

Nonfatal Gun Injury Data Findings Memo

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Findings: Nonfatal gun injury data pulled from the CDCs Web-based Injury Statistics Query and Reporting System ([WISQARS](#)) shows an increasing trend in injuries over time, while data from the Health Care Utilization Project's ([HCUP](#)) National Inpatient Sample ([NIS](#)) and Nationwide Emergency Department Sample ([NEDS](#)) shows a decreasing injury trend. The differences in slope coefficient for firearm injury trends were found to be statistically significant at the $p < 0.1$ level or lower. For comparable injuries among the datasets analyzed, firearm gunshots are the only category that is consistently different.

Reasons for investigation: For journalists, researchers, and the general public, the Centers for Disease Control and Prevention serves as an authoritative source for annual estimates of firearms deaths and injuries. The CDCs estimates are generated by the National Electronic Injury Surveillance System ([NEISS](#)), and this data is accessible through the WISQARS online database that can be queried on demand. Between 2015 and 2016, there appeared to be an unlikely single year increase in the number of Americans injured by a firearm. The data rose by 36 percent from 85,000 estimated injuries to 116,000. It was the largest single-year increase recorded in more than 15 years. The coefficients of variation for firearm injury estimates were also among the highest for the WISQARS estimates. When compared to other sources of gun injury data, the CDC is the only source that shows an increasing injury trend over a comparable period of time.

Cause of injury selection: Ten injury causes were selected for comparison between the CDC and HCUPs NEDS and NIS databases. The categories chosen were the ones believed to be most directly comparable between the cause of injury options available in [WISQARS](#) and the External Cause of Injury CCS classifications available in [HCUPnet](#) (ICD-9 codes in appendix). Causes that the sources did not have in common were excluded (such as bite and foreign object, which are found only in WISQARS), as were causes for which the sources injury definitions substantially differed (such as transportation injuries and poisoning).

HCUP excludes self-harm from its CCS classifications, so self-harm injury estimates were queried through HCUPnet based on the ICD-9 codes corresponding to the applicable causes of injury and added to the CCS estimates.

Table 1: Differences between Time Trend Coefficients

	CDC β_t	NEDS	NIS
Cut/Pierce	-0.0210	0.324	0.212
Drowning/Submersion	0.259	0.494	0.229
Fall	0.293	0.032	0.001
Fire/Burn	-0.0270	0.170	0.228
Firearm Gunshot	0.264	0.313	0.376
Inhalation/Suffocation	0.315	0.194	0.022
Machinery	-0.320	0.014	0.0180
Natural/Environment	0.230	0.113	0.092
Overexertion	-0.215	0.132	0.122
Struck By/Against	-0.189	0.132	0.0980

Analysis: To compare the trends over time of injury causes for different databases, we first standardized the yearly counts for each source and injury cause type. We then fitted a regression line over time for each source and injury cause type, and compared those time trend coefficients across data sources. Table 1 shows the absolute difference in time trend coefficients between various databases compared to the CDC data for each type of injury cause. Light red cells indicate a statistically significant difference between slope coefficients at the $p < 0.1$ level and dark red cells at the $p < 0.05$ level (all comparisons are looking at the respective data source versus the CDC). In general, the three databases had similar trends for most injury causes. The exceptions are the drowning/submersion and firearm gunshot categories. Firearm gunshot is the only category that is consistently (and significantly) different when comparing the CDC data with the other databases.

Figure 1 below shows the fitted trend lines for each injury cause category and data source. Here we can see the patterns that emerge between the data sources. Of note, in the firearm gunshot category, the CDC diverges from other sources in showing a positive association between gun injuries over time whereas it is negative for all the other data sources.

