A Look into Police Killings and its Disparities

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Table of Contents

ABSTRACT

Policing has become an increasingly popular topic of discussion in American political circles. However, across races and ethnicities, people in the United States view police differently. While 84% of black adults believe police treat those of color differently, only 63% of whites think the same. Even more striking, blacks gave police officers an average rating of 47 out of 100, while whites averaged a score of 72, highlighting the divorce in perceptions of blacks and whites towards law enforcement. Even among those with a badge, black officers are more than twice as likely to see police killings of black civilians as symptomatic of a larger problem (Pew Research Center). Raising questions of police discrimination, brutality, and excessive force, the deaths recorded in the dataset are but a small portion of a much larger conversation happening at dinner tables and in living rooms across the country about the role race still plays in the United States. In this case, this conversation becomes even more significant, with the dataset representing hundreds of tragic deaths which have affected friends and loved ones in every state.

Along those lines, the research questions presented revolve largely around building a strong preliminary understanding of the intersection of race, ethnicity, and police killings in the United States. Pulling data from those killed by police in 2015 with the statistical tools of R, we derived a few key findings. Not only did we find that blacks were disproportionately more likely to be shot than whites, but also far more likely to be shot in their vehicle. Furthermore, we found that the South and West had a disproportionate amount of police killings, in addition to a parabolic shape to the age of the victim, in which one there is a positive correlation in one's younger years with increased age which then becomes a negative correlation once someone

becomes older.

INTRODUCTION

The original data found is from those killed by police in 2015. We examined shootings relative to race, region, poverty, and whether or not the victim was armed. Our first research question raises the query of whether police shootings correlate with race and ethnicity. Comparing the proportion of each race that is killed relative to their underlying proportion of the American population assists in determining whether a certain race or ethnicity is shot at a greater rate than their relative share of the population using hypothesis testing and statistical inference. The second research question inquired whether whites and blacks are equally likely to be unarmed or in their vehicle when they are killed, using the similar methods of proportion tests and confidence intervals as the first question. The third research question explored which regions have the most shootings. Using US Census data and the data wrangling abilities possible through R, each state was assigned to its respective region, and the rates of shootings were also compared using hypothesis testing and confidence intervals to determine whether shootings were more likely in different regions of the country. The final research question queried if there is a correlation between age and police killings, using the techniques of linear regression.

RESEARCH QUESTIONS

What is the breakdown of victims by race and ethnicity, and how does that compare to the American populace at large?

Of the 467 individuals identified as being shot and killed by law enforcement officials in 2015, 452 have an identified race or ethnicity. Calculating based on raw numbers, the totals are clear: that more white Americans are shot by police than any other race, followed by black then Hispanic/Latino. Indeed, with 95% confidence it can be estimated that between 47.50% and 56.89% of those shot and killed by police are white. In comparison, the same interval for blacks is 25.73% to 34.36% and 11.74% to 18.51% for Hispanics. Thus, on its face, it seems that white Americans are disproportionately affected by police violence. Relative to their population proportions, however, the converse is true.

Utilizing 2015 US Census estimates (US Census Bureau), police killings were compared to the relative proportions of the aforementioned races and ethnicities in the United States as a whole, telling a much different story. The proportions of police killings for each race or ethnicity were compared against their proportion of the US population as a null proportion for the hypothesis test. With a p-value of 2.2e-16 for both whites and blacks, we can say with a great degree of certainty that whites are killed by police at a lower rate relative to their share of the American population, while blacks are killed at a rate far greater than their proportion of the population of the United States. For Hispanic/Latinos, the same test returned a p-value of 0.1366, meaning that with a significance level of 0.15, there is evidence to suggest Hispanic/Latinos are killed at a disproportionately higher rate than their population proportion. That being said, given a lower significance level (such as the common 0.05), the null hypothesis that Hispanic/Latinos are killed at a rate equivalent to their population proportion cannot be rejected.

Are whites and blacks equally as likely to be unarmed and in their vehicle when they are killed?

The dataset provided depicts the details of more than 450 shootings by police officers in 2015, including the critical question of whether the victim was armed. A simple table gives a clear answer that approximately half of all victims had a firearm when they were shot. What is more surprising, however, is the number of individuals who were not armed when they were killed. The second most common type of "weapon," more than 100 people were shot by police officers in 2015 while being completely unarmed. Other possible weapons included a knife, vehicle, and a non-lethal firearm, all in addition to either disputed, unknown, or other weapons. While these figures, most notably the number of individuals who were unarmed when shot dead is staggering and worthy of further research, the question at hand is whether race played a factor – whether blacks were just as likely to be shot as whites depending on their weapon (or lack thereof).

