Multiple Epidemics of Fatal and Non-fatal Firearm Injuries in Colorado Children

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Summary (2018 – 2022)

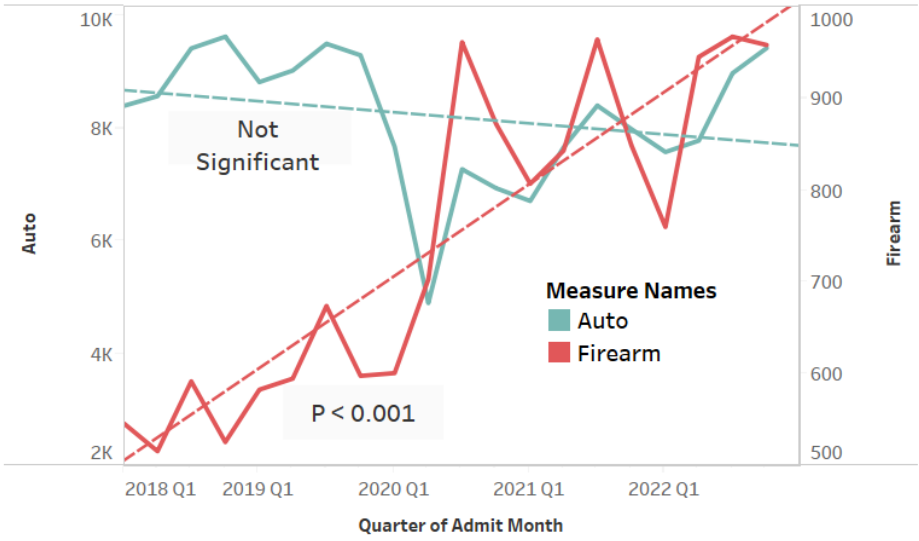
- **Firearm injuries and death in Colorado Children, ages 0-19 years:**
  - **Have continually increased, averaging almost one injury every day and one death per week - now exceeding the automobile death rate.**
  - **Have become the leading cause of death in children beyond the newborn period.**
  - **Are increasing significantly in multiple intent categories (unintentional, suicide and homicide), each with differing epidemiological characteristics and potential preventive remedies.**
  - **Are increasing as the firearm ownership rate increases.**
  - **Are mostly unintentional (52%), peaking in the summer, further documenting that access to continually increasing numbers of unsafely stored or handled firearms, increases risk of injury or death.**

Methods:

The numbers of non-fatal firearm and automobile injuries during 2018-2022 in Colorado children 0-19 years of age were estimated using the Colorado Hospital Association (CHA) inpatient and emergency department databases.[1] Firearm and automobile injury patients were identified by the presence of specific ICD-10 codes (see Appendix; Tables 4a-c for more details). Because different codes were used prior to 2018, those years were analyzed in a separate publication.[2] To adjust for possible double-counting, caused by transfers or readmissions related to the same injury, cases with proximate dates of visit (within that year), and the same birth year, birth month, gender and ZIP code were consolidated into a single record based on the first date of injury contact. Because the majority of automobile and firearm fatalities are not accounted for in the CHA emergency department or hospital records, we independently estimated them using the CDC Wonder database from 2000 to 2022, giving a longer period of analysis, but only compared them to the CHA data from 2018 - 2022.[3] The yearly cumulative increase in number of background checks (new purchase or transfer of firearms) in Colorado was estimated from Colorado Bureau of Investigation (CBI) InstaCheck Statistics. [4] In this analysis, a probability less or equal to 0.05 is considered to be significant. This implies that the observation is not likely to occur by chance.

Results:

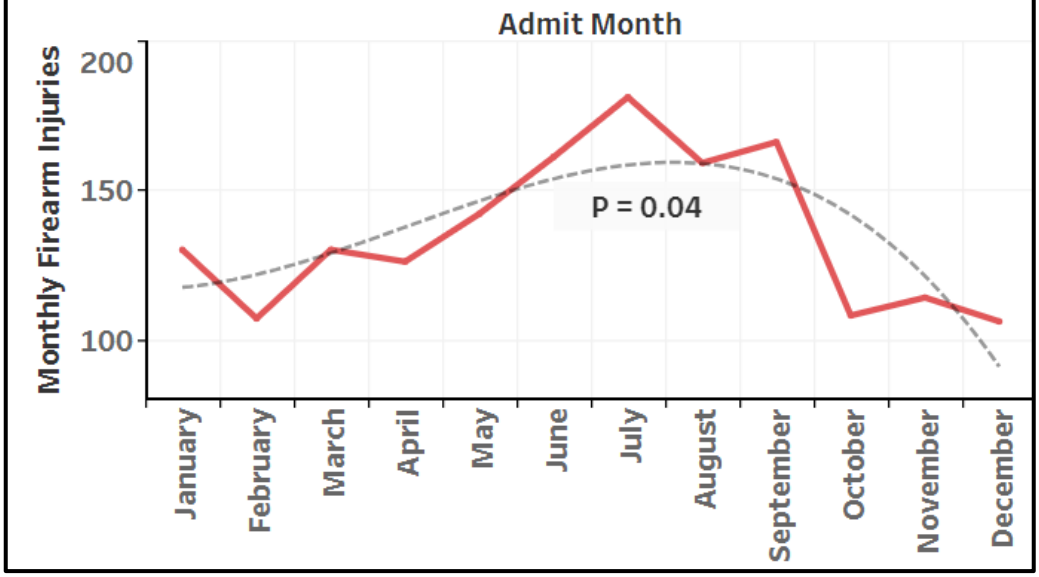
Figure 1: Auto and Firearm Injuries in Colorado Children, 0-19 years of age; 2018 - 2022 [Source CHA]

