



Published in final edited form as:

J Am Acad Child Adolesc Psychiatry. 2026 February ; 65(2): 291–300. doi:10.1016/j.jaac.2025.04.011.

Do Children's Mental Health Symptoms Impact Their Access to Unlocked Guns at Home?

Guangyu Tong, PhD^{1,2}, Josie Caves Sivaraman, PhD^{3,4}, Michele M. Easter, PhD⁴, Naomi N. Duke, MD, PhD, MPH⁴, Megan L. Ranney, MD, MPH^{1,2}, Jeffrey W. Swanson, PhD⁴, William E. Copeland, PhD⁵

¹Yale School of Medicine, Yale University, New Haven, Connecticut

²Yale School of Public Health, Yale University, New Haven, Connecticut

³RTI International, Research Triangle Park, North Carolina

⁴Duke University School of Medicine, Duke University, North Carolina

⁵Larner College of Medicine, The University of Vermont, Vermont

Abstract

Objective: To test whether changes in children's mental health symptoms predict changes in their access to unlocked guns at home.

Method: This study used data from a longitudinal cohort study of 1,420 youth and their parents in the Southeastern US. Parents were assessed annually up to eight times about their child's mental health (i.e., conduct, oppositional defiant, depression, and anxiety symptoms) between ages 9 to 16 (6,674 observations total). Parents were also asked whether there were guns in their home and whether they were locked. Generalized linear mixed-effect models were used to test associations between changes in symptoms and in-home gun access adjusted for sociodemographic variables. Children with or without access to unlocked guns at baseline were differentiated in analyses.

Results: Sixty-six percent of parents reported that their child had access to an unlocked gun at some point between ages 9-16. In homes in which children *did not* have gun access at baseline, changes in youth mental health symptoms did not increase or decrease the likelihood of child having access to unlocked guns subsequently. In homes in which children *did* have guns access at baseline, however, increases in some mental health symptoms (either oppositional defiant (OR=0.43, CI=[0.35, 0.53], p<0.001), or depression symptom (OR=0.74, CI=[0.59, 0.92], p<0.008)) were associated with reduced gun access at the next timepoint. These associations were strongest for adolescents.

Correspondence to Guangyu Tong, PhD, Department of Internal Medicine, Yale School of Medicine, 135 College St., Suite 234, New Haven, CT 06510; guangyu.tong@yale.edu.

Guangyu Tong served as the statistical expert for this research.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Disclosure: Guangyu Tong, Josie Caves Sivaraman, Michele M. Easter, Naomi N. Duke, Megan L. Ranney, Jeffrey W. Swanson, and William E. Copeland have reported no biomedical financial interests or potential conflicts of interest.

Conclusion: In an area where gun culture is strong, parents reported making safety-conscious adjustments to their children's gun access when their children displayed emotional or behavioral symptoms.

Keywords

mental health; in-home gun access; conduct disorder; oppositional defiant disorder; depression

INTRODUCTION

Children in the United States often have access to unlocked firearms in their homes.^{1,2} Surveys show that among households with children, one-third have at least one firearm in the home, and among firearm-owning households with children, only three in ten households safely store firearms (i.e., both unloaded and locked).² Firearm injury is a leading cause of death among children aged from birth to 19 in the United States.^{3–5} In-home gun access, in particular, poses significant risk of firearm injuries among children. For instance, more than 80% of firearm suicides for children aged 10–17 happened in a house or apartment,⁶ and more than 70% of suicides and suicide attempts used the victim's parent's gun.⁷ Firearm suicide risk is also over-represented among children diagnosed with mental health problems.⁶

For decades, public health and healthcare practitioners have advocated access reduction approaches such as safe storage or firearm removal practices,^{8–10} lethal means restriction,^{11,12} and violence or suicide intervention programs in hospitals,^{13,14} to reduce firearm-related violence, suicide, and injury for children. State-level child access prevention laws that impose criminal liability for negligently stored firearms are also associated with reductions in pediatric firearm injuries.^{15,16} In most of those existing interventions, parents play a crucial role in preventing firearm injuries to their children, in particular those struggling with mental health or behavioral problems. While existing literature has focused on identifying intervenable approaches to encourage firearm-owning parents to address child firearm access, few studies have examined how parents exercise control over child firearm access in response to their children's mental and behavioral problems.

Existing studies show mixed evidence of a relationship between in-home firearm storage practice and children's mental illness.^{17–21} A major limitation of the existing studies is that the associations assessed are cross-sectional and prone to confounding by various demographic and socioeconomic factors underlying the link between mental or behavioral disorders and firearm access in childhood. A clear chronological order between mental health disorder symptomatology onset and subsequent firearm access is necessary to evaluate how they relate. In addition, past studies suffer from data quality issues (e.g., low response rate²⁰, small selected sample with low generalizability¹⁷, lack of accurate measurement of mental health disorders^{18,22}). To our knowledge, no existing study has prospectively followed children with a cohort design that enables the observation of changes in both behavioral and mental health disorder symptoms and firearm access, along with related factors.

This study addresses this gap by conducting a secondary analysis of data from the prospective, community-representative Great Smoky Mountain Study (GSMS), a study on children living in predominantly non-urban, American Indian or White households that are known to have a high rate of in-home firearm possession.²³ GSMS collected repeated annual observations on children and their families during middle childhood and adolescence and measured both access to unlocked guns and childhood mental health symptoms. This design allows us to employ a lagged analysis to test whether increases in different types of childhood mental health symptoms affected subsequent child access to unlocked guns. This study will consider two conditions: 1) homes in which children did not have access to unlocked guns at baseline and 2) homes in which children already had access to unlocked guns. In addition, we tested the potential differences in the association of mental health symptoms and gun access by developmental period (age<13 or ≥13), sex, and race (American Indian vs. White).

METHOD

Participants

The Great Smoky Mountains Study is a longitudinal, community-representative study of children in 11 predominantly rural counties in the Southeastern US starting from 1993.²⁴ A total of N = 1,420 children (in three cohorts starting from age 9, 11, or 13) were recruited from a pool of about 12,000 children using a two-stage sampling design (49% female participants; see more details at ²⁵). First, potential participants were randomly selected from the population using a household equal probability design. Next, participants were screened for risk of psychopathology and those that screened as high risk were oversampled in addition to a random sample of the rest. American Indians were oversampled to constitute 25% of the sample. Sampling weights inversely proportional to their probability of selection allow representative prevalence estimates despite oversampling. See ascertainment Figure S1 (available online) and references^{24,25} for additional detail.