The first problem that arose was the small sample size for cross referencing an individual's race and their weapon at the time of death. For example, only one Asian-Americans was killed by police in a vehicle in 2015, making it hard to derive conclusions from that data. Thus, we have focused on research on comparing blacks and whites, and whether blacks and whites were killed at equal rates while unarmed or in a vehicle.

Insofar as unarmed victims, we were unable to reject the claim that whites and blacks are equally likely to be unarmed when they are shot by police. While 23.70% of blacks were unarmed, relative to only 21.61% of whites, the 95% confidence interval of the difference in proportions includes zero, with a resulting p-value of 0.3684. Thus, the null hypothesis of equal proportions cannot be rejected.

The same, however, cannot be said of blacks and whites killed while in their vehicle. While 6.67% of blacks were in their car when they were killed, only 2.12% of whites fell into the same category. Along those lines, the p-value of 0.027 indicates that blacks that are killed by police are indeed more likely to be killed by a police officer while they are in their vehicles. Indeed, this value should be of little surprise. Previous research indicates that the average black driver is stopped 0.34 times per year by either state or local police, while the average white driver is stopped only 0.25 times per year[1] (Stanford Computational Policy Lab). Thus, while blacks are 36% more likely to be pulled over than their white counterparts, death in their car at the hands of a police officer is 316% more likely to happen to black Americans than white Americans, indicative of much larger forces at play than just the rate at which African-Americans are pulled over in the United States.

Which regions have the most killings?

The next item examined was police shootings by region. The United States was separated into four regions, the South, Northeast, Midwest, and West, in line with the boundaries used by the U.S. Census. From there, the raw number of those killed in each region were examined. However, much in the way that looking at the raw number killed by race was misleading due to differences in population proportion, looking at the raw number of those killed in each region does not necessarily give the complete picture, as the number of citizens in each region is not equal.

To get a better understanding of the number of those killed by police on a per capita basis, the number killed in each region was converted into a number of individuals killed for

[1] Derived from the Stanford Computational Policy Lab's Open Policing Project, which analyzed more than 100 million traffic spots by both state and municipal law enforcement officers with data from every state.

every one million residents of the region using Census estimates from 2015 (the year from which the data is derived). At the lowest per capita rate was the Northeast, with 0.7 individuals killed by the police per 1 million residents. Next was the Midwest, with 1.08 killed. Far greater, however, were the South and West, with a death rate of 1.64 and 2.06, respectively. Given the differences in population between the regions, the per capita analysis gives a more accurate picture of the death rate when comparing the regions.

Furthermore, the proportion of individuals killed in each region was compared to that region's proportion of the American population using a one-sample proportion test. The Midwest and Northeast were less likely to be plagued by police killings relative to their share of the populace, with p-values of 0.004 and 2.71e-7, respectively, indicating that the true proportion of those killed by police was less than the proportion of the nation's populace that lives in each region. The South and the West faced similar results, but in the other direction, with both regions' police officers killing its citizenry at a rate disproportionate to their share of the American population. In the South, where 37.7% of the nation lives, the 95% confidence interval highlighted that between 38.10% and 47.25% of police killings occur. The West had even more shocking results, as between 29.17% and 37.91% of shootings occur, yet where only 23.6% of the population lives, resulting a p-value of 7.99e-7, cementing the disproportionate rate at which police officers shoot and kill citizens in the South and West.

Finding a causal explanation for these values proved difficult. In 2011, the FBI published regional crime data, indicating violent crime rates that were nearly identical in the Northeast and Midwest (352.1 per 100,000 and 349.9 per 100,000, respectively). Indeed, despite nearly identical rates of violent crime, the Midwest had significantly more deaths per capita at the hands

of a police shooting. However, the South and West did face higher rates of violent crime, which could partially explain the higher rate of police shooting. That being said, violent crime in the South was barely more than 20% greater than the Northeast and Midwest, yet the South's law enforcement officers killed its citizens at a far higher rate. Thus, violent crime rates serve as an insufficient causal factor to explain the wide disparity in rates at which different region's citizens suffer death at the hands of police officers. More targeted analysis of the causal factors behind police shootings of civilians is the work of a much more advanced, and undoubtedly more complicated, research project.

