Firework Injuries Remain High in Years After Legalization: A Two-Year Follow-Up

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University of Iowa Hospitals & Clinics — University of Iowa Health Care

The University of Iowa IPRC Injury Prevention Research Center

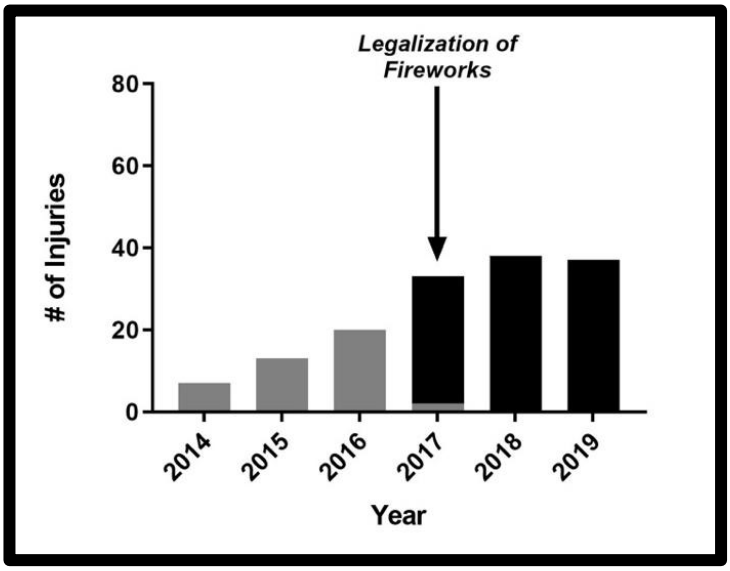
UnityPoint Health Des Moines

On May 9, 2017, the Iowa legislature approved SB489 which, for the first time, allowed the sale of fireworks in Iowa from June 1 through July 8 and December 10 through January 3. Although sales during these periods are legal statewide, counties and municipalities can restrict sales locally. We examine trends in emergency department visits to Iowa's two largest trauma systems before and after implementation of the law. Researchers at the University of Iowa Hospitals and Clinics Departments of Emergency Medicine and Surgery (Iowa City) and Iowa Methodist Medical Center, Unity Point Health (Des Moines), in association with the University of Iowa Injury Prevention Research Center, examined trends of firework injuries at both hospitals, for the years 2014-2019 to identify the public health implications of the new law.

Key Findings:

- Firework-related injuries were fairly consistent (ten to twenty injuries per year) in years prior to the legalization of consumer fireworks (2014-2016). In 2017 (the year of legalization), firework injuries more than doubled to just under 40 per year and have remained high through 2019.
- Injuries are most prevalent in the period surrounding the 4th of July holiday.
- More injuries are requiring amputation after legalization. 18% of post-legalization patients required amputations compared to no recorded amputations pre-legalization.
- Patients under the age of 18 increased by 11.3% and now make up 30.8% of patients.
- The proportion of injured patients who were handlers increased post-legalization (52% pre-legalization vs. 64% post-legalization)
- The proportion of injured patients with a positive drug screen on admission significantly increased from 2% to 17% post-legalization.

Firework Injuries Increase After Legalization



Recommendations:

- Establish safety campaigns targeting high-risk populations and emerging trends.
- Fund statewide research and establish a firework injury surveillance system with annual reporting.
- Engage stakeholders and lawmakers to create greater protections against children and intoxicated persons using fireworks.

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Firework Injuries More Than Doubled in 2017 and Have Remained High

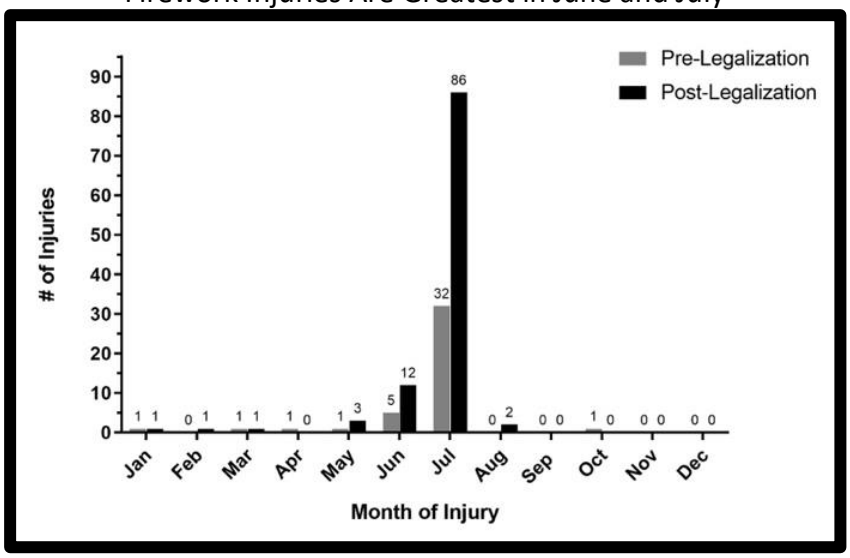
In the three years prior to implementing the new legislation, 42 firework-related injuries were treated by Iowa's two largest trauma systems. After the 2017 legislation legalizing fireworks, 107 injuries were treated by the same facilities in a shorter period between May 2017 and December 2019. The increase was first observedin 2017 with a 138.46% increase in injuries. Injuries remained high in the following years, with 200% and 184.62% increases over the pre-legislation three-year average in 2018 and 2019, respectively. Iowa's increase is far higher than national trends. A 2019 Consumer Product Safety Commission report stated that firework injuries had remained steady nationally from 2004 through 2019.[1]