Annual follow-up assessments were completed until age 16 (6,674 observations of 1,420 individuals; 1993 to 2000). In-person interviews were the primary form of assessment unless participants moved from the study area, in which case the interview was done by phone. Parents and children signed informed consent/assent forms before all interviews. Duke University Medical Center Institutional Review Board reviewed and approved the study protocol and consent forms for each initial and follow-up assessment.

Variables and Measurement

All mental health-related variables were assessed via interviews with the participants and a primary caregiver using the structured Child and Adolescent Psychiatric Assessment (CAPA).²⁶ The CAPA focuses on the 3 months preceding the interview to minimize recall bias. The reliability and validity of the CAPA are well established.^{27,28} A symptom was counted as present if reported by a parent, regardless of the child report, as parent report is most relevant to decision making regarding children's gun access.

The following four symptom scales were measured at ages 9 to 16: conduct disorder, oppositional defiant disorder, anxiety, and depression. Conduct disorder includes 15 symptoms²⁹ assessing repetitive and persistent patterns of behaviors in categories including aggressive behaviors (i.e., aggression to people and animals, destruction of property), deceitfulness/theft, and serious violations of rules.^{30,31} Both the overall conduct disorder symptom score and scores within each of the three categories were constructed. Oppositional defiant disorder includes 8 symptoms assessing negative, hostile, and defiant behavior. Anxiety includes 29 nonoverlapping symptoms assessing generalized anxiety, overanxious disorder, separation anxiety, social phobia, specific phobia, agoraphobia and panic disorder in their children. Depression includes 10 symptoms related to a DSM-IV major depressive episode, dysthymia, and depression not otherwise specified.

Gun access at home. Through age 16, participants and primary caregivers were asked whether any household member had a gun, whether gun was unlocked, and whether the participant had their own gun. Gun access was defined as either a child owning a gun or having access to an unlocked gun. No access to guns was defined as either having a gun locked up or not having a gun at home.

Covariates. Socio-demographic covariates included sex, race (i.e., American Indian, Black, or White), age at assessment and cohort, and urban/rural residence. Urban/rural residence status was based upon Census-based designations for the counties and census tracts. Psychosocial risk covariates at home include low socioeconomic status, environmental vulnerability, family dysfunction, and parent problems (Supplement 1, available online).

Statistical Analysis

Individual-level summary statistics for aggregated observations within each individual are provided for the whole sample and by gun access status. Differences in variable percentages or means were tested with χ^2 tests or student t-tests and are survey-weighted. Observation-level descriptive statistics for frequencies of gaining, maintaining, or losing gun access from time t to $t + 1$ ($t = 0, 1, 2, 3, 4$, representing measures from age 9 to 16) were calculated. Associations between changes in the symptom scores across repeated measures from time t (baseline) to $t + 1$ and gun access at time $t + 1$ ($t = 0, 1, 2, 3$ representing ages 9 to 14; $t + 1 = 1, 2, 3, 4$ representing ages 11 to 16) were estimated using the generalized linear mixed-effects models with the *glmer()* function in “lme4” in R 4.2.1 to accommodate the repeated observations within individuals. Two sets of models were fitted: 1) observations with gun access at baseline; and 2) observations without gun access at baseline. Subgroup analyses were performed by age (9-12 vs. 13-16), sex at birth, and racial groups (American Indian vs. White). All models adjusted for covariates at time t . The sampling weight derived from the two-stage sampling design in GSMS was accounted for in all models. The threshold of $p < 0.05$ was considered significant in all associations. For descriptive statistics, weighted percentages and unweighted Ns/sample sizes are reported according to the common conventions. Sensitivity analyses were performed by treating the gun access outcome as a three-category variable (i.e., no gun at home, having a gun at home without access for children, and having gun access for children).

Missing data

For all assessments on the 1,420 participants interviewed during childhood between age 9 and 16, 83% were complete. Residential area (rural or urban) missingness was replaced using information from repeated measures within individuals when available. Missingness was generally rare (< 3% for all entries), and we imputed 10 datasets for all regression analyses and used Rubin's formula to combine covariance matrices to obtain synthesized results.³²

RESULTS

Overall summary statistics and by gun access

There were 6,674 observations on 1,420 unique individuals measured between ages 9 and 16. Table 1 presents descriptive statistics for all study variables at the individual level. Most parents (978 or 65.5%) reported that children had in-home gun access or owning a gun at least once during childhood; 442 (or 34.5%) children never had gun access. Gun access/ownership was concentrated among male participants ($p<0.001$), Whites ($p<0.001$), rural residents ($p<0.001$), and participants with family dysfunction ($p<0.001$). Gun access was also associated concurrently with multiple types of mental health symptoms. These associations are consistent with existing studies on childhood gun access in rural areas.^{8,17,21} Table S1 (available online) provides descriptive statistics for all study variables at the observation level.

Changes in access to unlocked guns during childhood

Figure 1 presents the observed changes in gun access at home across adjacent observations. Among observations where the child did not have access to an unlocked gun at time t , 76.3% had the same non-access status at time $t+1$, while 23.7% had gun access at time $t+1$. By contrast, among observations where the children had access to an unlocked gun at time t , 66.9% had the same gun access at $t+1$ while 33.1% no longer had gun access at time $t+1$. Children without gun access were more likely to maintain their non-access status than children with gun access were to maintain their access ($p<0.001$). Changes in gun access status from one observation to the next were not uncommon, accounting for 27.0% of observations.

Children with access to unlocked guns at baseline

We first tested the impact of changes in youth mental health symptoms in families in which children had access to an unlocked gun (Table 2). Changes in conduct disorder symptoms overall were not associated with a change in in-home gun access, but changes in deceitfulness/theft (adjusted OR=0.43, CI = [0.22, 0.87], $p=0.02$) and violation of rules (adjusted OR=0.22, CI = [0.07, 0.76], $p=0.02$) were associated with reduced access to unlocked guns. Increased oppositional defiant (adjusted OR=0.43, CI = [0.35, 0.53], $p<0.001$) or depressive symptoms (adjusted OR=0.74, CI = [0.59, 0.92], $p=0.008$) were associated with significant reductions in access to unlocked guns. No such association was observed for anxiety symptoms. The reduction in access to unlocked guns for those with increasing oppositional defiant symptoms as compared to the same/decreasing symptoms

was 10-18%; for those with increasing depression symptoms as compared to the same/decreasing symptoms was 8-9% (see unadjusted changes for all symptoms on Table S2, available online).