Is there a correlation between age and police killings?

For a more comprehensive analysis of the data, the full data set of police killings in 2015 was obtained from the Guardian website.[2] In this dataset, the age of victims from police killings varies widely, ranging from age 15 all the way to 87. This begs the question, is there any correlation between the age of the victim and the victim being killed by the police? One would hypothesize that middle-aged individuals would be more likely to get shot, given that they are more of a threat to the police officers. Therefore, as younger individuals become older, one would assume that the number of deaths would increase. However, there is also the question that as an individual gets older, wouldn't they be less of a threat? Wouldn't the number of deaths decrease as an individual gets older? To answer these questions and hypotheses, a regression model was used.

The first regression model used showed a negative relationship between age and the number of deaths. The linear regression equation was: $\hat{y} = -0.46969x + 39.93399$. The number of

[2] https://www.theguardian.com/us-news/ng-interactive/2015/jun/01/about-the-counted

deaths was represented by $\hat{y}$ and x represents the age of each individual. This model predicts that every one year increase in age is associated with around a 0.5 decrease in the number of deaths. This effect was determined to be statistically significant at a conventional level of 0.05 with a p-value equal to 5.91e-11. With an R-squared value of 0.506, this model only accounted for 50% of the variance between age and number of deaths. This model seemingly agrees with the hypothesis that the number of deaths decreases when an individual gets older. However, it contradicts the other hypothesis that the number of deaths would increase when individuals get older from a younger age (moving towards younger to middle-aged years). Given that the hypotheses were not fulfilled and the R-squared value of the model was fairly low, a closer look at the model was taken.

It appears at first that the relationship between age and the number of deaths is non-linear. Since non-linear regression is beyond the scope of this class, the data was subsetted into two groups: individuals aging from 15 to 25 years of age and individuals 26 and older. From here, two linear regressions were run on both of the subsets. The subset of younger individuals had this regression equation: $\hat{y} = 3.9455x - 56.5455$. This model predicts that every one year increase in age (between ages of 15 and 25) is associated with around 4 more deaths. Using the predict function, it can be estimated that annually, there will be about 3 deaths of 15 year olds and 26 deaths of 21 year olds. While both figures are tragic, they convey the great increase in danger for individuals as they become older. This model was also highly statistically significant at a conventional level of 0.05 with a p-value of 2.92e-05. This model had a higher R-squared value than the first model, with its value being 0.869 (or 86.9% of variance being explained by the model). This effect agrees with the first hypothesis that killings would increase with age

(when starting from a younger age), as the line fits much better with the subsetted data and shows a positive relationship.

For the subset of older individuals, the regression equation was: $\hat{y} = -0.71040x + 54.30231$. This model predicts that every one year increase in age (from age 26 and beyond) is associated with a decrease of around 0.7 deaths. This model was also highly statistically significant at a conventional level of 0.05 with a p-value of <2e-16. This model had a similar R-squared value to the younger model, with its value being 0.8615 (or 86.15% of variance being explained by the model). This effect agrees with the second hypothesis that the older an individual gets (already being older than 25), the less deaths there are, showing a negative relationship.

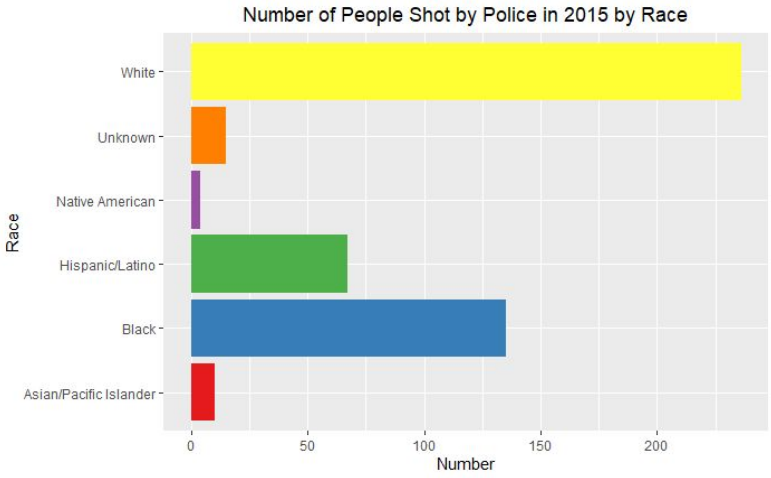
Overall, the relationship between age and number of deaths is parabolic (concave down). Younger individuals see a positive linear association between age and number or deaths while older individuals see a negative linear association. This means that the effect of age on the number of deaths changes with the age of the individual.

