

CONNECTICUT'S OPIOID EPIDEMIC

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The opioid epidemic is an issue that is plaguing the United States. There are too many access points from which substance abusers are receiving their fix. Whether it be through illegal suppliers or drug diversion in the healthcare system, the opioid epidemic impacts all citizens.

As of recently, the Connecticut Legislature has passed measures in attempts to control the flow and usage of opioids. As seen in Connecticut and across the nation, current legislation isn't putting a halt to the ominous wave of increasing accidental deaths as a result of opioid usage, nor is it lessening the financial burden on taxpayers' pockets. Simultaneously, there is the ongoing trend in Connecticut for the need of government assisted housing as a result of high median housing prices and poor planning and zoning. This research paper will examine the trend in accidental drug related deaths in Connecticut and examine its relationship with the affordable housing trend, proposing solutions to that end.



Sacred Heart University
Introduction to Business Analytics

I. Introduction

As of January 2019, more than 130 people in the United States die every day after overdosing on opioids and other illegal drugs. Picture “Big Pharma” in the late 1990’s, attempting to gain greater leverage in the healthcare industry and secure its financial grip on the medical community, these pharmaceutical companies managed to reassure the medical community that patients wouldn’t become addicted to prescription opioid pain relievers. This led healthcare providers to prescribe these drugs at a greater rate, leading to national diversion and illegal use of these drugs before it became apparent that these medications could become highly addictive. The blatant misuse and addiction of “street drugs” like cocaine as well as opioids, including prescription pain relievers, heroin, and fentanyl, is a serious national crisis that is affecting public health as well as social and economic welfare (National Institute on Drug Abuse, 2019).

Simply put, opioids are pain relievers which diminish the effects of a painful stimulus within the body. Some of the most popular drugs diverted among health care professionals and misused by patients are in fact opioids. Some drugs that are categorized as opioids include hydrocodone, oxycodone, morphine, and codeine. In addition, other narcotics such as antiretroviral drugs, which are used to treat retroviruses, and non-opioid psychotropic drugs, which are used to alter brain function, are also diverted (Brady, Joanne E., et al., 2014).

When looking at the public health issues that arise from illegal drug use and opioid addiction as well as the means by which they are administered, the most pressing issue is contamination. Under a controlled environment, drugs can be administered with little to no contamination impacting the person administered to. However, using the drug on one’s own, receiving the drug through diversion, or illegally acquiring a drug can lead to accidental death

caused by drug overdose. To make the prevalence of this diversion clearer, data has shown a minimum of 10% of health care providers have participated in drug diversion in some shape or form (Schaefer M, Perz J., 2014). Stemming off this, a study directed by Berge and his team in the Department of Anesthesiology at the notable Mayo Clinic provided the multiple ways that drug diversion occurs as well as which health care providers are most commonly involved. The three most substance-dependent health care professionals are nurses, anesthesiologists, and surgeons. The diversion of a drug can occur in the following three ways: the narcotic can be directly seized from the dispensing system or openly from patients; a nurse can openly steal the drug from the available supply and falsifies patients' records; a nurse can inject themselves with the licit drug and then proceed to refill the syringe with saline, sterile water, or any available source for the future use of the patient (Berge, Dillon, Sikkink, Taylor, & Lanier, 2012). This action leaves the patient in a situation of neglect and deprived of his or her required medication. Some heavily narcotic-dependent nurses engage in the risk of incorrectly documenting a patient that was never even admitted to the hospital in the first place. This unethical behavior demonstrates the existing dishonesty and fraud of certain health care providers. The most popular of the above-mentioned methods is when a nurse injects themselves with the licit drug and then proceeds to refill the syringe with saline, sterile water, or any available source for the use of their patient (Trinkoff, Storr, Wall, 9-17). Not only is this technique placing the patient in a state of risk and vulnerability, but it also causes the patient to be injected with a contaminated needle. This alone has exposed nearly 30,000 patients to Hepatitis C (Berge, Dillon, Sikkink, Taylor, & Lanier, 2012).

Schaefer and Perz reviewed records from the Centers for Disease Control and Prevention related to outbreaks of infection from drug diversion by health care personnel in the health care

settings from January 1st, 2000 to December 31st, 2013. Throughout a ten-year period, lasting from the beginning of 2004 until the end of 2013, six outbreaks occurred over the span of 8 states. The outbreaks were initiated by six nurses, all belonging to the anesthesiology department of the respective states. Two of the infections were spread by injecting controlled substances and altering opioid analgesia pumps, whereas four of the infections were caused by tampering with syringes strictly containing fentanyl. This resulted in a total of 30,000 patients being exposed to blood-borne pathogens, 34 patients were found to have gram-negative bacterium, and 84 patients received the transmission of Hepatitis C (Lahey & Nelson, 2015).

