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Firearm Ownership Among Young Adults: Associations with Impulsivity and Impulse Control Disorders

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Abstract

Background—Firearm ownership is extremely common in parts of the USA. Yet little research has examined whether it is associated with impulsive symptoms and traits.

Methods—Adults aged 18-29 years who gamble at least occasionally were recruited in two US cities using media advertisements for an exploratory study examining general mental health, impulse control disorders, impulsive personality, and aspects of cognition (decision-making, response inhibition, and flexible responding). The participants were grouped as firearm owners and non-firearm owners; these two groups were compared on the above measures.

Results—149 young adults took part, of whom 33 (22.1%) endorsed owning one or more firearms. Firearm ownership was significantly associated with male gender and elevated risk of gambling disorder, but not with other measures of impulsivity.

Discussion—The link between firearm ownership and disordered gambling merits further research and may have policy implications, such as in terms of screening for guns in gambling arenas including casinos. Further research is needed to explore potential associations between gun ownership and impulsivity in cohorts with other demographic characteristics, including longitudinally.

Keywords

gambling; impulsive; firearms; guns; cognition

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Conflicts of Interest and Disclosures

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Introduction

According to the Pew Research Center, 30% of adults in the United States personally own a firearm (1). Homicides, suicides, and unintentional injuries from firearms are common in countries around the world, and aggregate firearm injury deaths appear to be highest among persons aged 20 to 24 years (2). Studies at the population, household, and individual levels, have all found that access to firearms and level of firearm ownership have been associated with firearm deaths (2–3). Among adolescents and young adults, factors other than homicide and suicide have also been associated with firearm access. A recent cross-sectional analysis of data from the US National Comorbidity Survey (Adolescent Supplement) (N= 10,123 US adolescents, aged 13-18 years) found that adolescents with a firearm in the home were more likely to have higher lifetime prevalence of alcohol abuse (10.1% vs 3.8%, $P < .001$) and drug abuse (11.4% vs 6.9%, $P < .01$) compared with those without firearm access (4). Interestingly, history of suicidality appeared unrelated to firearms access in the sample (4). In a cross-sectional study from the US National Comorbidity Survey (Adolescent Supplement), gun carrying in the previous 30 days was associated with drug use disorders, conduct disorder, and specific phobias (5). In the National Comorbidity Study Replication, conducted in adults, links were found between impulsive tendencies (impulsive angry behaviors) and possession of firearms (6).

Despite the above associations reported between firearm access and an array of problems in adolescents and adults, relatively little is known about the associations between firearm access and healthy behaviors, cognitive status, quality of life and mental health conditions. Therefore, this study sought to examine both the prevalence of firearm ownership and the associated aspects of impulsivity among young adults as one possible explanation for the associations between firearm access and homicide, suicide, and alcohol and drug problems. Young adulthood is a developmental period frequently associated with occurrence of impulsive behaviors and personality traits (7–8). Peer group influences, genetics, brain development, and life transitions have all been studied as elements contributing to the elevated rates of impulsive behaviors in this age group (9–10). Based on prior literature (11), we hypothesized that firearm access in young adults would be associated with addictive behaviors such as alcohol and cigarette use as well as heightened impulsivity.

Methods

Participants

Individuals from the community were enrolled for a study of impulsivity in young adults. Inclusion criteria were being aged 18-29, willingness to provide informed consent and to attend the clinic for an assessment, and having gambled at least five times in the preceding year (since this was part of a wider study focusing on gambling in the general population and gambling was used as a proxy for at least some degree of impulsive tendencies). The only exclusion criterion was the inability to understand and consent to the study. Participants were recruited in the Minneapolis and Chicago metropolitan areas using media advertisements. Each participant received a $50 gift card to an online store as compensation.

The study procedures followed the guidelines established in the Declaration of Helsinki. The University of Minnesota and University of Chicago Institutional Review Boards approved the study procedures and consent process. All subjects provided written, voluntary informed consent after study procedures were explained.

Assessments

Demographic variables, including age, gender, and highest level of education completed, were recorded for all participants. Participants were asked whether they personally owned a firearm and had any history of exposure to gun violence (this latter question was stated as "have you been a victim of gun violence or witnessed someone being a victim of gun violence?"). Subjects received a psychiatric evaluation using the Mini International Neuropsychiatric Inventory (MINI) (12) and the Minnesota Impulse Control Disorder Interview (MIDI) (13–14); the former screens for mainstream mental disorders (e.g. depression, anxiety), as well as suicide risk level; while the latter screens for impulse control disorders (e.g. trichotillomania, kleptomania).