Follow-up subgroup analyses tested whether these associations differed based on developmental period (Table 3), child's sex at birth (Table S3, available online), or race (Table S4, available online). The association of changes in conduct disorder and oppositional defiant disorder symptoms with access to unlocked guns were significantly stronger in adolescence than in childhood. Only changes in conduct disorder symptoms – either deceitfulness/theft or overall symptoms – varied by sex with reductions in access to unlocked guns observed for male participants only. Increased deceitfulness/theft, oppositional defiant disorder, and depression symptoms predicted reduced gun access only among Whites but not American Indians, though no significant differences were indicated by the interaction tests.

Children without access to unlocked guns at baseline

Next, we tested whether changes in mental health symptoms predict access to unlocked guns for children who did not have access to unlocked guns at baseline (Table 4). Changes in symptoms were not associated with the likelihood of access to unlocked gun at follow-up for any symptom type. Additional subgroup analyses were performed by developmental period (Table S5, available online), child's sex at birth (Table S6, available online), or race (Table S7, available online). Increased deceitfulness/theft and oppositional disorder predicted access reduction for the age group of 13-16 but not age group of 9-12, with significant interaction by age observed for oppositional disorder. Some symptom-access associations were significant among male but not female participants, while none were significant in stratified analysis by race.

Sensitivity analysis

Follow-up sensitivity analyses (Tables S8–10, available online) treated access to unlocked guns outcome as a three-category variable and found the group with guns at home but locked up to children was similar to the no gun-at-home group, and thus, the combination of those two groups was appropriate. In addition, among children with access to unlocked guns at baseline (Table S10, available online), an increase in oppositional defiant disorder symptoms was associated with a reduction in gun access, even though the guns remained in the home. This suggests that the reduction in gun access is attributable to the increased symptoms rather than external confounding factors that might simultaneously contribute to both symptom escalation and gun removal. The results are included. We also examined whether increases in suicidality predicted reduced access to unlocked guns, but the findings were not statistically significant (OR = 2.57, CI = [0.78, 8.48], $p = 0.12$). This may be influenced by the low prevalence of parent-reported suicidality in our study sample, which occurred in less than 3% of participants.

DISCUSSION

In this community-representative, predominantly rural sample, most children had either access to unlocked guns or self ownership reported at least once from age 9 to 16. Changes in in-home access to unlocked guns during childhood were common (27.0%). Such changes in gun access were associated with changes in childhood mental health symptoms, but the results were asymmetric. Children who had access to unlocked guns tended to have their access limited after increases in mental health symptoms like deceitfulness, violation of rules, oppositionality and depression. Increases in symptoms were often associated with a significant reduction in the odds of the child having gun access at follow-up in adolescence, among males, and among Whites. In contrast, changes in youth mental health symptoms did not increase or decrease the likelihood of parents granting gun access to children in the first place.

Parents are often in the best position to evaluate their children's emotional and behavioral functioning, and it is reasonable for them to consider such information when deciding whether to keep a gun in the home and providing the child access to unlocked guns. Each of the symptoms identified here is associated with adverse outcomes. For example, oppositional defiant disorder and conduct disorder are considered part of a continuum of disruptive and antisocial behaviors, with the former considered milder and a potential precursor to the onset of more severe behavioral or mental health problems or criminality.^{33,34} While this study was not designed to establish a direct association between suicidality and gun access, depression has long been recognized as a potent risk factor for suicidal ideation or attempts. (e.g.,³⁵) Among children with worsening depression, reducing access to unlocked guns can significantly decrease both suicide attempts and death by suicide rates.⁷

Changes in gun access may reflect parental concerns about behavioral disorders or depressive symptoms in children. Parents might restrict firearm access as a precautionary measure in response to increasing behavioral issues or mental health challenges, aiming to ensure safety rather than using it as a form of discipline. Past studies have not linked childhood mental health symptoms with reduced gun access because they have all relied upon a cross-sectional design. The current study followed families over time and suggests that parents whose children have access to unlocked guns may limit that access based on symptom levels.

Among children with access to unlocked guns at the baseline, how changes in mental health symptoms influenced children's gun access varied by developmental stage, where parents were more responsive to increased symptoms during adolescence (age 13- 16) compared to age below 13. As children enter adolescence, parents may become more attuned to the risks associated with access to unlocked guns due to the known correlation between adolescent mental health problems and increased risk for violent behaviors and suicide.^{37,38} For younger children (below 13), mental health changes might not be deemed severe enough to warrant restrictions or may not correlate strongly with gun access decisions, as firearms might be seen as off-limits regardless. Moreover, increased symptoms in conduct disorder (in particular deceitfulness/theft) were more predictive of reduced gun access among male

than female participants, whereas symptom changes in oppositional defiant disorder were about equally predictive of access to unlocked guns for both male and female participants. The association between increased depressive symptoms and reduced access to unlocked guns was more pronounced among female participants, suggesting that parents may be more responsive to what they perceive as gender-typical patterns of mental health issues. Conduct problems are generally more common in male participants, while depressive symptoms are typically more prevalent in female participants.^{39,40} In addition, symptom changes in deceitfulness/theft, oppositional defiant disorders, and depression were predictive of reduced access to unlocked guns only among Whites but not among American Indians, though the interactions between racial groups and changes in symptom scores were all insignificant. This may be related to the relatively small number of American Indian participants, but could also reflect the complex interplay of factors such as cultural attitudes toward firearms within some Native American communities,⁴¹ historical inequalities (e.g., historical trauma, distrust of external authorities),^{42,43} and disparities in access to health resources (e.g., mental health services, counseling, and interventions).^{44,45} We note that few studies include an adequate subsample of Native American youth, and urge future researchers to ensure representation of Native American populations to allow further investigation of these relationships. Additionally, our results also suggested parental response to mental health symptoms differed between children who already had access to unlocked gun and those who were initially granted access. For the latter, some positive symptom-access associations were observed among male participants. Besides differentiated gender norms, children who already have access to unlocked gun at baseline may be part of families where firearms are normalized and integrated into the household routine, and these families may be more sensitive to changes in the child's mental health because they are aware of the potential risks posed by guns in the home.⁴⁶