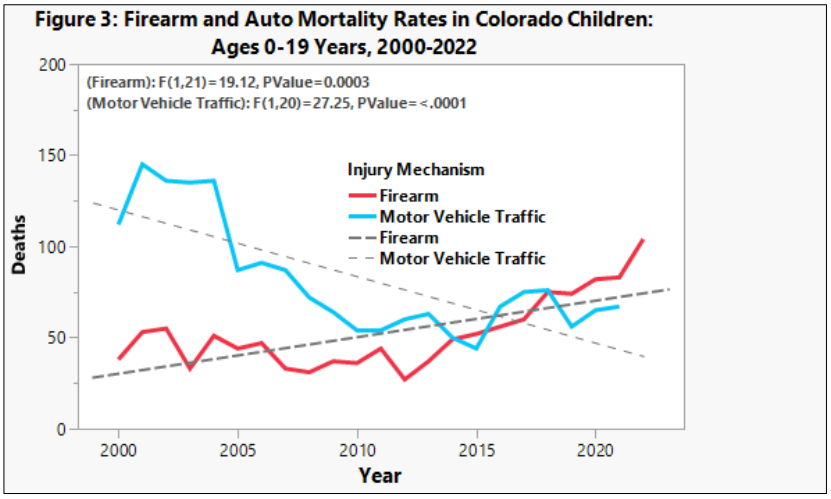


For many years, the incidence of non-fatal automobile injuries has been decreasing while firearm injuries have been increasing. Figure 1 shows the number of non-fatal firearm (red) and automobile (blue) injuries in Colorado children, 0–19 years of age. While non-fatal firearm injuries (right axis) are less frequent than automobile injuries (left axis), they are increasing significantly (P = 0.001) in Colorado children while automobile injuries are not increasing.

Non-fatal firearm injuries show a tendency to peak in the summer months (Figure 2) suggesting they are often occurring at a time children are home alone, unsupervised and more likely to experiment with firearms not safely stored. This observation is supported by the dip in the firearm injury cases noted in Figure 1 that coincided with the early peak of the COVID epidemic, when many parents were home in many States because of COVID lockdowns.

Figure 2: Incidence of non-fatal firearm injuries by month in Colorado children, ages 0-19 years, 2018-2022. [Source: CHA]





Similarly, Figure 3 shows that the firearm mortality rate in Colorado children is increasing significantly (P <0.0003) and now exceeds the automobile mortality rate which is decreasing signifcantly (P <0.0001). The fatality rate (19.6%) for firearm injuries is orders of magnitude higher than for automobile injuries (0.9%). For the first time (2018-2022), firearm-related injuries are the leading cause of death (28.1%) in Colorado children beyond the perinatal period, exceeding automobile injuries (23.4%), poisoning (17.3%), cancer (8.7%) and all other causes [Source: CDC Wonder database].

Figure 4 shows that, since 2010, the increasing firearm mortality rate in Colorado children is coincident with the increase in firearm purchases/transfers in Colorado (as estimated by the yearly cumulative number of firearm background checks). This is consistent with the assertion that the more firearms are accessible in the home, the more likely they will be used to cause injury and death (both intentional and unintentional, Table 1) in Colorado children.

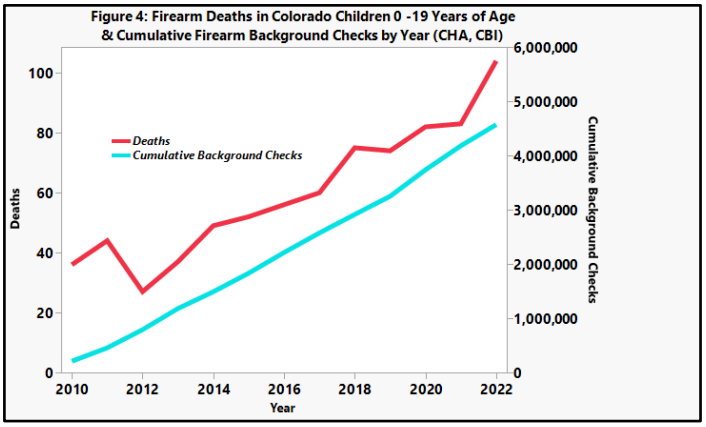


Table 1: Case counts of firearm injury and death in Colorado children 0-19 years, 2018-2022.