Conclusion

The conclusions from this paper are as clear as they are tragic. Holistically, this paper points to one conclusion -- that young people of color are disproportionately the victims of police killings. In many cases not even armed, blacks are victims of police shootings at a rate far higher than their share of the American population, while the opposite is true for whites, despite more whites being the victims of police killings in total numbers. Furthermore, blacks were far more likely to be in their vehicle at the time of the killing. These both raise questions about police training and police discrimination, precipitating demands for reform in the way the police treat the nation's black and brown communities. The West and the South also had an elevated number of police shootings, especially compared to the Northeast, a conclusion that could have widespread implications in terms of best practices, police training, and use of force. Also, our research concluded that younger individuals were more likely to be killed, with the early 20's being the most dangerous period. Such a conclusion ought to instigate a discussion about how police (and America as a whole) view young people, and whether the mythology of the dangerous youth and the fear of the young black male has resulted in unnecessary deaths. Literally a matter of life or death, these issues are pressing nationwide, and ought to start a discussion that will hopefully begin a wave of reform to end the absurd amount of police killings in the United States.

Appendix

Figure 1



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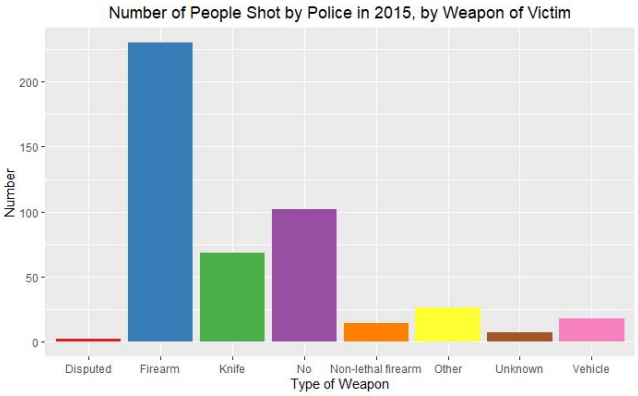

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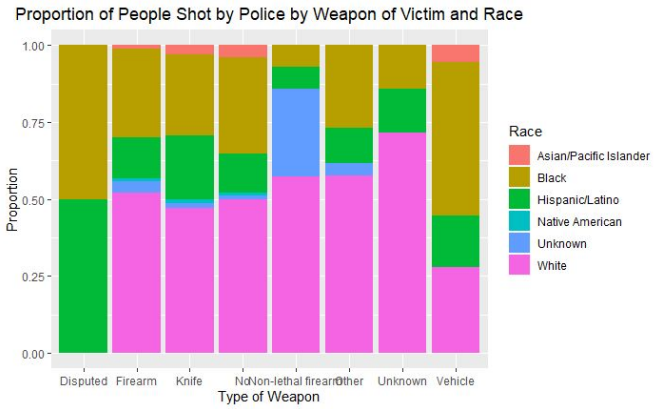

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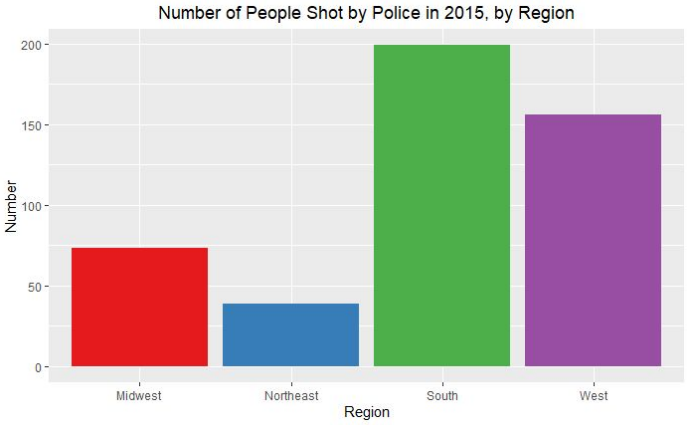

