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MASS SHOOTINGS

ARE THEY A SIGNIFICANT PROBLEM?

by

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Mass shootings are horrific events. There is no doubt about that. However, before we can answer the question in the title, we need to define the problem, collect data to measure the extent of the problem, and compare the significance of the problem to the significance of similar problems. Only then should we propose alternative effective cost effective solutions. We should not just emote in a politically correct fashion and hurriedly DO SOMETHING which will probably not solve the problem, cause a lot of heartburn, and waste a lot of money.

The next section contains a short summary of my analysis of the problem, followed by the analysis itself. At the end is an appendix containing a computer run with computations mentioned in the analysis.

SUMMARY

The number of fatalities due to motor vehicle crashes is 310 times the number of fatalities due to mass shootings. Yet, we have not panicked and demanded that our politicians DO SOMETHING about motor vehicle crashes. We have had thoughtful safety programs in place over many years to improve vehicles and get impaired drivers off the road. We need to calm down and do the same thing with mass shootings.

ANALYSIS

DEFINITION OF MASS SHOOTING

There is no official definition (standard) for a “mass shooting”. However, there is a public law[1] that requires federal authorities to assist, if asked by state and local authorities, in investigations of shootings resulting in the deaths of three or more people in a public places.

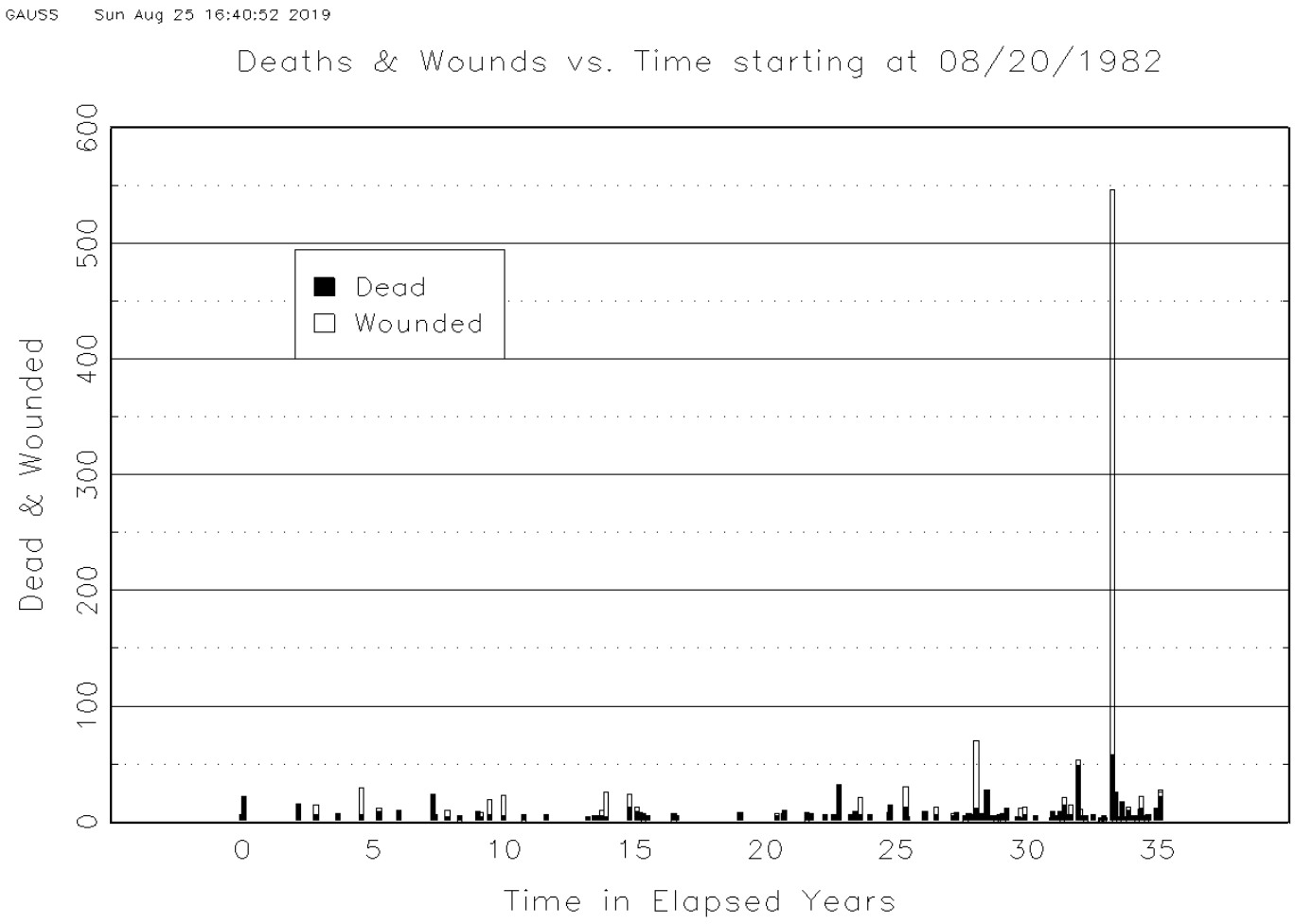
[1] Public Law 112–265 112th Congress

Several databases keep track of mass shootings. Each uses a different definition, which is set by the database keepers[2]. The conclusions an analyst draws may well depend upon the database the analyst uses. I chose to use the database kept by Mother Jones[3] because the standard closely conforms to the public law mentioned above, requiring three fatalities (excluding the shooter), and excluding crimes of armed robbery, gang violence or domestic violence. Moreover, from my observations, the mass shootings reported by the popular press tend to meet the Mother Jones standard.

DATA AND DATA ANALYSIS

When I downloaded the Mother Jones data, it covered 114 shootings dating from 8/20/82 to 8/4/19.

Looking at the numbers of people killed and wounded, the numbers seem to be reasonably steady except for the shooting that occurred in Las Vegas, Nevada, on October 1, 2017, where 58 and 546 people were killed and wounded respectively. The below graph shows the numbers of people killed and wounded over the time of the 114 shootings. In some of the shootings, the number of people wounded (if any) was less than the number killed so the wounded bar is masked by the killed bar. The mean numbers of people killed and wounded per shooting was 8.2 and 12.4 respectively. The computation of these numbers is in the computer printout shown in section A of the appendix.



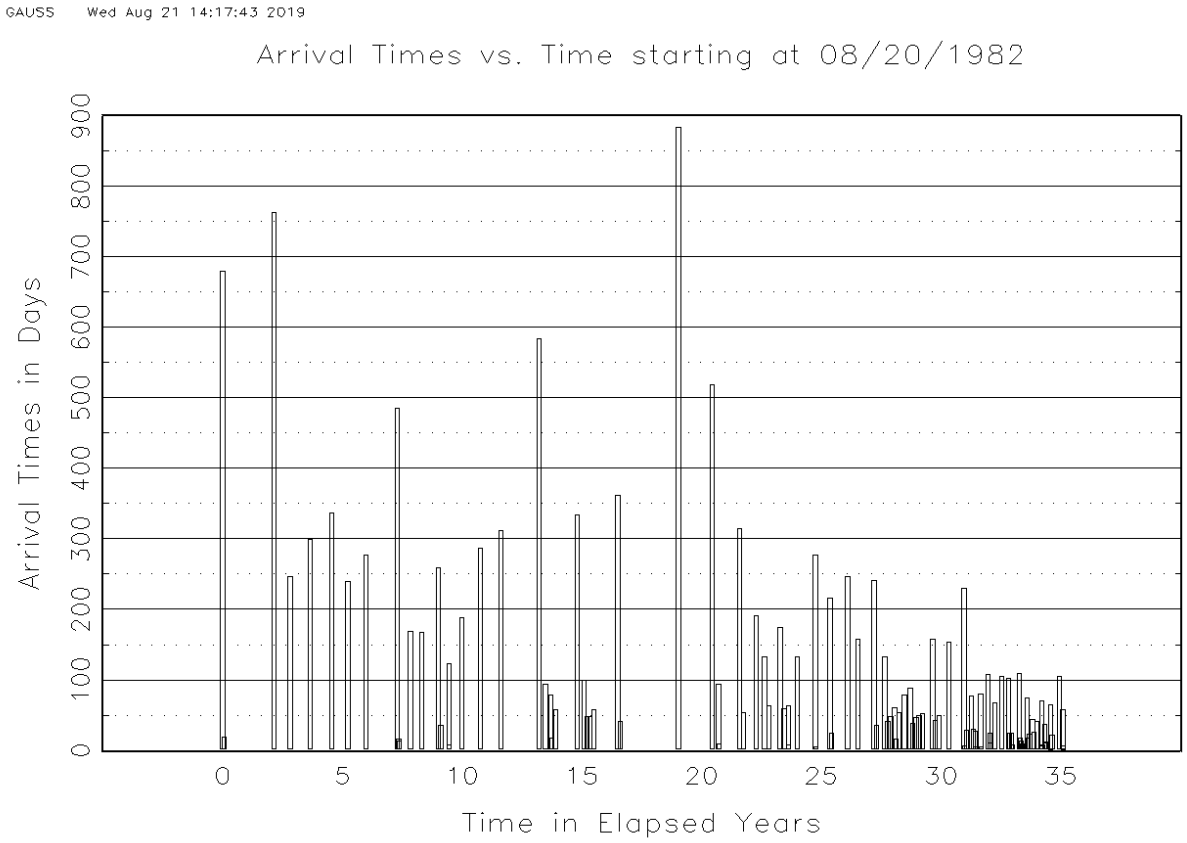
[2] The science of gun policy : a critical synthesis of research evidence on the effects of gun policies in the United States. The RAND Corporation, Santa Monica, CA : RAND, [2018], p266.