These findings have implications for healthcare providers and other practitioners working with families. First, gun access can be fluid over time. Even in an area of the country where gun culture is strong,⁴¹ parents appear to be aware of, and potentially responsive to, the risks posed by access to unlocked guns when their children exhibit emotional or behavioral issues. Healthcare practitioners may have the potential to influence parents' decisions on how and when to limit their children's gun access. This aligns with the approach suggesting that healthcare providers play a pivotal role in firearm safety counseling, especially in pediatric and family health settings (e.g.,^{47,48}). The effectiveness of such interventions can be enhanced through culturally competent approaches that consider the context of families living in regions with strong gun traditions.⁴⁹ Second, *this study* suggests that even families that do not currently allow their children access to guns may still benefit from education on risks for firearm injury. In households that did not give their children access to firearms at baseline, no association was found between children's mental health symptoms and gun access; in some cases, increases in symptoms were paradoxically linked to greater access at follow-up. Our findings therefore support the idea that routine firearm counseling should be a standard part of pediatric and family healthcare, regardless of firearm access at baseline, much like interventions on safe sex, smoking, and alcohol use.^{48,50} Providing firearm safety education, even in the absence of confirmed gun access, may help families make informed decisions about gun safety in their homes.

This study leveraged a distinctive community-representative sample followed repeatedly over time and assessed rigorously for mental health symptoms and gun access. However, the following caveats should be considered when evaluating our findings. First, although the lagged analysis used here inherits the logic of the “difference-in-difference” model⁵¹ which is often used to estimate a causal effect, it likely does not completely eliminate confounding in a cohort design. Changes in mental health symptoms can possibly be either a cause or consequence of another causal agent that affects gun access. As such, the interpretation of our results should still be considered associational. Our analysis, stratified by the gun access of children at time *t*, is unconditional on either the gun access or symptom score changes at previous times. The underlying assumption here is that given observations at time *t*, the outcome of gun access is independent of observations before time *t*. Second, our effect estimates are based on a single-point change in symptoms. While these estimates show good sensitivity in the potential responses of parents to children’s mental health conditions, the unit of effect might not be clinically relevant. Third, the measurement of gun access in our study is based on parental reports, which may not fully capture children’s actual access to firearms. Prior research has demonstrated that caregiver perceptions and child-reported access can be discordant,^{52,53} and this reliance on parental perception introduces the potential for reporting bias. As such, our findings may only reflect how parents perceive and report their children’s access to firearms, which may not align with actual access. Fourth, the GSMS collected data from 11 rural counties in the Southeast since the early 1990s and was designed to be representative of rural areas in the Southeast United States and Appalachia. Results may or may not generalize to other periods and broader regions. Fifth, our results are limited by potential recall bias and ambiguity in self-reported firearm storage, as our instrument lacks specificity in defining ‘locked’ firearms. Reporting may also be influenced by the child’s mental health status, potentially affecting associations. The fluctuations in firearm access over time may reflect genuine changes in household ownership or storage practices, though recall bias remains a possibility. Future research is needed to better understand the stability of household firearm ownership and the factors that drive changes over time.

Given the 30-year difference between the study data and the present day, it is important to acknowledge that societal, cultural, political, and policy factors, such as the development of social media, the increased frequencies of school shootings, changing views on firearm ownership may influence the relevance of our findings. Notably, the period of study predates the 1999 Columbine High School shooting, an event that fundamentally changed public discourse on youth access to firearms and prompted a wave of policies and parental vigilance.⁵⁴ Subsequent incidents, including the shootings at Sandy Hook Elementary (2012), Marjory Stoneman Douglas High School (2018), and Robb Elementary School in Uvalde (2022), have amplified concerns and awareness about the link between children’s mental health and gun access. The high-profile conviction of the parents of the Michigan shooter Ethan Crumbley in 2021 (Oxford High School) further underscores growing societal and legal expectations for parental responsibility. While it is possible that heightened awareness has led to greater restrictions on firearm access in response to children’s mental health concerns, it remains unclear how these shifts have affected household firearm practices over time. We hope this analysis will inform future research to capture

contemporary parental attitudes and behaviors surrounding firearm access and youth mental health.

In conclusion, in-home gun access among children is common in the United States and is a major risk factor for firearm injuries among children, including suicide, homicide, and accidents. We present a high-risk demographic group of predominantly White, rural residents in the American Southeast, where the prevalence of in-home firearm access among children is high,^{21,23} and the willingness to curb firearm access or practice safe storage is low.¹⁷ Nevertheless, our findings suggest that parents in such a high-risk demographic group may reduce gun access for children when they observe increased symptoms of certain mental and behavioral problems. Increasing parents' exposure to knowledge on mental and behavioral health risk factors for firearm injuries through education can be a viable means of informing parents' decision-making over children's gun access.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This research was funded by the National Institute of Mental Health (Award Number: R01MH117559 to William E. Copeland). This work is also supported by National Center for Injury Prevention and Control (Award Number: R01CE00326 to Megan L. Ranney) and National Institute of Child Health and Human Development (Award Number: R01HD093655 to Megan L. Ranney). Additional support was provided by the Joyce Foundation, the Fund for a Safer Future, and the Elizabeth K. Dollard Charitable Trust (funding to Jeffrey Swanson).

Data Sharing:

Data collected for the study will not be made available to others.