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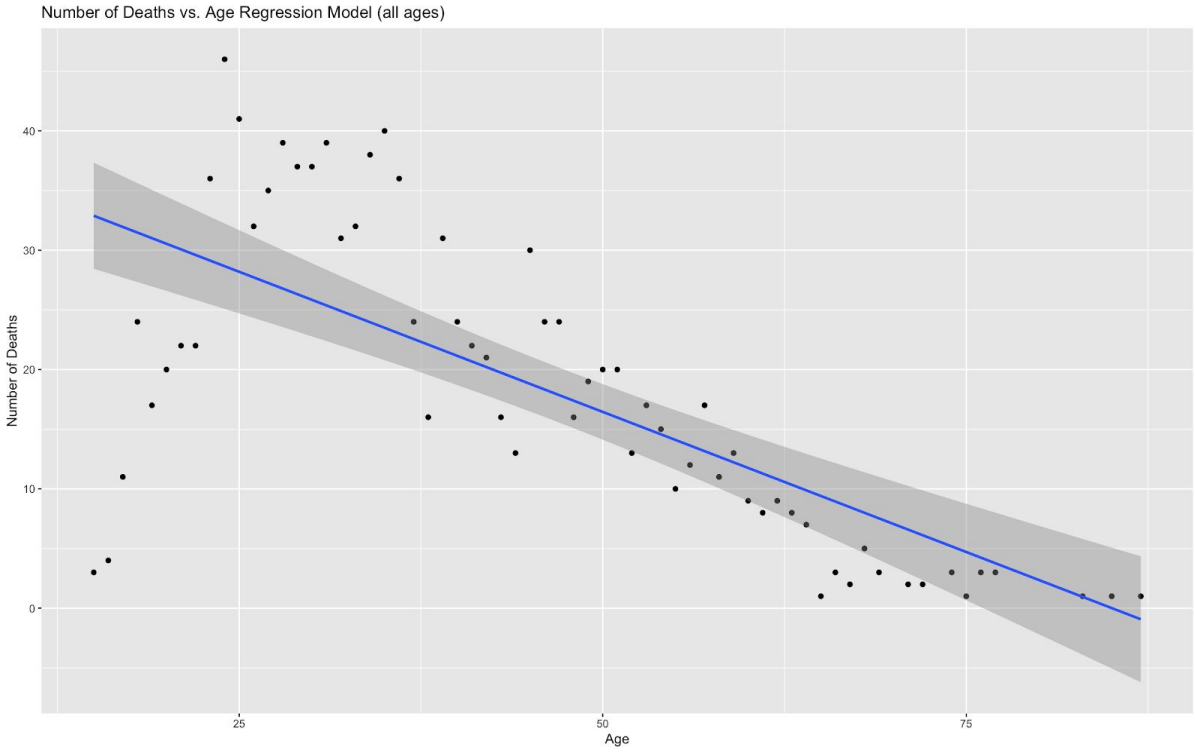

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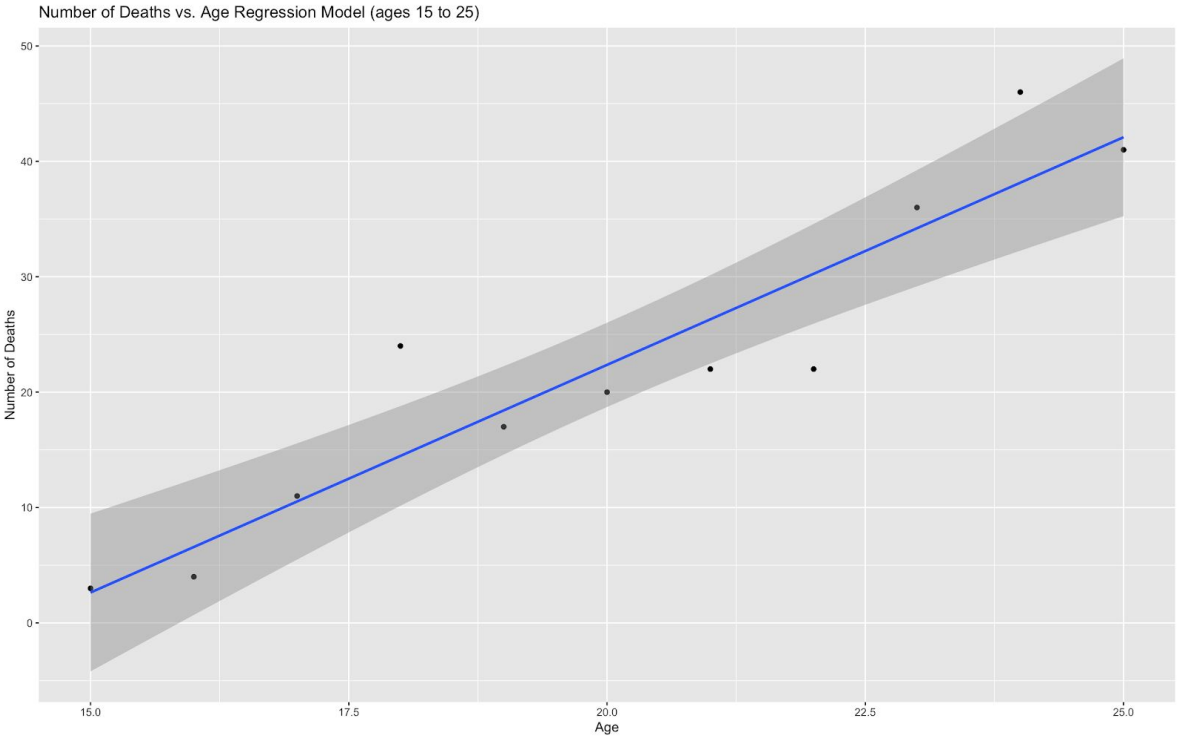