[3] https://www.motherjones.com/politics/2012/12/mass-shootings-mother-jones-full-data/

The occurrence of mass shootings can be looked at as a queuing problem. The arrival times -- the times between consecutive mass shootings – being exponentially distributed, can be mapped into the probability of zero or more mass shootings on any day, which are Poisson, distributed[4]. Using the data as presented, one finds that the mean arrival time is 119.45 days and the probability of one or more mass shootings on any day is less than 1%.

Using the means of the killed and wounded data, the expected value of the killed or wounded on any day are 0.07 and 0.10 people per day respectively. Again, the computation of these numbers is shown in the computer printout in section A of the appendix.

The below graph shows the arrival times over the time period of the 114 shootings.



The graph shows that the arrival times have been generally getting shorter as the years have passed meaning that the pace of mass shootings is increasing which lead me to believe that a more appropriate arrival time for use in estimating the expected number of casualties would be an estimate of the arrival time at the time of the last shooting. The estimates of this arrival time and associated probability of one or more shootings are 26.4 days and slightly less than 4% respectively resulting in expected numbers of people killed or wounded of 0.33 and 0.50 per day respectively. The computations of these numbers are shown in section B of the appendix.

COMPARISON WITH TRAFFIC FACILITIES

There were 37,133 highway deaths 2017[5]. Adjusting the expected numbers of people killed or wounded per day in a mass shooting to an annual basis yields 120 and 182 people killed or wounded. Approximately 310 times as many people

[4] Manoukian, Edward B. Modern Concepts and Theorems of Mathematical Statistics. Springer-Verlag, NY, NY. 1986. P135.
[5]https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812603.

are being killed in motor vehicle crashes than in mass shootings but we are not pulling out our hair and shouting “DO SOMETHING” about motor vehicle crashes.

Quoting the reference in footnote five, “Over the past 40 years, there has been a general downward trend in traffic fatalities. Safety programs such as those increasing seat belt use and reducing impaired driving have substantially lowered the traffic fatalities over the years. Vehicle improvements such as air bags and electronic stability control have also contributed greatly to the reduction of traffic fatalities.” In other words, we did not panic. We have established thoughtful deliberate programs to lower traffic fatalities that are working. We need to do the same thing with mass shootings. Moreover, a good starting place would be the RAND study referenced in footnote two. I have been collecting publications relevant to the mass shooting problems. If you contact me at detweij@peak.org, I will send them to you in a zip file.

APPENDIX

(A)

```
mean deaths                          =        8.1946903
mean wounded                         =        12.415929
mean time between arrivals           =        119.45133
inverse time between arrivals (mu)   =     0.0083716106
```

# of events	prob	killed	wounded
0.00000000	0.99166333	0.00000000	0.00000000
1.0000000	0.0083018193	0.068030838	0.10307480
2.0000000	3.4749799e-05	0.00056952768	0.00086290209
3.0000000	9.6970596e-08	2.3839320e-06	3.6119402e-06
4.0000000	2.0295002e-10	6.6524501e-09	1.0079252e-08
5.0000000	3.3980370e-13	1.3922931e-11	2.1094894e-11
	Totals	0.068602756	0.10394132

(B)

Time = 0 at last mass shooting. ln(arrints) = ln(b0) + b1*t

Valid cases:	113	Dependent variable:	lnarrint
Missing cases:	0	Deletion method:	None
Total SS:	227.638	Degrees of freedom:	111
R-squared:	0.241	Rbar-squared:	0.234
Residual SS:	172.830	Std error of est:	1.248
F(1,111):	35.201	Probability of F:	0.000

Variable	Estimate	Standard Error	t-value	Prob >|t|	Standardized Estimate	Cor with Dep Var
ln(b0)	3.202155	0.174505	18.349895	0.000	---	---
b1	-0.000189	0.000032	-5.933031	0.000	-0.490684	-0.490684

b0 (estimate of arrival time at t=0) = 24.585462

# of events	prob	killed	wounded
0.00000000	0.96014166	0.00000000	0.00000000
1.0000000	0.039053229	0.32002911	0.48488212
2.0000000	0.00079423419	0.013017006	0.019722311
3.0000000	1.0768345e-05	0.00026472975	0.00040109702
4.0000000	1.0949911e-07	3.5892452e-06	5.4381328e-06
5.0000000	8.9076310e-10	3.6497638e-08	5.5298258e-08
	Totals	0.33331447	0.50501102