Just as the easy access to drugs has negatively impacted public health and social welfare, it also negatively impacts the American citizens' economic welfare. Information retrieved from the work of Lahey and Nelson stated that the frequency of Hepatitis C transmission has increased. It was explained how nurse anesthesiologists found syringes of fentanyl left out on the operating table prior to a procedure. This allowed them to proceed to take advantage of the narcotic abuse opportunity. Additionally, the article disclosed that drug diversion heavily affects certain aspects of the nation's finances. A \$72.5 billion debt is placed upon insurance providers strictly from opioid usage alone. The debt placed upon insurance providers is often passed to consumers through higher health insurance premiums. Furthermore, the losses not only include insurance schemes, but also the larger hidden costs of treating patients who are heavily affected by the diversion (Lahey & Nelson, 2015).

Addiction and the willingness to misuse drugs is a trait that makes some people more susceptible to these vices than others. According to the National Institute on Drug Abuse, "When we speak of addiction as a chronic disorder of the brain, it thus includes an understanding that some individuals are more susceptible to drug use and addiction than others, not only because of

genetic factors but also because of stress and a host of other environmental and social factors in their lives that have made them more vulnerable” (National Institute on Drug Abuse, 2017). Although this proves the opioid epidemic as an “equal opportunity” disease, it doesn’t always turn out that way. There is a glaringly overlooked fact that is obscured regarding the opioid epidemic – this being that the opioid epidemic is largely affecting some of the poorest regions of the country. By process of deduction, this means that those living in poverty are especially at risk for addiction and its consequences such as overdose. Therefore, it would be fair to predict that in Connecticut, those labeled “low-income/high-risk” might be coming from places like governmentally assisted homes. If we can solve the poverty issue that surrounds this theory of Connecticut’s opioid epidemic, maybe we can halt its progression.

II. Data

Since the study is focused on Connecticut, all the data is from data.ct.gov which holds the archives for a multitude of different data sets for different industries. For the first variable “accidental deaths”, the data titled “Accidental Drug Related Deaths 2012-2018” which was updated May 8th, 2019 was accessed. Data was derived from an investigation by the Office of the Chief Medical Examiner which included a toxicity report, death certificate, and scene investigation. For the study’s purpose, the important categories are age, sex, race, residence city, and type of drug. There were a variety of drugs with data, however, the focus was placed on street drugs and common opioids that are being misused. For that reason, the drugs analyzed were heroin, cocaine, fentanyl, oxycodone, hydrocodone, benzodiazepine, morphine, hydromorphone, and “any opioid”. The “any opioid” category tracks an accidental death where the medical examiner cannot conclude whether it’s RX Morphine or heroin-based morphine in the toxicity results. (“Accidental Drug Related Deaths 2012-2018”, 2019). All subjects in the

data are announced dead via accidental drug death. When the toxicity report comes back, a “Y” value was placed under the different substance column that indicated the particular substance that was detected and found responsible for the death. There were 135 data points to analyze within this data set. Some of the data points didn’t have a complete list of attributes (i.e. missing the residence or race). In this case, the data point was survived as valid, so long as there was a drug associated with the data point’s death.

For the second variable “government assisted housing”, data titled “Affordable Housing by Town 2011-Present” and updated November 6th, 2017 was accessed with an external PDF link to the data from 2017 and 2018. The dataset known as the Affordable Housing Appeals Procedure List is published annually on February 1st. It pools its data from several sources like federal, state, and local programs. With the multiple agencies involved and for the sake of accuracy, the Department of Housing asks municipalities to provide administrative review of the data. The dataset includes attributes such as town, year, 2010 census units, government assisted units, tenant rental assistance, single family CHFA/USDA mortgages, deed restricted units, and total assisted units. All of these sections of data were utilized for the purpose of the study and comparison, paying especially close attention to the government assisted attribute. (“Affordable Housing by Town 2011-Present: Connecticut Data”, 2017). “Government assisted units” refers to those assisted housing units or housing receiving financial assistance under any governmental program for the “construction or substantial rehabilitation of low and moderate income housing that was occupied or under construction by the end of the date of the report period” (“Affordable Housing Appeals Listing”, 2019). “Tenant rental assistance” refers to rental housing occupied by persons receiving rental assistance under C.G.S. Chapter 138a. “Single family CHFA/USDA mortgages” refers to those tenants who currently have a mortgage and fall into the demographic.

“Deed restricted units” refers to properties with “deeds containing covenants or restrictions that require the units to be sold or rented at or below prices that will preserve the unit as affordable housing as defined in C.G.S. Section 8-39a for persons or families whose incomes are less than or equal to 80% of the area median income” (“Affordable Housing Appeals Listing”, 2019).

There were 842 data points between 2012-2016. For the years 2017 and 2018, the data was published on an external PDF and therefore wasn’t in Excel format. For the sake of time and to avoid a tedious task, the column totals for years 2017 and 2018 were summed and added to the raw data set. This was not disruptive to the data set, because all analysis was conducted using the sum of the data from each year.

Summary statistics for the data are presented on page 16 in Table I. The X Data refers to total amount of accidental drug deaths per year and the Y Data refers to the total amount of government assisted homes.