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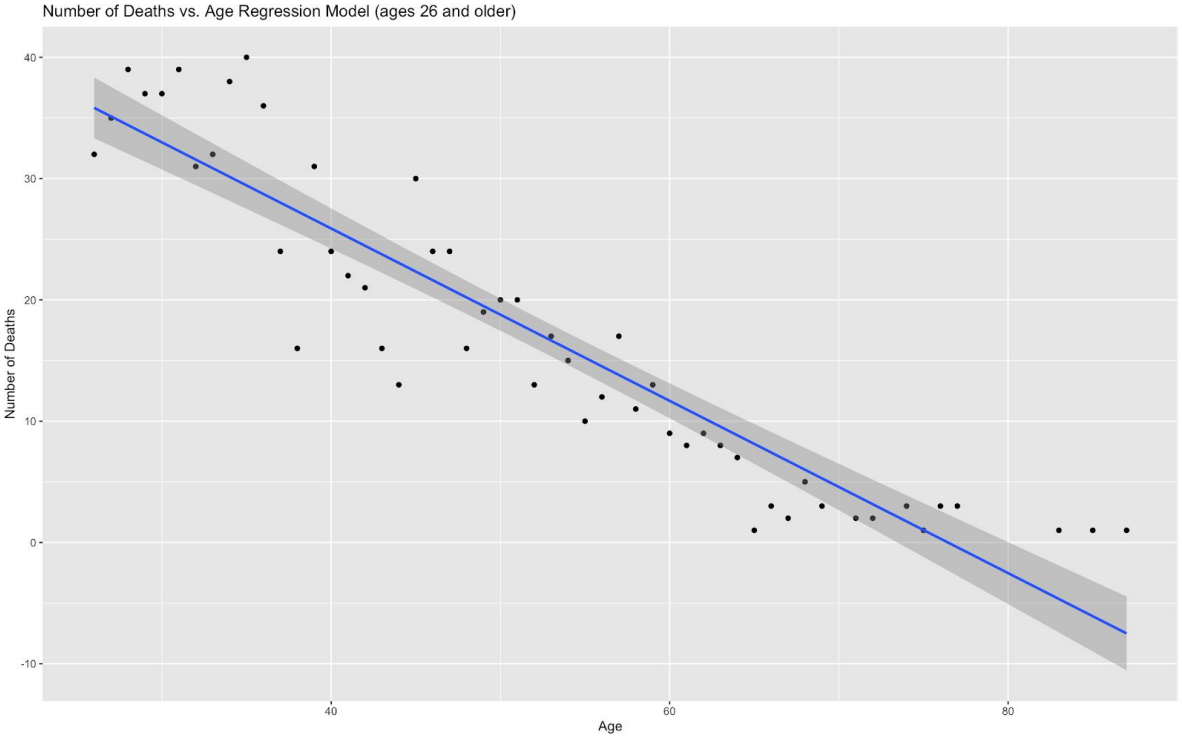

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