REFERENCES

1. Johnson RM, Coyne-Beasley T, Runyan CW. Firearm ownership and storage practices, US households, 1992–2002: A systematic review. *American journal of preventive medicine*. 2004;27(2):173–182. doi:10.1016/j.amepre.2004.04.015 [PubMed: 15261906]
2. Azrael D, Cohen J, Salhi C, Miller M. Firearm storage in gun-owning households with children: results of a 2015 national survey. *Journal of urban health*. 2018;95:295–304. doi:10.1007/s11524-018-0261-7 [PubMed: 29748766]
3. Cunningham RM, Walton MA, Carter PM. The Major Causes of Death in Children and Adolescents in the United States. *New England Journal of Medicine*. 2018;379(25):2468–2475. doi:10.1056/NEJMSr1804754 [PubMed: 30575483]
4. Andrews AL, Killings X, Oddo ER, Gastineau KA, Hink AB. Pediatric firearm injury mortality epidemiology. *Pediatrics*. 2022;149(3). doi:10.1542/peds.2021-052739
5. Schnitzer PG, Dykstra HK, Trigylidas TE, Lichenstein R. Firearm suicide among youth in the United States, 2004–2015. *Journal of behavioral medicine*. 2019;42:584–590. doi:10.1007/s10865-019-00037-0 [PubMed: 31367924]
6. Fowler KA, Dahlberg LL, Haileyesus T, Gutierrez C, Bacon S. Childhood firearm injuries in the United States. *Pediatrics*. 2017;140(1). doi:10.1542/peds.2016-3486
7. Grossman DC, Reay DT, Baker SA. Self-inflicted and unintentional firearm injuries among children and adolescents: the source of the firearm. *Archives of pediatrics & adolescent medicine*. 1999;153(8):875–878. doi:10.1001/archpedi.153.8.875 [PubMed: 10437764]

8. Grossman DC, Mueller BA, Riedy C, et al. Gun storage practices and risk of youth suicide and unintentional firearm injuries. *Jama*. 2005;293(6):707–714. doi:10.1001/jama.293.6.707 [PubMed: 15701912]
9. Miller M, Azrael D, Hemenway D, Vriniotis M. Firearm storage practices and rates of unintentional firearm deaths in the United States. *Accident Analysis & Prevention*. 2005;37(4):661–667. doi:10.1016/j.aap.2005.02.003 [PubMed: 15949457]
10. Monuteaux MC, Azrael D, Miller M. Association of increased safe household firearm storage with firearm suicide and unintentional death among US youths. *JAMA pediatrics*. 2019;173(7):657–662. doi:10.1001/jamapediatrics.2019.1078 [PubMed: 31081861]
11. Kruesi MJ, Grossman J, Pennington JM, Woodward PJ, Duda D, Hirsch JG. Suicide and violence prevention: parent education in the emergency department. *Journal of the American Academy of Child & Adolescent Psychiatry*. 1999;38(3):250–255. doi:10.1097/00004583-199903000-00010 [PubMed: 10087685]
12. Bandealy A, Herrera N, Weissman M, Scheidt P. Use of lethal means restriction counseling for suicide prevention in pediatric primary care. *Preventive Medicine*. 2020;130:105855. doi:10.1016/j.ypmed.2019.105855 [PubMed: 31644896]
13. Nofi CP, Roberts BK, Cornell E, et al. Hospital-Based Violence Intervention Programs to Reduce Firearm Injuries in Children: A Scoping Review. *Journal of Pediatric Surgery*. Published online April 29, 2023. doi:10.1016/j.jpedsurg.2023.04.020
14. Cleary A, Kaczor F, Finnegan M, et al. An intervention to improve safe firearm storage for adolescents presenting with suicide ideation or attempt in a pediatric emergency department. *Inj Epidemiol*. 2022;9(S1):37. doi:10.1186/s40621-022-00399-1 [PubMed: 36544234]
15. Kivisto AJ, Kivisto KL, Gurnell E, Phalen P, Ray B. Adolescent suicide, household firearm ownership, and the effects of child access prevention laws. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2021;60(9):1096–1104. doi:10.1016/j.jaac.2020.08.442 [PubMed: 32971189]
16. Ranney ML, Zeoli AM, Beidas R. Evidence-based solutions to pediatric firearm deaths —the need for out-of-the-box answers. *JAMA pediatrics*. 2020;174(5):411–412. doi:10.1001/jamapediatrics.2019.6239 [PubMed: 32119061]
17. Brent DA, Baugher M, Birmaher B, Kolko DJ, Bridge J. Compliance With Recommendations to Remove Firearms in Families Participating in a Clinical Trial for Adolescent Depression. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2000;39(10):1220–1226. doi:10.1097/00004583-200010000-00007 [PubMed: 11026174]
18. Simonetti JA, Theis MK, Rowhani-Rahbar A, Ludman EJ, Grossman DC. Firearm Storage Practices in Households of Adolescents With and Without Mental Illness. *Journal of Adolescent Health*. 2017;61(5):583–590. doi:10.1016/j.jadohealth.2017.05.017
19. Sigel EJ, Mattson SA, Mercado MC. Increased violence involvement and other behavioral and mental health factors among youth with firearm access. *Journal of Adolescent Health*. 2019;65(1):63–71. doi:10.1016/j.jadohealth.2019.01.028
20. Scott J, Azrael D, Miller M. Firearm storage in homes with children with self-harm risk factors. *Pediatrics*. 2018;141(3). doi:10.1542/peds.2017-2600
21. Gutierrez CM, Prickett KC, Hollowell C, Teiko P, Caton L. Type of household firearm ownership and firearm suicide among adolescents, 1976–2018. *Preventive Medicine*. 2022;165:107244. doi:10.1016/j.ypmed.2022.107244 [PubMed: 36089096]
22. Simonetti JA, Mackelprang JL, Rowhani-Rahbar A, Zatzick D, Rivara FP. Psychiatric comorbidity, suicidality, and in-home firearm access among a nationally representative sample of adolescents. *JAMA psychiatry*. 2015;72(2):152–159. doi:10.1001/jamapsychiatry.2014.1760 [PubMed: 25548879]
23. Morral AR, Smart R, Schell TL, Vegetabile B, Thomas E. Geographic and Demographic Differences in the Proportion of Individuals Living in Households With a Firearm, 1990–2018. *JAMA Network Open*. 2024;7(2):e240562–e240562. doi:10.1001/jamanetworkopen.2024.0562 [PubMed: 38416496]