Figure 1: Fitted Trend Lines, By Injury Category

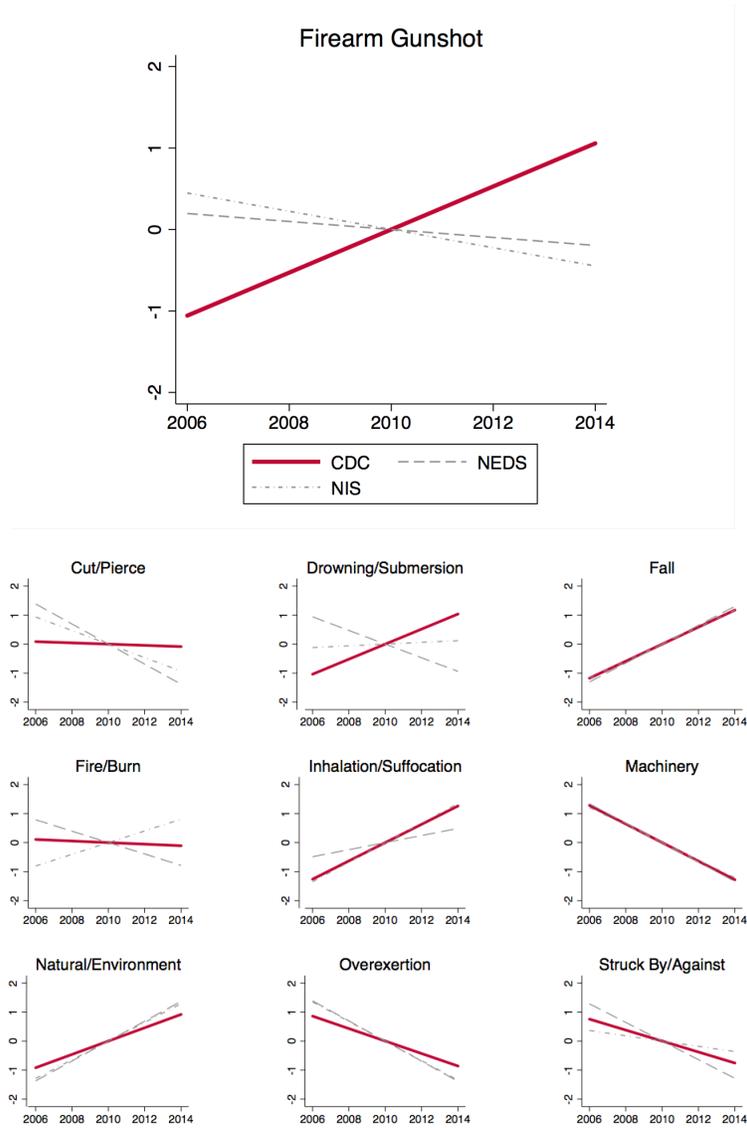


Figure 2: Fitted Trend Lines using *Lowess*, By Injury Category

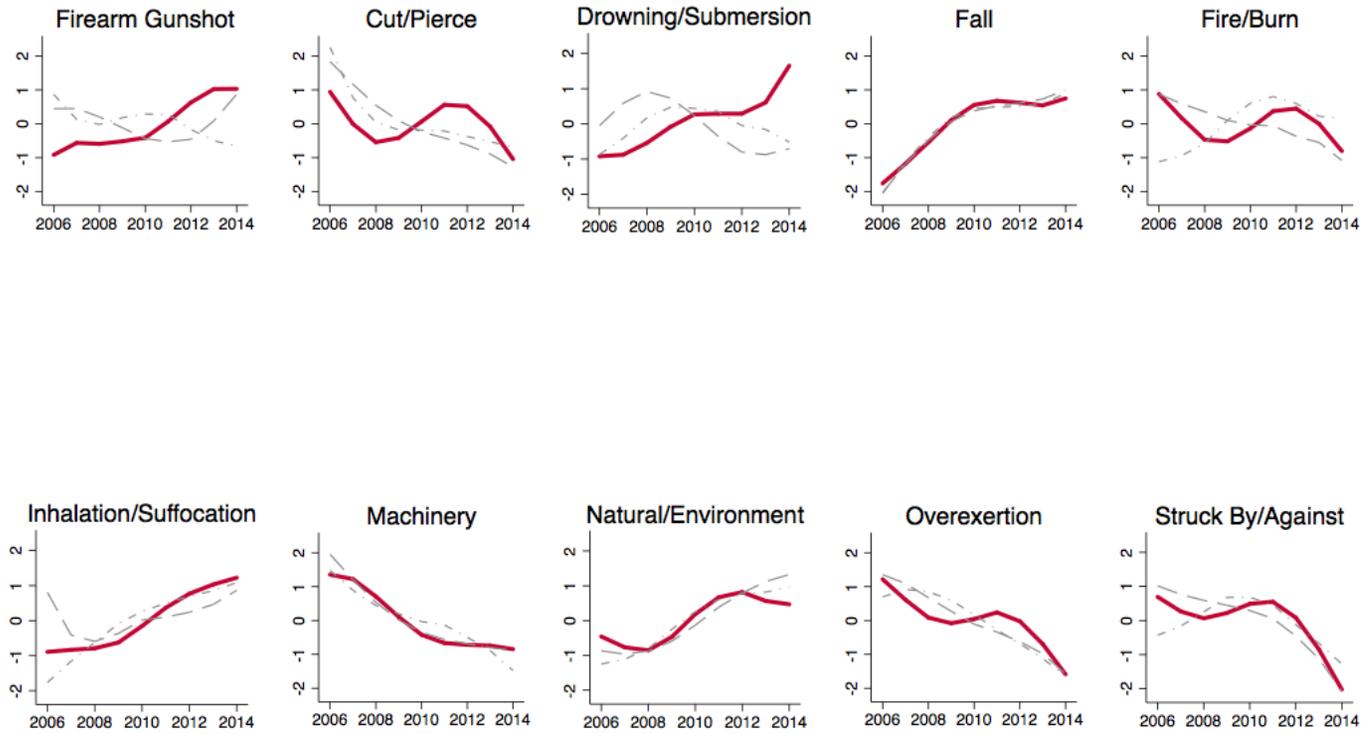
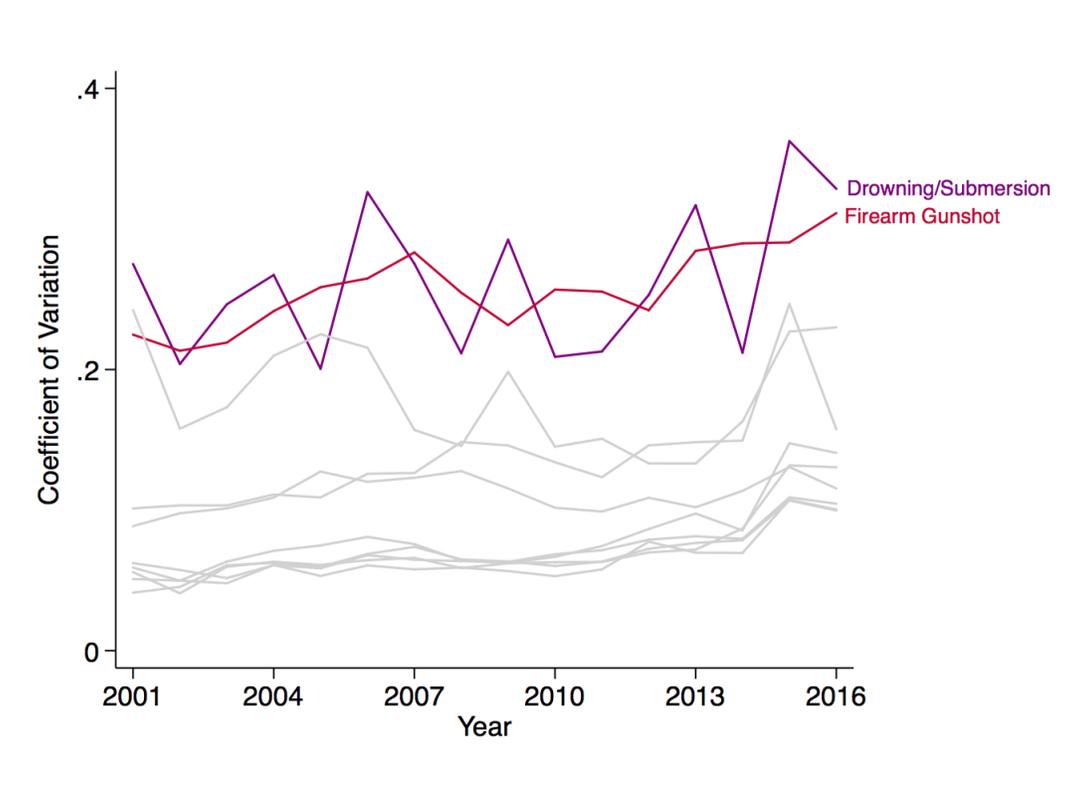


Figure 2 shows the trend lines fitted using a lowess regression. Again we see that for most categories, the trends are similar between all three sources except for firearm gunshot and drowning/submersion (and to a lesser degree cut/pierce).

Figure 3 below shows the coefficient of variation over time for each injury category in the CDC database. As is seen, the categories with the most consistently high coefficient of variations are drowning/submersion and firearm gunshot. This lends more evidence to how the data may be less reliable than expected.

Figure 3: Coefficient of Variation Over Time, By Injury Category



Other sources: Annual summaries of injury data from the National Trauma Data Bank were considered for analysis, but ultimately excluded since a reliable national estimate could not be generated from the sources available. The proportion of nonfatal gun injuries to total injuries was used as a proxy for a national trend in hospital intake injuries. The trend for this proportion of the data decreased from 2005 to 2016, but the proportion of injuries ultimately proved to be an unreliable indicator for injury trends.

Injury estimates from the National Crime Victimization Survey (NCVS) showed a decreasing

firearm injury trend. However, the data source and methodology is not directly comparable to emergency department administrative data, so this analysis was not applied to NCVS estimates.