Injury Intent	Non-fatal Injury	Fatal Injury*	Total Injuries	Average Cases per Month	Fatality Rate
Unintentional	1117	12	1129	18.8	1.1%
Assault	485	192	677	11.3	28.4%
Suicide	39	198	237	4.0	83.5%
Undetermined	83	15	98	1.6	15.3%
Law enforcement	12	0	12	0.2	
Total	**1,736**	**417**	**2,153**	**36**	

Table 1 consolidates the information for fatal and non-fatal firearm injuries in Colorado children from 2018 through 2022. The greatest number of non-fatal firearm injuries (64%) are unintentional. The greatest number of fatal firearm injuries (51%) are caused by suicide, which also has the highest fatality rate (83.3%) as compared to other causes. Taken in aggregate, there is one firearm injury every day in Colorado children and more than

one fatality every week. As previously shown in Figure 2, the monthly incidence of all non-fatal firearm injuries peaks each year in the summer months when Colorado children are out of school and at home. This is also true for unintentional, non-fatal firearm injuries from 2018-2022, which are significantly (p= 0.02) increasing in Colorado children peaking each year in the summer months.

Table 2 shows the intent of combined fatal and non-fatal firearm injuries stratified by age. For 2018-2022, unintentional injury or death by firearm predominated (52.4%) in all age groups followed by assaults (31.4 %) and suicide (11.0%). Assaults and suicide occurred primarily in children 15-19 years of age but were also common in those 10-14.

Table 2: Fatal and Non-fatal Firearm Injuries by Age Group and Intent, 2018-2022

Intent	Age Group (years)			Row Total	% of Total
	< 10	10 - 14	15-19		
Unintentional	109	255	753	**1,129**	**52.4%**
Assault	20	86	571	**677**	**31.4%**
Suicide	1	46	190	**237**	**11.0%**
Undetermined	6	19	58	**98**	**4.6%**
Law enforcement	0	1	11	**12**	**0.6%**
Column Total	**136**	**407**	**1,583**	**2,153**	**100.0%**
% of Total	**6.3%**	**18.9%**	**73.5%**	**100.0%**	

Table 3 (next page) shows the univariate analysis of demographic and geographic variables associated with both fatal and non-fatal firearm injury. Over 80% of fatal and non-fatal firearm injuries occurred in males with over 70% occurring in children ages 15-19. The intent of non-fatal firearm injury was primarily unintentional (64.4%) whereas the intent of fatal injuries was most commonly suicide followed closely by assault. Because of differences in classification of race and ethnicity between the two data sources it was difficult to reach precise conclusions other than both fatal and non-fatal firearm injuries occurred most commonly in those classified as "white". Similarly, both fatal and non-fatal firearm injuries, occurred most commonly in metropolitan areas. In Regional Accountable Entities (RAEs), where non-fatal firearm injury rates could be calculated, rates were most common in Denver (RAE 5), Southeast Colorado (RAE 4) and East Central Colorado (RAE 3). Although limited somewhat by methodology, in aggregate, these data confirm that firearm injuries and death occur in all ages, races and geographic areas in Colorado.