24. Costello EJ, Mustillo S, Erkanli A, Keeler G, Angold A. Prevalence and development of psychiatric disorders in childhood and adolescence. *Archives of general psychiatry*. 2003;60(8):837–844. doi:10.1001/archpsyc.60.8.837 [PubMed: 12912767]
25. Copeland WE, Angold A, Shanahan L, Costello EJ. Longitudinal patterns of anxiety from childhood to adulthood: the Great Smoky Mountains Study. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2014;53(1):21–33. doi:10.1016/j.jaac.2013.09.017 [PubMed: 24342383]
26. Angold A, Costello EJ. The child and adolescent psychiatric assessment (CAPA). *Journal of the American Academy of Child & Adolescent Psychiatry*. 2000;39(1):39–48. doi:10.1097/00004583-200001000-00015 [PubMed: 10638066]
27. Angold A, Costello EJ. A test–retest reliability study of child-reported psychiatric symptoms and diagnoses using the Child and Adolescent Psychiatric Assessment (CAPA-C). *Psychological medicine*. 1995;25(4):755–762. doi:10.1017/s0033291700034991 [PubMed: 7480452]
28. Angold A, Erkanli A, Copeland W, Goodman R, Fisher PW, Costello EJ. Psychiatric diagnostic interviews for children and adolescents: a comparative study. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2012;51(5):506–517. doi:10.1016/j.jaac.2012.02.020 [PubMed: 22525957]
29. Rowe R, Costello EJ, Angold A, Copeland WE, Maughan B. Developmental pathways in oppositional defiant disorder and conduct disorder. *Journal of abnormal psychology*. 2010;119(4):726. doi:10.1037/a0020798 [PubMed: 21090876]
30. Breslau J, Saito N, Tancredi DJ, Nock M, Gilman SE. Classes of conduct disorder symptoms and their life course correlates in a US national sample. *Psychological medicine*. 2012;42(5):1081–1089. doi:10.1017/S003329171100198X [PubMed: 21943502]
31. Hinshaw SP, Lee SS. Conduct and oppositional defiant disorders. In: *Child Psychopathology*. 2nd ed. ; 2003:144–198. Accessed October 16, 2024. [https://books.google.com/books?hl=en&lr=&id=uoKsJUd-73gC&oi=fnd&pg=PA144&dq=Hinshaw,+S.+P.,+%26+Lee,+S.+S.+\(2003\).+Conduct+and+Oppositional+Defiant+Disorders.+In+E.+J.+Mash+%26+R.+A.+Barkley+\(Eds.\),+Child+Psychopathology+\(2nd+ed.,+pp.+144%E2%80%9393198\).+New+York:+Guilford+Press.&ots=Lm9ijZJwzA&sig=YLfnXlmZykDxJFKRtle9mUmvhF4](https://books.google.com/books?hl=en&lr=&id=uoKsJUd-73gC&oi=fnd&pg=PA144&dq=Hinshaw,+S.+P.,+%26+Lee,+S.+S.+(2003).+Conduct+and+Oppositional+Defiant+Disorders.+In+E.+J.+Mash+%26+R.+A.+Barkley+(Eds.),+Child+Psychopathology+(2nd+ed.,+pp.+144%E2%80%9393198).+New+York:+Guilford+Press.&ots=Lm9ijZJwzA&sig=YLfnXlmZykDxJFKRtle9mUmvhF4)
32. Tong G, Li F, Allen AS. Missing Data. In: Piantadosi S, Meinert C, eds. *Principles and Practice of Clinical Trials*. Springer, Cham; 2020:1–21.
33. Loeber R, Burke JD, Lahey BB, Winters A, Zera M. Oppositional defiant and conduct disorder: a review of the past 10 years, part I. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2000;39(12):1468–1484. doi:10.1097/00004583-200012000-00007 [PubMed: 11128323]
34. Booker JA, Ollendick TH, Dunsmore JC, Greene RW. Perceived parent–child relations, conduct problems, and clinical improvement following the treatment of oppositional defiant disorder. *Journal of Child and Family Studies*. 2016;25:1623–1633. doi:10.1007/s10826-015-0323-3 [PubMed: 27284234]
35. Mann JJ, Waternaux C, Haas GL, Malone KM. Toward a Clinical Model of Suicidal Behavior in Psychiatric Patients. *AJP*. 1999;156(2):181–189. doi:10.1176/ajp.156.2.181
36. Bridge JA, Goldstein TR, Brent DA. Adolescent suicide and suicidal behavior. *Journal of child psychology and psychiatry*. 2006;47(3-4):372–394. doi:10.1111/j.1469-7610.2006.01615.x [PubMed: 16492264]
37. Costello EJ, Copeland W, Angold A. Trends in psychopathology across the adolescent years: What changes when children become adolescents, and when adolescents become adults?: Trends in psychopathology across the adolescent years. *Journal of Child Psychology and Psychiatry*. 2011;52(10):1015–1025. doi:10.1111/j.1469-7610.2011.02446.x [PubMed: 21815892]
38. Brent DA, Mann JJ. Familial Pathways to Suicidal Behavior — Understanding and Preventing Suicide among Adolescents. *N Engl J Med*. 2006;355(26):2719–2721. doi:10.1056/NEJMp068195 [PubMed: 17192535]
39. Zoccolillo M. Gender and the development of conduct disorder. *Development and psychopathology*. 1993;5(1-2):65–78. doi:10.1017/S0954579400004260