The following questionnaires were completed by participants: the Barratt Impulsivity Questionnaire (BIS-11) (15) to quantify personality-related impulsiveness in the three factor domains (motor, non-planning, and attentional impulsivity); the Padua inventory (16) to comprehensively quantify obsessive-compulsive symptoms; and the Tridimensional Personality Questionnaire (TPQ)(17), a valid and reliable 100-item, self-report, true-false scale that assesses personality dimensions. The TPQ has three subscales: Novelty Seeking, Harm Avoidance, and Reward Dependence; each thought to measure a different dimension of personality, including impulsiveness, dependency, and uncertainty or shyness (18).

In addition to paper-pencil measures, participants underwent selected cognitive tests from the Cambridge Neuropsychological Test Automated Battery (19). Study subjects completed the following cognitive tasks in a quiet room using a touch screen computer under the guidance of a trained assessor. We included tasks focusing on impulsivity and rigid response styles, since these domains have often been implicated in risky symptoms and behaviors in prior work (20–23).

Decision-making was examined using the Cambridge Gamble Task (CGT) (24). Participants were informed that for each trial, the computer had hidden a 'token' inside one of ten boxes shown on the screen. These boxes were each either red or blue, and the participant indicated whether they felt the token would be hidden behind a red or a blue box. After making this judgment, participants gambled a proportion of their points on whether their color choice was correct. The key outcome measures were (i) mean proportion of points gambled; (ii) quality of decision-making (the proportion of trials where the volunteer chose red when red boxes were in the majority and vice versa – i.e. made the logical color choice); (iii) and risk adjustment (tendency to adjust how many points are gambled depending on the degree of risk).

We assessed response inhibition using the Stop-Signal Task (25), a paradigm in which the participant viewed a series of directional arrows appearing one per time on-screen, and made quick motor responses depending on the direction of each arrow. On a subset of trials, an

auditory stop-signal occurred (a ‘beep’) to indicate that response suppression was needed for the given trial. The main outcome measure of the Stop-Signal Task was the stop-signal reaction time, which is an estimate of the time taken by the given volunteer’s brain to suppress a response that would normally be undertaken.

Set-shifting was measured using the Intra-Dimensional/Extra-Dimensional Set-shift task (IED) (26). This task, derived from the Wisconsin Card Sorting Task, quantifies several aspects of rule learning and flexible behavior. Volunteers choose from two stimuli presented on the screen on each trial, and attempt to discover an underlying rule governing which stimulus is ‘correct’ (based on simple feedback provided by the computer). One the volunteer has learnt a given rule, the task then changes the rule. The main outcome measure on the task was the total number of errors made, adjusted for stages that were not attempted.

Data Analysis

Current owners of firearms were compared to those who did not own firearms using Analysis of Variance (ANOVA) for continuous measures, and likelihood ratio Chi-square tests for categorical measures. This being an exploratory study, and in view of the sample size, significance was defined as $p<0.05$ uncorrected. All analyses were conducted using JMP Pro software.

Results

The sample size was N=149 young adults aged 18-29 years (n=84 female [56.4%]), of whom 33 [22.1%] owned firearms and 116 who did not. The two study groups did not differ from each other in terms of age or educational levels (Table 1). Those who owned firearms were significantly more likely to be male and to endorse a history of being a victim of gun-related violence. There were no significant differences between the two study groups in terms of mental health histories on the MINI (capturing mainstream mental disorders), suicidality, or alcohol or cigarette use.

In terms of impulse control disorders, those who owned a firearm were significantly more likely to meet criteria for gambling disorder, but not other impulsive disorders as quantified by the MIDI (Table 2).

Those who owned firearms did not significantly differ from those who did not on measures of impulsivity, compulsivity or personality profiles. In addition, the two groups did not significantly differ on cognitive measures of flexibility, inhibition or decision making (Table 3).

