3101 (31.8)	80 (36.6)	3020 (31.7)	
	15,16	3282 (34.4)	71 (30.9)	3204 (34.4)	.080
	17,18	3870 (36.2)	69 (27.0)	3798 (36.5)	
	Other	3897 (41.5)	88 (41.3)	3807 (41.5)	
Race/ethnicity	Other	2356 (22.3)	82 (31.7)	2268 (22.0)	.022
	Hispanic	622 (5.0)	16 (3.0)	603 (5.0)	
Parent education	Non-Hispanic black	1914 (14.4)	39 (11.0)	1872 (14.4)	
	Non-Hispanic white	1953 (15.1)	30 (8.8)	1921 (15.2)	.224
	College graduate	5634 (65.5)	154 (77.2)	5477 (65.3)	
Number of parents in home	College graduate	3360 (35.3)	56 (28.0)	3304 (35.5)	
	Some college	1998 (19.4)	42 (16.3)	1954 (19.5)	.425
	High school graduate	3081 (29.7)	99 (38.7)	2979 (29.5)	
	<High school	1684 (15.5)	42 (16.9)	1636 (15.5)	
Region of the country	2 parents	5355 (55.0)	110 (49.0)	5237 (55.2)	
	1 parent	3797 (35.7)	99 (39.4)	3697 (35.6)	.013
	no parents	971 (9.3)	30 (11.6)	939 (9.2)	
	Northeast	1868 (18.2)	27 (9.9)	1838 (18.4)	
Urbanicity	Midwest	2776 (23.3)	70 (28.5)	2704 (23.2)	
	West	3434 (36.0)	102 (43.0)	3328 (35.8)	.003
	South	2045 (22.6)	40 (18.6)	2003 (22.7)	
Other urban	Rural	2311 (14.9)	83 (24.5)	2225 (14.7)	
	Other urban	3304 (37.6)	82 (44.6)	3222 (37.5)	

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Respondent characteristics	Response	Total N (%) <sup>*</sup>	Carried gun n (%) <sup>*</sup>	Did not carry gun n (%) <sup>*</sup>	P value
Metro		4508 (47.5)	74 (30.9)	4426 (47.8)	

\* Survey weighted percentages shown.

Associations between lifetime psychiatric and substance use disorders and reported 30-day gun carrying among US adolescents (N = 10 112)

**Table II.**

	Gun carrying, n (%)	PR (95% CI)	APR (95% CI)
I. Any disorder	98 (3.03)	1.83 (1.17–2.87)	1.75 (1.07–2.87)
II. Bipolar disorders	Suppressed	1.66 (0.81–3.40)	1.59 (0.77–3.29)
III. Fear disorders	96 (2.91)	1.32 (0.94–1.85)	1.45 (0.98–2.13)
Agoraphobia	Suppressed	0.45 (0.16–1.31)	0.66 (0.22–1.96)
Panic disorder	Suppressed	1.05 (0.43–2.53)	1.08 (0.48–2.44)
Specific phobia	46 (2.96)	1.28 (0.87–1.89)	1.54 (1.07–2.22)
Social phobia	26 (3.57)	1.53 (0.88–2.69)	1.71 (0.94–3.08)
IED	61 (3.75)	1.67 (1.07–2.62)	1.54 (0.96–2.46)
IV. Behavior disorders	53 (4.07)	2.09 (1.12–3.92)	1.73 (0.99–3.04)
ADHD	24 (3.79)	1.67 (0.95–2.93)	1.12 (0.64–1.94)
ODD	29 (3.32)	1.47 (0.84–2.55)	1.24 (0.67–2.28)
Conduct disorder	34 (5.08)	2.22 (1.60–3.08)	1.88 (1.38–2.57)
V. Distress disorders	43 (1.93)	0.75 (0.42–1.34)	0.80 (0.39–1.61)
PTSD	12 (1.47)	0.59 (0.21–1.70)	0.84 (0.28–2.53)
GAD	Suppressed	0.80 (0.25–2.54)	0.92 (0.29–2.98)
SAD	52 (2.49)	1.02 (0.62–1.69)	1.14 (0.66–1.96)
MDE/dysthymia	37 (2.50)	1.05 (0.57–1.93)	1.12 (0.54–2.29)
VI. Substance disorders	63 (4.87)	2.29 (1.26–4.16)	1.75 (0.94–3.24)
Alcohol abuse/dependence	44 (5.79)	2.63 (1.40–4.93)	1.83 (0.97–3.47)
Drug abuse/dependence	53 (5.14)	2.36 (1.30–4.27)	1.91 (1.05–3.45)

*ADHD*, attention-deficit/hyperactivity disorder; *GAD*, generalized anxiety disorder; *IED*, intermittent explosive disorder; *MDE*, major depressive disorder; *ODD*, oppositional defiant disorder; *PR*, prevalence ratio; *PTSD*, post-traumatic stress disorder; *SAD*, separation anxiety disorder.

Prevalence ratios describe prevalence of reported gun carrying among adolescents with indicated disorder/prevalence of reported gun carrying among those without the indicated disorder. Some cells are suppressed due to low numbers.

n = 6483 for conduct disorder and major depressive disorder/dysthymia, and the categories of any behavior, any distress and any disorder because of the use of the restricted sample in which parent responses were available.