



When the kids get guns – The effects of lowering the minimum age of firearm possession in Alabama

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ABSTRACT

At this time, the relationship between firearm minimum age laws and pediatric injury rates remains unclear. In September 2015, Alabama implemented Act 2015–341 (Act 341) which allowed minors to carry guns with parental permission. The purpose of this study was to evaluate the effect that Act 341 had on firearm injury rates. We created a database of all pediatric patients who presented to the Children's of Alabama's (CoA) emergency department and the Jefferson County Coroner's Office (JCCO) with a gunshot wound injury between May 2011 to December 2019. Wilcoxon ranked sum test analysis were used to contrast the average number of monthly patients arriving before and after implementation of Act 341 and Wilcoxon ranked sum test and Fisher Exact were used to evaluate differences in demographic and outcome data.

A total of 316 patients presented within the specified time period with 116 arriving prior to Act 341 and 200 arriving after; an average of 2.21 and 3.85 patients per month respectively. We found an increase of 1.63 patients per month ($p < 0.001$). There was also significant increases in the proportion of patients who died or had a long-term disability following the event as well as the number of days of admission. Our study is suggestive that lowering the minimum age can lead to increased pediatric injury and indicates that further research is needed to fully elucidate the relationship.

1. Introduction

The minimum age at which a person is able to possess a handgun in the United States ranges from 16 to 21 years of age depending on the state (Dowd and Sege, 2012, Petty et al., 2019). Pediatric firearm mortality remains low with an annual rate of 2.2 deaths per 100,000 children (Naghavi et al., 2018), but this rate is still significantly higher than any other developed country. In the United States, firearm-related deaths are one of the top three causes of pediatric mortality with 53% of deaths due to homicide, 38% due to suicide, and 6% due to unintentional use (Dowd and Sege, 2012, Parikh et al., 2017). While suicide risks were evenly distributed throughout the country, children living in Southern states were more likely to die from homicide with Alabama, Florida, and Georgia ranking as the states with the highest rates. This has prompted advocacy groups to call for strengthening childhood gun safety in those states (Esparaz et al., 2021).

In September 2015, Alabama implemented Act 2015–341 (Act 341), which allowed children under the age of 18 years of age to possess a handgun with parental permission. The law specifies that “A minor shall

not be in violation of [the firearm code] if the minor has permission to possess a pistol from a parent or legal guardian who is not prohibited from possessing a firearm under state or federal law” and fulfills certain other criteria such as carrying while practicing shooting, being on property under the control of the guardian, or traveling (Casetext, 2021).

There is concern that lowering the minimum age for possession increases adolescent access to guns leading to more childhood exposure to firearms and subsequently increased injury rates. However, there is a dearth of studies assessing the effect at this time and no definitive link has been found (Morain and Crifasi, 2019, Zeoli et al., 2019). The goal of this study is to evaluate the impact that Act 2015–341 has had on pediatric firearm injury rates. Children's of Alabama is the only pediatric level 1 trauma center in Alabama with a catchment area spanning the state. The Jefferson County coroner's office serves the most populous county in Alabama and evaluates approximately one-third of all deaths within. By examining injuries before and after passage of the law, we hope to identify the overall effect that lowering the minimum age of firearm possession has had on childhood injury and if there are any

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populations who have been particularly affected.

2. Methods

2.1. Study population

This is a retrospective study evaluating pediatric patients with gunshot wounds (GSW) who presented to the Children’s of Alabama (CoA) emergency department and the Jefferson County Coroner’s Office (JCCO) from May 2011 – December 2019. We chose the time period to allow for analysis of 52 months both before and after implementation of Act 341 on September 1, 2015. Our team created a database including information on race, gender, age, county of residence, shooter age, gun type, need for surgery at presentation, intentionality, mortality, long-term prognosis, and hospital length of stay. Inclusion criteria included all patients aged 0–17 years old who presented to the CoA emergency department and the JCCO with a GSW between May 1, 2011 – December 31, 2019 who were residents of Alabama. Exclusion criteria included patients aged 18 or older and patients who lived outside Alabama. Only two core members of our team were responsible for abstracting data from the charts in order to limit variations in interpretation of the variables collected.

2.2. Demographic and outcome definition

Patient information was sorted based on demographic data, including sex, race, age, and county of residence. Race data were categorized as Black, White, and other. Geographical data were categorized as Jefferson County, the county which Children’s of Alabama operates in, or other. The age of the shooter was divided into younger than 18 years of age versus equal to or older than 18. Gun types were sorted into handgun, other gun type, or unknown.

Intentional firearm injuries were defined as the firearm trigger intentionally being pulled in order to harm someone, whether or not the victim was the intended target. Unintentional injuries were defined as the firearm trigger unintentionally being pulled, without the motivation or true understanding that the victim would be harmed or killed. Similarly, suicidality was defined as shooters pulling the firearm trigger with the intention to kill themselves.