Discussion

Our study, the first we are aware of that examined a broad range of impulsivity measures in young adults who own firearms, found that 22% of these young adults owned firearms, a percentage slightly lower than estimated for the population at large. Contrary to expectations, however, we found that those who owned firearms did not have higher levels of suicidality, did not report or exhibit generally greater impulsivity, and did not have greater

alcohol consumption or mental health histories. However, firearm ownership was significantly associated with male gender and with gambling disorder. It should be noted that everyone in our sample gambled at least occasionally, due to the nature of the cohort we examined.

In terms of the elevated rates of gambling disorder in owners of firearms observed here, it seems unlikely that generalized impulsivity contributed to both gambling and firearm ownership, because firearm owners and non-owners did not differ on the Barratt and Tridimensional Personality Questionnaires, nor in terms of cognitive performance on the decision-making and response inhibition tasks. One could argue that if the people had been experiencing gambling problems that involved loan sharks, then they may have purchased a firearm for safety reasons due to feeling unsafe. Another possibility is that the link between gun ownership and gambling disorder observed here was driven by some other variables that were not recorded.

There are a poverty of prior data concerning links between gambling and firearm ownership. In one study that examined men enrolled in a batterer program, gun ownership was associated with engaging in problem gambling (27). In a sample of women aged 18-67, who used alcohol and/or other drugs, gun ownership was reported in 3% of the sample, whereas 24% reported carrying a gun in their lifetimes, and 31% described having immediate access to a firearm if they needed it (28). The authors therefore focused on exposure to guns as their variable of interest. Exposure to guns in this prior study was associated with problem gambling and with gambling disorder.

The lack of a significant association between firearm ownership and substance use (notably alcohol use) is contrary to expectation, as several previous studies reported a link with alcohol use problems (4, 5). This could reflect differences in the nature of the cohorts. These prior studies were in adolescents whereas we focused on adults. Thus, it may be the case that alcohol use problems are related to gun ownership but only in younger people. Alternatively, these contrasting data could reflect the different types of measurements used in different studies. For example, we examined frequency of alcohol consumption rather than lifetime occurrence of formal substance use disorders.

Given the limited and cross-sectional nature of these data, temporal or causal interpretations are not possible. Nonetheless, if gun ownership is linked to gambling disorder, as seems to be the case based on the current findings and limited prior literature, this has policy implications for arenas used for gambling such as casinos, which can involve exposure to alcohol or other substances that may increase the risk of impulsive acts.

This study represents the first examination of personality and cognitive associations in healthy individuals who own versus do not own firearms. There exist, however, several limitations. Firstly, we focused on young adults who gamble at least occasionally, recruited from two major US cities, and so results may not generalize to other populations or samples. This is important because previous longitudinal research found that firearm-related deaths were associated with household firearm ownership; however, this relationship was affected by sociodemographic variables such as gender, ethnicity, and urbanization status (29). The

cognitive tests used in this study assessed only certain aspects of cognition, and did not cover all possible domains relating to impulsivity. A greater number of tasks with broader examination of cognitive domains may have detected differences between the groups. The cross-sectional nature of these data preclude establishing temporal patterns. In particular, the reasons for the link between gun ownership and gambling disorder symptoms are unclear, due to inherent limitations in the study design and the range of questions asked. Future work should seek to replicate this result and explain it, by collecting a broader range of relevant measures. This being an exploratory, descriptive study, and due to the sample size of the cases, we did not correct findings for multiple comparisons. We feel that the significant link between gun ownership and gambling disorder is unlikely to be a false positive, due to similar results being reported in other studies. Nonetheless, any significant associations merit replication in future work. While many variables did not differ significantly between groups, the sample size meant that we did not have statistical power to detect subtle/small group differences; hence larger studies are needed in future. We could not examine differences between men and women who owned firearms due to the sample size and statistical power. Lastly, it is possible that some individuals may not have disclosed their gun ownership. If this occurred, the study would have been less able to detect group differences.

In summary, we found that gun ownership was associated with gambling disorder, but not with other manifestations of impulsivity, including personality and cognitive measures that were examined, in this sample of young adults who gambled at least occasionally. This study serves to highlight the lack of research in this area and the need for more detailed exploration of associations with firearm ownership, both cross-sectionally and longitudinally, in different populations. This is particularly important given the association between firearm-related deaths and household firearm-ownership reported in longitudinal research; and that this link can differ depending on socioeconomic variables (e.g. (29)).