The total number of gun assault incidents from the Federal Bureau of Investigation's Uniform Crime Reporting Program (UCR) was considered as another source of injury comparison. These figures only deal with crimes known to law enforcement and an assault incident does not preclude an injury event, so this data was also excluded from the analysis. The linear trend is decreasing in this data, although the data indicates a parabolic U-shaped trend from 2008 to 2015.

Questions:

- Why might we be seeing these results?
- How reliable do you suspect the CDC's gun injury estimates are in light of this analysis?
- What can be done to improve gun injury data collection?
- Is this methodology appropriate for these kinds of comparisons and are we overlooking anything in our analysis?
- Is there anything else that you would like to add?

Appendix

HCUPnet injury counts were obtained by adding the results of queries for CCS injury classifications with queries for self-harm codes, which are excluded from the [CCS definitions](#).

- **Firearm**

- CCS Firearm definition: E922.0 E922.1 E922.2 E922.3 E922.8 E922.9 E928.7 E965.0 E965.1 E965.2 E965.3 E965.4 E970 E979.4 E985.0 E985.1 E985.2 E985.3 E985.4
- Self-harm codes: E955.0 E955.1 E955.2 E955.3 E955.4

- **Inhalation/Suffocation**

- CCS Suffocation definition: E911 E912 E913.0 E913.1 E913.2 E913.3 E913.8 E913.9 E928.4 E928.5 E963 E983.0 E983.1 E983.8 E983.9
- Self-harm codes: E953.0 E953.1 E953.8 E953.9

- **Drowning/Submersion**

- CCS Drowning/submersion definition: E830.0 E830.1 E830.2 E830.3 E830.4 E830.5 E830.6 E830.7 E830.8 E830.9 E831.7 E832.0 E832.1 E832.2 E832.3 E832.4 E832.5 E832.6 E832.7 E832.8 E832.9 E910.0 E910.1 E910.2 E910.3 E910.4 E910.8 E910.9 E964 E984
- Self-harm codes: E954

- **Cut/Pierce**

- CCS Cut/pierce definition: E920.0 E920.1 E920.2 E920.3 E920.4 E920.5 E920.8 E920.9 E966 E974 E986
- Self-harm codes: E956

- **Fall**

- CCS Fall definition: E880.0 E880.1 E880.9 E881.0 E881.1 E882 E883.0 E883.1 E883.2 E883.9 E884.0 E884.1 E884.2 E884.3 E884.4 E884.5 E884.6 E884.9 E885 E885.0 E885.1 E885.2 E885.3 E885.4 E885.9 E886.0 E886.9 E888 E888.0 E888.1 E888.8 E888.9 E968.1 E987.0 E987.1 E987.2 E987.9

– Self-harm codes: E957.0 E957.1 E957.2 E957.9

- **Struck By/Against**

– CCS Struck by/against definition: E916 E917.0 E917.1 E917.2 E917.3 E917.4 E917.5 E917.6 E917.7 E917.8 E917.9 E927.4 E960.0 E968.2 E973 E975

– Self-harm codes: E958.0

- **Fire/Burn**

– CCS Fire/burn definition: E890.0 E890.1 E890.2 E890.3 E890.8 E890.9 E891.0 E891.1 E891.2 E891.3 E891.8 E891.9 E892 E893.0 E893.1 E893.2 E893.8 E893.9 E894 E895 E896 E897 E898.0 E898.1 E899 E924.0 E924.1 E924.2 E924.8 E924.9 E961 E968.0 E968.3 E979.3 E988.1 E988.2 E988.7

– Self-harm codes: E958.1 E958.2

- **Natural/Environment**

– CCS Natural/environment definition: E900.0 E900.1 E900.9 E901.0 E901.1 E901.8 E901.9 E902.0 E902.1 E902.2 E902.8 E902.9 E903 E904.0 E904.1 E904.2 E904.3 E904.9 E905.0 E905.1 E905.2 E905.3 E905.4 E905.5 E905.6 E905.7 E905.8 E905.9 E906.0 E906.1 E906.2 E906.3 E906.4 E906.5 E906.8 E906.9 E907 E908 E908.0 E908.1 E908.2 E908.3 E908.4 E908.8 E908.9 E909 E909.0 E909.1 E909.2 E909.3 E909.4 E909.8 E909.9 E928.0 E928.1 E928.2 E988.3

– Self-harm codes: E958.3

- **Machinery**

– CCS Machinery definition: E919.0 E919.1 E919.2 E919.3 E919.4 E919.5 E919.6 E919.7 E919.8 E919.9

- **Overexertion**

– CCS Overexertion definition: E927 E927.0 E927.1 E927.2 E927.3 E927.8 E927.9

Raw Counts