Surgery was classified as the need for surgery at the time of initial presentation; JCCO patients were excluded from this classification as the majority of patients had died at time of arrival. Patient mortality was classified as death that occurred either during the encounter or during the initial admission. Permanent disability was defined as the patient having long term difficulty with activities of daily life as a direct result of injury sustained the GSW event. Only patients who had not died during the initial encounter were included in our analysis of permanent disability. Outcomes were determined by reviewing all subsequent inpatient and outpatient charts for each individual patient.

2.3. Ethical considerations

This study was approved by the Institutional Review Board at the University of Alabama at Birmingham (Reference No. IRB-051223001).

2.4. Statistical analysis

A Wilcoxon ranked sum test was used to look at the difference in the average number of patients who appeared per month before and after implementation of Act 341. Demographic and outcome data were primarily analyzed by Fisher exact testing, except for age and hospital length of stay, which were assessed via Wilcoxon ranked sum tests. Significance was determined by a p value of <0.05.

3. Results

A total of 316 patients with gunshot injuries presented to the Children’s of Alabama emergency room and the Jefferson County coroner’s office during our chosen time period with 116 patients appearing before Act 341 and 200 patients after (Table 1). Coroner’s office data were responsible for 16 patients (14%) in the before cohort and 35 patients (18%) in the after cohort.

Prior to implementation of Act 341, an average of 2.21 children with GSW presented to the emergency room every month. Following implementation, the average number of patients increased to 3.85 per month. There was an increase of 1.64 patients per month following implementation, which was noted to be significant via Wilcoxon ranked sum test ($p < 0.001$).

Analysis of demographics showed that there appeared to be more male and Black patients in both groups though there was no difference in proportion between them. The average age was similar as well of 11.20 in the before cohort and 11.38 years of age in the after ($p = 0.757$). County of residence was similar for both groups with approximately 60% of patients presenting from Jefferson County ($p = 0.721$) Table 2.

No differences were found on analysis of shooter characteristics or intentionality. Fisher exact analysis examining whether the shooter was younger than 18 years of age or whether they used a handgun, the age group and type of firearm specifically addressed in the law, were not significantly changed though both groups had a notable proportion of unknowns which reduced the power of analysis. There was also no difference noted in the rate of intentionality or the number of suicide attempts.

There was no difference in the percentage of patients requiring surgery at presentation. When looking at hospital length of stay, there was an increase of 1.14 days of admission in the after group which was found to be significant ($p = <0.001$). There was also a notable difference in the overall prognosis of patients following implementation of Act 341. Nineteen percent of patients in the before group died during the initial admission while 29% had died in the after group ($p = 0.045$). Of surviving patients, there was also an increase from 11% to 24% in the percentage of patients who sustained a permanent disability ($p = 0.010$).

4. Discussion

4.1. Implications for firearm policy

Compared to other states, Alabama has one of the highest rates of firearm ownership with an estimated 57.2% of households possessing a gun (Okoro et al., 2005). Additionally, the state has the highest prevalence of loaded household and unlocked firearms. With the passage of Act 341, Alabama became one of several states that allow individuals under 18 years of age to carry guns leading to concerns that lowering the minimum age for possession would increase the incidents of firearm violence. The results of our study support these concerns, showing a 74% increase in monthly firearm injuries. Furthermore, of those who presented to the ED, there was a significant increase in hospital length of

Table 1
Sociodemographic comparison of patients presenting to Children’s of Alabama and the Jefferson County Coroner’s Office (n = 318).

| | CoA Before | CoA After | JCCO Before | JCCO After |
|------------------|------------|-----------|-------------|------------|
| Total | 100 | 165 | 16 | 33 |
| Male | 78 | 118 | 15 | 27 |
| Female | 22 | 47 | 1 | 8 |
| Black | 65 | 119 | 16 | 25 |
| White | 34 | 43 | 0 | 10 |
| Other Race | 1 | 3 | 0 | 0 |
| Jefferson County | 53 | 87 | 15 | 35 |
| Other County | 47 | 78 | 1 | 0 |

Table 2

Sociodemographic, event, and outcome characteristics of patients presenting with firearm injuries to Children's of Alabama or the Jefferson County Coroner's Office (n = 318).