40. Demmer DH, Hooley M, Sheen J, McGillivray JA, Lum JA. Sex differences in the prevalence of oppositional defiant disorder during middle childhood: a meta-analysis. *Journal of abnormal child psychology*. 2017;45:313–325. doi:10.1007/s10802-016-0170-8 [PubMed: 27282758]
41. Boatman D. Appalachian caregiver perspectives on childhood gun safety in the home. *Journal of Appalachian health*. 2021;3(1):29. doi:10.13023/jah.0301.04
42. Heart MYHB. The Historical Trauma Response Among Natives and Its Relationship with Substance Abuse: A Lakota Illustration. *Journal of Psychoactive Drugs*. 2003;35(1):7–13. doi:10.1080/02791072.2003.10399988 [PubMed: 12733753]
43. Whitbeck LB, Adams GW, Hoyt DR, Chen X. Conceptualizing and Measuring Historical Trauma Among American Indian People. *American J of Comm Psychol*. 2004;33(3-4):119–130. doi:10.1023/B:AJCP.0000027000.77357.31
44. Santiago CD, Kaltman S, Miranda J. Poverty and Mental Health: How Do Low-Income Adults and Children Fare in Psychotherapy? *J Clin Psychol*. 2013;69(2):115–126. doi:10.1002/jclp.21951 [PubMed: 23280880]
45. Sarche M, Spicer P. Poverty and Health Disparities for American Indian and Alaska Native Children: Current Knowledge and Future Prospects. *Annals of the New York Academy of Sciences*. 2008;1136(1):126–136. doi:10.1196/annals.1425.017 [PubMed: 18579879]
46. Azrael D, Hemenway D. ‘In the safety of your own home’: results from a national survey on gun use at home. *Social Science & Medicine*. 2000;50(2):285–291. doi:10.1016/S0277-9536(99)00283-X [PubMed: 10619696]
47. Barkin SL, Finch SA, Ip EH, et al. Is office-based counseling about media use, timeouts, and firearm storage effective? Results from a cluster-randomized, controlled trial. *Pediatrics*. 2008;122(1):e15–e25. doi:10.1542/peds.2007-2611 [PubMed: 18595960]
48. Wintemute GJ, Betz ME, Ranney ML. Yes, You Can: Physicians, Patients, and Firearms. *Ann Intern Med*. 2016;165(3):205. doi:10.7326/M15-2905 [PubMed: 27183181]
49. Betz ME, Harkavy-Friedman J, Dreier FL, Pincus R, Ranney ML. Talking About “Firearm Injury” and “Gun Violence”: Words Matter. *Am J Public Health*. 2021;111(12):2105–2110. doi:10.2105/AJPH.2021.306525 [PubMed: 34878863]
50. Ranney ML, Betz ME, Dark C. #ThisIsOurLane — Firearm Safety as Health Care’s Highway. *N Engl J Med*. 2019;380(5):405–407. doi:10.1056/NEJMp1815462 [PubMed: 30517063]
51. Donald SG, Lang K. Inference with difference-in-differences and other panel data. *The Review of Economics and Statistics*. 2007;89(2):221–233. doi:10.1162/rest.89.2.221
52. Salhi C, Azrael D, Miller M. Parent and adolescent reports of adolescent access to household firearms in the United States. *JAMA network open*. 2021;4(3):e210989–e210989. doi:10.1001/jamanetworkopen.2021.0989 [PubMed: 33687444]
53. Sorenson SB, Cook PJ. “WE’VE GOT A GUN?”: comparing reports of adolescents and their parents about household firearms. *Journal Community Psychology*. 2008;36(1):1–19. doi:10.1002/jcop.20213
54. Pew Research Center. A Year After Columbine Public Looks To Parents More Than Schools To Prevent Violence. <https://www.pewresearch.org/politics/2000/04/19/a-year-after-columbine-public-looks-to-parents-more-than-schools-to-prevent-violence/>. April 19, 2000.

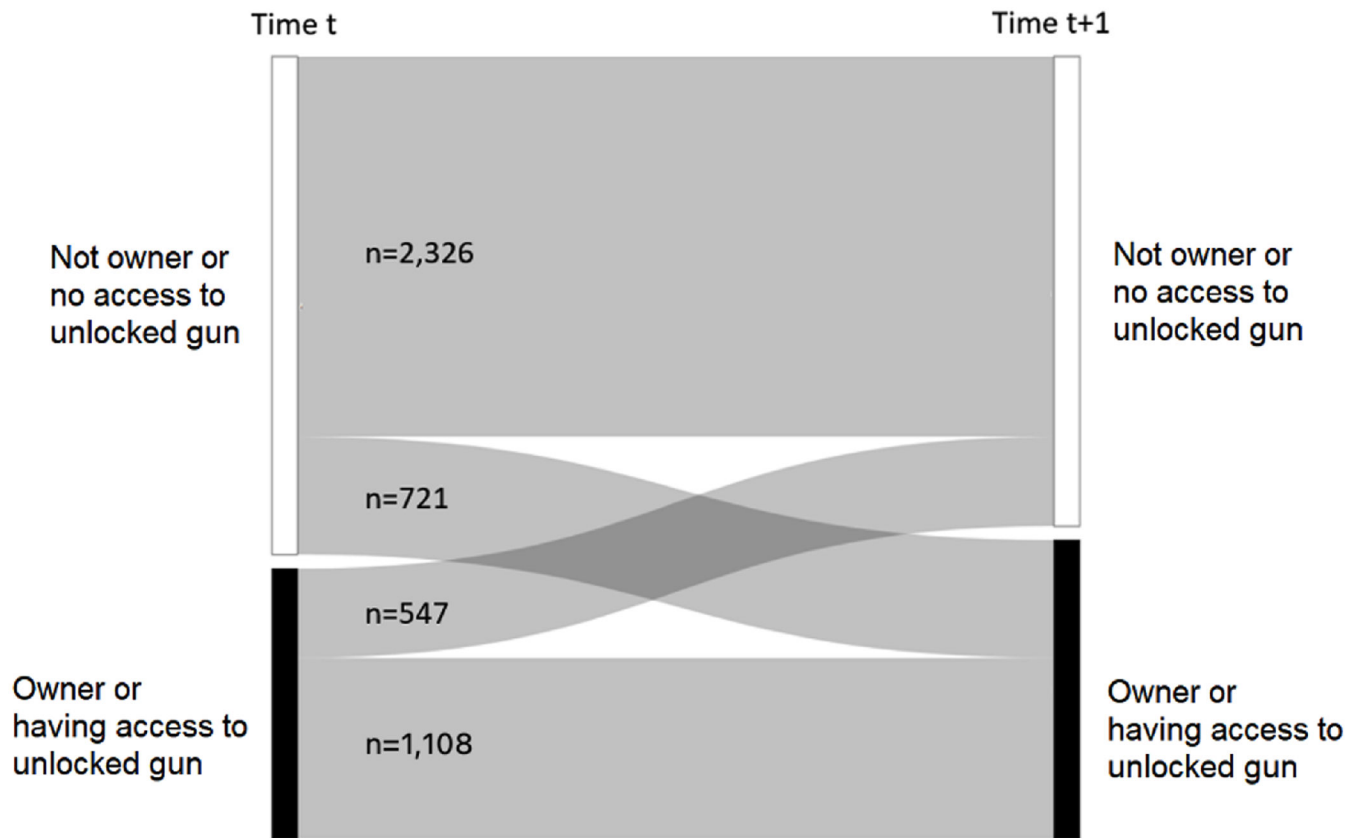


Figure 1.

Changes in firearm access at home across adjacent observations from time t to $t+1$ within individuals

Note: A total of $N=4,711$ observations at the level of changes were generated based on 6,674 repeated measures from ages 9 to 16. Nine pairs of adjacent observations of firearm ownership were incomplete and this figure is based on $N=4,702$ pairs.