Year	2014	2015	2016	2017 (Pre-legalization)	2017 (Post-legalization)	2018	2019
# of injuries	7	13	19	4	31	39	37

Injuries Are Concentrated Around the 4th of July Holiday

Most firework injuries occur in July, with June as a runner-up. Those months also saw the greatest significant increase in injuries, with a 168.75% increase in July from the pre-legalization period to the post-legalization period and a 140% increase in June. This finding is consistent with one of the legal use periods, which runs from June 1 through July 8. Importantly, there is not a similar finding for the other legal use period that runs from December 10 through January 3. There was no injury during either period in December and only two injuries in January, one prior to legalization and one after legalization.

Firework Injuries Are Greatest in June and July



Amputations Have Increased Significantly After Legalization

The most common injury site across both study periods was hands, with half of all injuries being to the hands. Other common injury sites include the eyes (32%), face (27%), and torso (20%). Burns were also very common, with 58% of patients suffering from burns. The most substantial change in injury characteristics was the significant increase in amputations. While no in-hospital amputations were recorded prior to legalization, 18% of patients required amputation after legalization. Amputations are associated with higher healthcare costs and greater disability. Hospital admissions have also increased, from just 3.6 per year prior to legalization to 14.6 per year after legalization. Those admissions have also resulted in more extended hospital stays with a median stay of 1.6 days prior to legalization and a median stay of three days after legalization. No patient died in the hospital setting from fireworks injuries, but this metric does not include out-of-hospital firework-related deaths.

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[1] Marier, A., Tu, Y., & Lee, S. (2020). *2019 Fireworks Annual Report: Fireworks-Related Deaths, Emergency Department-Treated Injuries, and Enforcement Activities During 2019* (United States of America, Consumer Product Safety Commission, Directorate for Epidemiology). Bethesda, MD: Government Publishing Office.

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Patients Under 18 Remain Disproportionately Affected

The average age of a firework injury patient before the legalization of consumer fireworks was 35 years old. After legalization, the average age decreased to 26 years old**. After legalization, 30.8% of patients were under 18 years old. In the three years prior to legalization, just 19.5% of patients were minors**. Prior to the legalization of fireworks, a majority of patients under 18, 50%, were bystanders. After legalization, that number dropped to 33%, a 17% decrease. Although the law prevents individuals under 18 from purchasing fireworks, the law does not protect minors, nor does it keep minors from using fireworks. **Post legalization, the majority of minors, 55%, were firework handlers**.

There is an Emerging Trend Correlating Drug Use and Firework Injuries

Most patients presenting with firework injuries are not tested for drugs or alcohol. In the pre-legalization period, 90% of patients were not tested for drugs, and 86% were not tested for alcohol. In the post-legalization period, 79% of patients were not tested for drugs, and 73% of patients were not tested for alcohol. In the post-period, 17% of patients tested positive for drugs, which is a significant increase from only 2% in the Pre-period. This means that of the 21% of patients who were tested for drugs, nearly 81% tested positive. It is not currently unlawful to use fireworks while intoxicated or under the influence of controlled substances.

Younger, White Men Are Most Likely to be Injured by Fireworks

After legalization, 72% of patients were male. 76% of patients were white. The median age of patients was 26 years old, with an interquartile range of 15-35, representing the middle 50% of the data. 60% of all injuries are to firework handlers.

Research Methods

Data was collected by querying all electronic health records (EHR's) held by University of Iowa Hospitals and Clinics and Iowa Methodist Medical Center using a search algorithm to locate the word "firework" in any part of a patient's EHR for the years 2014-2019. This data was reviewed to remove false positives and obtain demographics and encounter details. This data was compiled into a database with specifically defined variables. Statistical analyses were then performed on the database to create a dataset that conclusions could then be drawn from.

Research Limitations

This study only identified 149 patients across six years who suffered injuries from fireworks. It is possible that the method used to identify firework injuries missed patients who, in fact, were injured by fireworks, but it was not noted in the patient's EHR. Further, many findings are not statistically significant. The small sample size makes the statistics underpowered. This is especially true of data concerning minors. Though findings lack statistical significance, the societal ramifications cannot be ignored as each data point represents an injured Iowan.

Additionally, the majority of cities and towns in Johnson County, where University of Iowa Hospitals and Clinics is located, banned the use of fireworks within their jurisdictions, which could have reduced the number of injuries seen at University of Iowa Hospitals and Clinics. In Polk County, where Iowa Methodist Medical

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Center is located, fireworks have been permitted by some municipalities and by the county, but also banned by many of the most highly populated municipalities. This research identified all patients with firework injuries presenting to University of Iowa Hospitals and Clinics and UnityPoint Health providers regardless of their state of residency. While few patients came from out of state (five patients, three pre-legalization, and two post-legalization), that could slightly change the dataset. University of Iowa Hospitals and Clinics and Iowa Methodist are the only two level one trauma centers in the state of Iowa with the subspecialty support to manage the more complex firework injuries. Therefore, our study represents a partial sample of patients with firework injuries in the state as injuries that can be safely managed at local facilities are not transferred to the higher level of care.

Acknowledgments

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