Table 3: Characteristics of Fatal and Non-fatal Firearm Injuries in Colorado Children ages 0-19 years, 2018-2022						
Non-fatal				Fatal		
Characteristic	Options	Non-fatal (N)	Non-fatal (%)	Options	Fatal (N)	Fatal (%)
Gender	Female	294	17.0%	Female	61	14.6%
	Male	1,439	83.0%	Male	356	85.4%
Age Group	< 10 years	125	7.2%	< 10 years	18	4.3%
	10-14 year	347	20.0%	10-14 year	64	15.3%
	15-19 years	1,264	72.8%	15-19 years	335	80.3%
Race	White	756	47.4%	White	307	74.5%
	Other	367	23.0%	Black or African American	76	18.4%
	Black	291	18.2%	More than one race	19	4.6%
	Hispanic (see next section)	(140)		Asian	10	2.4%
	Unknown	130	8.1%			
	Asian	37	2.3%			
	Native American	15	0.9%			
Hispanic	Not Hispanic or Latino	1,047	60.3%	Not Hispanic or Latino	250	60.4%
	Hispanic or Latino	689	39.7%	Hispanic or Latino	164	39.6%
Facility	ED	1,332	76.7%			
	Hospital	404	23.3%	No Data		
Intent	unintentional	1,117	64.4%	unintentional	12	2.9%
	assault	485	28.0%	assault	192	46.0%
	undetermined	83	4.8%	undetermined	15	3.6%
	suicide	39	2.2%	suicide	198	47.5%
	law enforcemt	12	0.7%	law enforcemt	0	0.0%
Location	1 Metropolitan area core	1,509	86.9%	Large Central Metro	68	16.3%
	2 Metropolitan area high commuting	60	3.5%	Large Fringe Metro	155	37.2%
	3 Metropolitan area low commuting	1	0.1%	Medium Metro	128	30.7%
	4 Micropolitan area core	34	2.0%	Small Metro	22	5.3%
	5 Micropolitan high commuting	14	0.8%	Micropolitan (Nonmetro)	24	5.8%
	7 Small town core	79	4.6%	NonCore (Nonmetro)	20	4.8%
	8 Small town high commuting	4	0.2%			
	9 Small town low commuting	1	0.1%			
	10 Rural areas	34	2.0%			
RAE*		N	%	Population	Rate/100,000	
	1 - Western Colorado	138	7.9%	218,830	63.1	
	2 - Northeast Colorado	114	6.6%	118,491	96.2	
	3 - East Central Colorado	590	34.0%	408,877	144.3	
	4 - Southeast Colorado	182	10.5%	84,417	215.6	
	5 - Denver Colorado	347	20.0%	149,325	232.4	
	6 - West Central Colorado	159	9.2%	223,143	71.3	
	7 - South Central Colorado	206	11.9%	204,330	100.8	

*** https://www.coloradohealthinstitute.org/sites/default/files/file_attachments/Ways%20of%20the%20RAEs_1.pdf**

RAE 3 (Adams, Arapahoe, Elbert & Douglas Counties)

RAE 6 (Boulder, Broomfield, Gilpin, Clear Creek & Jefferson Counties)

RAE 7 (Park, Teller & El Paso Counties)

Comment:

Firearm injuries and deaths are common and increasing in US and Colorado children, 0-19 years of age.[5] This reflects an increasing public health crisis that occurs in both rural and urban areas and affects all races and ethnicities.[6] The great majority of non-fatal injuries are unintentional,[7] while the majority of firearm fatalities are due to suicides and homicides.[8] These are increasing at alarming rates in Colorado and the US.[9]

We confirm multiple epidemics of gun injury and death (unintentional, homicide and suicide), at the same time as the number of firearms in Colorado is increasing. In this study, firearm injury occurs in Colorado children once every day, with death occurring once every week. For the first time, the mortality rate for childhood firearm injury in Colorado children exceeds that for automobile injury, with a 21 times greater fatality rate. Non-fatal firearm injury is most often unintentional in all age groups (0-19 years of age). Also occurring most often in the summer, these observations strongly support the need for policies that limit firearm access and encourage and enforce safe storage best practices that can prevent many injuries and deaths in Colorado children.[14]

Beginning decades back, efforts to improve automobile safety for children resulted in significant decreases in automobile accident-related injury and death.[10–13] States with more stringent firearm laws have fewer numbers of children with firearm injuries or death.[15] Contrary to the misperception that 'firearms in the home keep families safe', easy access to an increasing number of firearms is a major risk factor for non-fatal and fatal firearm injuries. This is a public health crisis in Colorado that requires more rigorous approaches to assure the safe possession and use of firearms.[9,16–22]

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APPENDIX

Table 4a: ICD-10 codes for causes of firearm injuries

Cause of injury	ICD-10 code and description
Assault	X93, X94, X95 (gun homicide, attempted or completed)
Suicide attempt	X72, X73, X74 (gun suicide, attempted or completed)
Unintentional	W32, W33, W34 (unintentional shooting, fatal or non-fatal)
Undetermined	Y22, Y23, Y24 (unknown cause, fatal or non-fatal)
Law enforcement	Y350 (intervention involving firearm discharge)
Terrorism	Y384 (terrorism involving firearms)

Table 4b: ICD-9 E-codes for causes of automobile injuries

Cause of injury	E code
Collision with another motor vehicle	E811
Other motor vehicle traffic accident involving collision with motor vehicle	E812
Collision with other vehicle	E813
Pedestrian collision	E814
Collision on highway	E815
Loss of control	E816
Injured person code	**(4th digit)**
Driver of motor vehicle other than motorcycle	0
Passenger in motor vehicle other than motorcycle	1
Motorcyclist	2
Passenger on motorcycle	3
Pedal cyclist	6
Pedestrian	7

Table cc: ICD-10 codes for causes of automobile injuries

Cause of injury	ICD-10 code and description
V40-V49	Car occupant injured in collision
V50-V59	SUV or pickup truck occupant injured in collision