Table 1.
Individual Level Descriptive Statistics for Variables Aggregated over Age 9-16 (N=1420)

	Overall	Never access to guns	Ever access to guns	<i>p</i>
	N(%)	N(%)	N(%)	
Total	1420(100)	442(34.5)	978(65.5)	
Sex				<0.001
Male	790(51.0)	200(39.4)	590(57.2)	
Female	630(49.0)	242(60.6)	388(42.8)	
Cohort				0.61
Youngest (age 9 yr)	534(37.8)	175(39.1)	359(37.2)	
Middle (age 11 yr)	479(33.4)	142(31.6)	337(34.3)	
Late (age 13 yr)	407(28.8)	125(29.3)	282(28.6)	
Race				<0.001
Am. Indian	349(3.7)	79(2.3)	270(4.4)	
Black	88(6.9)	62(12.5)	26(4.0)	
White	983(89.3)	301(85.2)	682(91.6)	
SES status				0.17
Low SES	573(28.7)	187(26.4)	386(29.9)	
Not low SES	847(71.3)	255(73.6)	592(70.1)	
Residence				<0.001
Urban	351(31.2)	165(40.9)	186(26.1)	
Rural	1069(58.8)	277(59.1)	792(73.9)	
	Mean(SD)	Mean(SD)	Mean(SD)	
Environment vulnerability (range 0-9)	1.59(1.57)	1.59(2.05)	1.59(2.41)	0.87
Family dysfunction (range 0-6)	0.51(0.69)	0.48(0.86)	0.56(1.15)	<0.001
Parent problems (range 0-6)	0.64(0.92)	0.64(1.18)	0.63(1.47)	0.53
Conduct disorder (range 0-15)	0.18(0.54)	0.16(0.65)	0.21(0.96)	0.003
Aggression (range 0-9)	0.09(0.36)	0.08(0.43)	0.10(0.63)	0.005
Deceitfulness/theft (range 0-3)	0.07(0.27)	0.06(0.33)	0.08(0.49)	0.008
Violation of rules (range 0-3)	0.02(0.14)	0.02(0.18)	0.02(0.21)	0.24
Oppositional defiant disorder (range 0-8)	0.47(1.01)	0.42(1.22)	0.56(1.78)	<0.001
Total anxiety (range 0-22)	0.47(1.17)	0.47(0.47)	0.46(1.97)	0.66
Depression symptoms (range 0-10)	0.43(0.76)	0.44(0.97)	0.40(1.20)	0.03

Note: “Never access to guns” includes no access to unlocked guns or no firearm at home. “Ever access to guns” include access to unlocked guns or self-owning guns. Explanations of environmental vulnerability, family dysfunction, and parent problems can be found in the supplementary text. Percentages for each variable have a column sum of 100%.

Table 2.

Changes in Symptoms Predicting Access to Unlocked Guns at the Next Time Among Children with Gun Access (n = 1,657)

Predictors	OR	CI	CI	p
Conduct disorder	0.74	0.53	1.05	0.09
Aggression	0.98	0.58	1.68	0.97
Deceitfulness/theft	0.43	0.22	0.87	0.02
Violation of rules	0.22	0.07	0.76	0.02
Oppositional defiant disorder	0.43	0.35	0.53	<0.001
Total anxiety	0.94	0.80	1.12	0.51
Depression symptoms	0.74	0.59	0.92	0.008

Note: Models use mixed-effects logistic regression to assess the relationship between changes in symptoms from time t to t+1 and subsequent firearm access at t+1 among children who already had access to firearms. All models adjust for age cohort, sex, race, urbanicity, SES status, environmental vulnerability, family dysfunction, and parental problems. They incorporate individual-level random effects and are survey-weighted. Results are pooled using Rubin's formula based on 10 imputed datasets. Statistically significant results ($p < 0.05$) are represented in boldface type.

Table 3. Changes in Symptoms Predicting Access to Unlocked Guns at the Next Time Among Children With Firearm Access by Age Group (n=1,657)

Predictors	Age 9-12				Age 13-16				p value for age difference
	OR	CI	CI	p	OR	CI	CI	p	
Conduct disorder	0.94	0.49	1.80	0.85	0.05	0.02	0.20	<0.001	<0.001
Aggression	1.29	0.48	3.47	0.61	0.02	0.002	0.22	0.001	<0.001
Deceitfulness/theft	0.44	0.07	2.80	0.39	0.10	0.03	0.32	<0.001	<0.001
Violation of rules	0.62	0.10	3.73	0.60	1.07	0.05	20.67	0.96	0.03
Oppositional defiant disorder	0.56	0.38	0.85	0.006	0.36	0.25	0.53	<0.001	<0.001
Total anxiety	0.86	0.61	1.21	0.39	0.84	0.64	1.09	0.18	0.05
Depression symptoms	1.61	0.17	15.87	0.68	0.60	0.39	0.92	0.02	0.06

Note: Models use mixed-effects logistic regression to assess the relationship between changes in symptoms from time t to t+1 and subsequent firearm access at t+1 among children who already had firearm access. Analyses are stratified by age group. All models adjust for age cohort, sex, race, urbanicity, SES status, environmental vulnerability, family dysfunction, and parental problems. They incorporate individual-level random effects and are survey-weighted. Results are pooled using Rubin's formula based on 10 imputed datasets. Statistically significant results (p<0.05) are represented in boldface type.

Table 4.

Changes in Symptoms Predicting Access to Unlocked Guns at the Next Time Among Children Without Firearm Access (n=3054)

Predictors	OR	CI	CI	P value
Conduct disorder	0.97	0.72	1.31	0.85
Aggression	1.38	0.99	1.91	0.05
Deceitfulness/theft	0.85	0.49	1.49	0.57
Violation of rules	0.66	0.29	1.51	0.32
Oppositional defiant disorder	0.89	0.76	1.03	0.12
Total anxiety	1.12	1.00	1.25	0.05
Depression symptoms	1.08	0.94	1.24	0.26

Note: Models use mixed-effects logistic regression to assess the relationship between changes in symptoms from time t to t+1 and subsequent firearm access at t+1 among children without prior firearm access. All models adjust for age cohort, sex, race, urbanicity, SES status, environmental vulnerability, family dysfunction, and parental problems. They incorporate individual-level random effects and are survey-weighted. Results are pooled using Rubin's formula based on 10 imputed datasets.