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Table 1

Demographic and Clinical Characteristics of Young Adults Who Own Firearms.

Data are mean (Standard Deviation) or N [%].

Measure	Firearm owners (N=33)	Non-Owners of Firearms (N=116)	F (df 1,147)	p
Age, years	23.8 (4.1)	23.3 (3.3)	0.385	0.536
Education score	3.5 (0.9)	3.4 (0.9)	0.007	0.934
Body mass index (BMI), kg/sqmt	26.6 (6.2)	25.3 (5.9)	1.125	0.291
Gender, Male N [%]	25 [75.8%]	59 [50.9%]	6.800c	0.009 *
Presence of any MINI mental disorder, N [%]	18 [54.6%]	46 [40.0%]	2.305c	0.129
Alcohol consumption, times per week	1.56 (1.45)	1.52 (1.34)	0.0308	0.861
Nicotine consumption, packs per day equivalent	0.13 (0.27)	0.07 (0.19)	1.802	0.182
Suicide risk level (MINI), not low	5 [15.2%]	24 [19.8%]	1.903c#	0.593
Parents ever owned a gun? Yes, N [%]	18 [54.6%]	50 [43.1%]	2.182c	0.336
Have YOU ever been a victim of gun violence? Yes, N [%]	5 [15.2%]	4 [3.5%]	5.100c	0.024 *
Has SOMEONE YOU CARE ABOUT ever been a victim of gun violence? Yes, N [%]	13 [40.0%]	29 [25.0%]	2.513c	0.113

c: Likelihood ratio chi-square; # for simplicity MINI suicide risk data presented as “zero” versus “non-zero”, but statistical test incorporates all levels of risk levels generated by the instrument. MINI: Mini-International Neuropsychiatric Inventory. * $p<0.05$.

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Table 2

Prevalence of Impulse Control Disorders (ICDs) Among Young Adults Who Own Firearms.

Data are N [%].

ICD, Present, N [%]	Firearm owners (N=33)	Non-Owners of Firearms (N=116)	Likelihood ratio chi-square	p
Compulsive buying disorder	1 [3.0%]	4 [3.5%]	0.016	0.900
Kleptomania	0 [0%]	0 [0%]	N/A	N/A
Trichotillomania	0 [0%]	1 [0.9%]	0.503	0.478
Intermittent explosive disorder	2 [6.1%]	2 [1.7%]	1.516	0.218
Pyromania	0 [0%]	0 [0%]	N/A	N/A
Gambling Disorder	14 [42.4%]	22 [19.0%]	7.098	0.008 *
Compulsive sexual disorder	1 [3.0%]	3 [2.6%]	0.019	0.891
Binge-eating disorder	0 [0%]	4 [3.5%]	2.034	0.154

* $p<0.05$.

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Table 3

Impulsivity, Compulsivity, Personality and Cognitive Measures of Young Adults Who Own Firearms.

Data are mean (Standard Deviation).

Measure	Firearm owners (N=33)	Non-Owners of Firearms (N=116)	F (df 1,147)	p
Barratt impulsivity, sum score	63.2 (11.3)	65.9 (12.0)	1.303	0.256
Padua compulsivity, sum score	19.1 (21.1)	19.0 (18.2)	<0.001	0.979
TPQ Novelty Seeking	17.2 (6.10	17.4 (6.0)	0.0353	0.851
TPQ Harm Avoidance	14.5 (8.0)	12.6 (7.2)	1.742	0.189
TPQ Reward Dependence	17.9 (4.8)	17.6 (4.7)	0.090	0.764
IED errors	22.3 (17.7)	27.8 (27.2)	1.185	0.278
SST SSRT, msec	180.9 (72.4)	183.3 (70.0)	0.029	0.866
CGT, proportion bet	0.55 (0.15)	0.55 (0.13)	0.011	0.917
CGT, quality of decisions	0.95 (0.06)	0.95 (0.09)	0.239	0.626
CGT, Risk adjustment	1.28 (0.94)	1.46 (1.24)	0.600	0.411

TPQ = Tridimensional Personality Questionnaire; IED: Intra-Dimensional / Extra-Dimensional Shift task; SST: Stop-Signal task; SSRT = stop-signal reaction time; CGT = Cambridge Gamble Task.