| | Before (%) | After (%) | p value |
|----------------------------------------------------------------|------------|-----------|---------|
| Patients presenting with GSW | | | |
| Total | 116 | 200 | |
| Avg patients per month | 2.21 | 3.85 | <0.001 |
| Gender | | | |
| Male | 93 (80%) | 145 (73%) | 0.138 |
| Female | 23 (20%) | 55 (28%) | |
| Race | | | |
| Black | 81 (70%) | 144 (72%) | 0.886 |
| White | 34 (29%) | 53 (27%) | |
| Other | 1 (1%) | 3 (2%) | |
| Age of patient | | | |
| Average Age | 11.20 | 11.38 | 0.972 |
| County | | | |
| Jefferson | 68 (58%) | 122 (61%) | 0.721 |
| Other | 48 (41%) | 78 (39%) | |
| Age of shooter | | | |
| <18 | 28 (24%) | 77 (38%) | 0.084 |
| ≥18 | 3 (3%) | 25 (12%) | |
| Unknown | 85 (73%) | 98 (48%) | |
| Type of gun | | | |
| Handgun | 43 (37%) | 117 (58%) | 0.320 |
| Other | 21 (18%) | 40 (20%) | |
| Unknown | 52 (44%) | 43 (21%) | |
| Shooter intentionality | | | |
| Intentional | 59 (51%) | 108 (53%) | 1.00 |
| Unintentional | 45 (39%) | 82 (41%) | |
| Unknown | 12 (10%) | 10 (5%) | |
| Attempted suicide | | | |
| Suicide attempt | 4 (3%) | 12 (6%) | 0.429 |
| No suicide attempt | 112 (97%) | 188 (94%) | |
| Surgery at time of presentation for patients presenting to CoA | | | |
| Surgery | 72 (72%) | 128 (78%) | 0.466 |
| No surgery | 28 (28%) | 37 (22%) | |
| Mortality of event | | | |
| Patient death | 22 (19%) | 59 (30%) | 0.045 |
| No patient death | 94 (81%) | 141 (70%) | |
| Permanent disability in surviving patients | | | |
| Permanent disability | 10 (11%) | 34 (24%) | 0.010 |
| No permanent disability | 84 (89%) | 107 (76%) | |
| Hospital length of stay | | | |
| Days admitted | 7.36 | 9.50 | <0.001 |

stay and the proportion of patients who died or had long-term disability. To note, there has been a rise in violent crime within Alabama with a 20% increase in incidents between 2014 and 2019, but the findings from our study show a disproportionate increase even accounting for that rise suggesting that the law has still had an adverse effect (Crime Data Explorer, 2021).

Act 341 did not appear to affect any demographic in particular nor change the characteristics of the shooters themselves. The findings were consistent with previous studies in the Birmingham area which showed a disproportionate effect of firearm violence on black and male populations, but the proportions were similar in both cohorts (Senger et al., 2011). However, the events did appear to result in more severe injuries given the increase in mortality and disability rates and hospital length of stay. This suggests that an allowance for childhood firearm possession does increase violence against pediatric patients and places them in higher risk situations but does not affect any demographic disproportionately. Previous minimum age research has not shown a decrease in injury rates, but this is partially due to a paucity of studies (Zeoli et al., 2019). Given the effectiveness of child access prevention (CAP) laws, the key to reducing pediatric firearm deaths may be preventing them from physically obtaining a gun. Therefore, minimum age laws may help lower the injury rate by making it more difficult for the children to have open access to a gun which would be consistent with our findings.

Overall, our study appears to support concerns that the passage of Act 341 has worsened pediatric firearm injury rates in Alabama. Despite

recommendations from the American Academy of Pediatrics and the American Pediatric Surgical Association to increase the legal firearm possession age to 21 years old, lawmakers throughout the country have been moving towards loosening gun laws to allow minors to carry firearms (Dowd and Sege, 2012, Petty et al., 2019, Prickett et al., 2019). Given our findings, lawmakers should be wary about lowering the age of possession until future studies clarify the effect of minimum age laws. Advocates interested in lowering the rates of firearm injuries should recommend policies to reduce the possession of guns by vulnerable populations until further studies can be performed while working with gun owners to avoid overly stringent laws.

4.2. Limitations

While this study provides insight into the effects of allowing minors to carry guns, it has some limitations. Our study was a retrospective chart review, so there may be a bias present in the type of questions that certain demographics received. The study is also limited to the catchment area of one Alabama pediatric emergency room and one county coroner's office which limits its generalizability. This is partially corrected by the catchment area spanning a large portion of the state, but this will miss less serious and non-surgical injuries in areas outside of Jefferson County which makes the data more applicable to urban populations.

There was also a large number of unknowns in the areas directly affected by the law, notably the age of the shooter and the type of gun used. The findings from the study are suggestive, but only indicative that a more thorough population-based study will need to be done in the future specifically examining the effect that lowering the minimum age of possession has on the demographics of shooters and the outcome of their victims.

5. Conclusion

As states grapple with the country's relatively high pediatric firearm violence rates, a variety of measures are being tried. One method that has gained popularity is to increase the availability of guns, including for children, with the belief that a well-armed population discourages incautious firearm usage. The results of our study pose serious concerns about the consequences of allowing adolescents to carry guns, even with parental agreement. The findings emphasize that future studies are needed to directly examine the number and characteristics of events involving child shooters following removal of minimum age laws.

CRedit authorship contribution statement

Adnan F. Haque: Conceptualization, Methodology, Writing - original draft. **Eric Jorge:** Conceptualization, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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