The summary stats paint an interesting picture about the two important variables at question. Firstly, one can recognize the high covariance between the two variables. Although a large covariance can mean a strong relationship between the variables, it’s difficult to compare the data sets strictly from a covariance point of view because they aren’t exactly on the same unit scale (deaths and housing units). One thing that the covariance in this data set can allude to however, is that there is some sort of positive relationship between the variables. Now, notice the correlation of .311. This positive correlation reinforces the linear relationship between the two variables – albeit, a weak uphill relationship as opposed to a 1.00 correlation. Lastly, have a look at the R-squared. With an R-squared of 10%, this data analysis is saying that approximately, 10% of the observed variation can be explained by the model’s input. In other words, this is saying that 10% of accidental drug deaths are influenced by governmentally assisted housing. These

viewpoints are somewhat limited because establishing the existence of this relationship doesn't tell us much about the cause and effect; rather, it could be the result of some other factors' external influence.

III. Methodology

There are a few variables that need to be regulated and controlled in order to answer the initial problem. One of which is quite obvious, the control and regulation of opioids and other substances. According to the Connecticut General Assembly, "In recent years, the legislature responded to this trend [increase in the number of emergency room visits and drug overdose deaths involving opioid analgesics] by enacting laws to reduce and prevent opioid drug abuse, such as (1) increasing access to opioid antagonists (i.e., medication to treat a drug overdose); (2) providing immunity for people who (a) seek emergency medical assistance for themselves or another person experiencing a drug overdose or (b) prescribe and administer opioid antagonists to a person experiencing a drug overdose ("Good Samaritan" laws); (3) establishing a statewide prescription drug monitoring program; and (4) limiting the amount of certain opioid drugs that may be prescribed to adults and minors" ("Current Laws related to Opioids Overdose Prevention", 2019). Ironically enough, these acts were slowly phased in throughout the years 2011-2015, right during the same reference as the dataset. If this is the case, why aren't these laws having any success?

It's one thing to pass a law, and another thing to see a trend diminish because of it. Refer to Table II on page 17 to see the prescribing rate as compared to the overdose death rate. As seen by this chart referring to Rx opioid overdoses in Connecticut, it's not that there is a higher prescribing rate – in fact, it has gone down. Ironically enough, the prescribing rate has gone down, yet the number of overdose deaths per 100k persons has skyrocketed. It appears that

people are still afraid to fall victim to these laws such as the “Good Samaritan Law” which allows immunity to someone who calls 911 for such an issue. As bad as it seems, many of the accidental deaths are, plainly and simply, *accidents*. Therefore, with that being said, would it be reasonable and smart to create safe injection sites, or will this merely progress the opioid addiction crisis and deflate accidental death statistics for aesthetic purposes? When pondering this possibility, it’s interesting to compare the “safe injection sites” to the states in which cannabis has been legalized. There have been a few studies on the reduction in crime in states where cannabis has become legal. One study on the issue has shown, “reductions in crime after marijuana is legalized for medical use, demonstrating a relationship, but not necessarily causation...showing a ‘clear connection between medicinal use and reductions in non-drug crime,’ Arthur Huber III, Rebecca Newman and Daniel LaFave of Colby College link medical marijuana to a 4 percent to 12 percent reduction in property crimes such as theft and burglaries. Crime has fallen across the United States in recent years, but in states with MML [medical marijuana laws] it has fallen approximately 5 percent more” (Trilling, 2017). Could there be a similar type of impact on the opioid crisis where the decriminalization of it via safe injection sites actually fosters a “positive” environment? It would be an interesting and unprecedented task for Connecticut to enact, but it’s worth pondering considering the current trend.

Based on the research conducted and the correlation between accidental opioid death and the rise in governmentally assisted living, the lower-class/high-risk population must be addressed. Jordan Grice of the Connecticut Magazine reports, “Since 2011, the state and private sector have invested billions of dollars in developing and funding thousands of units of housing available to those whose income is at or below the area median, which as of April 5 was \$89,773, according to USA Today” (Grice, 2019). Many cities in Connecticut have a health code

with certain minimum standards regarding square footage per person. Furthermore, Lynn Haig, director of Bridgeport's planning and zoning committee explains, "the city's housing stock in general has been outpaced by growing demand, especially in market rate and affordable units. As a result, people who can afford market rate units are moving into the more affordable lower rate units, throwing the market out of balance for need-based residents" (Grice, 2019). Poor planning and zoning, high median home value, and a displaced market are what's contributing to the rise in government assisted housing within Connecticut's cities. That's exactly where it's happening, urban regions, or cities. According to The CT Mirror, "Urban regions [in CT] have seen the largest increases in opioid-related deaths from 2012-2017" (Ankrah, 2018). It's interesting how the area with the largest need for government assisted housing is also the same area that has seen the largest increases in opioid-related deaths in Connecticut. Surely there must be some sort of solution that can aid in diminishing the levels of poverty seen in regards to housing. The U.S. News reports, "half of Connecticut renters and about a third of homeowners spend more than 30 percent of their income on housing, the Hartford-based Partnership for Strong Communities found in January. The U.S. government considers housing affordable when individuals spend 30 percent of their income or less on it" (Munson, Papp, O'Leary, & Dellinger, 2018). With a third of Connecticut individuals on the cusp of what the government deems as affordable housing, there potentially comes into play the issue of wages, "To afford a two-bedroom rental, a Connecticut resident on average needs to make \$24.90 per hour or work 99 hours a week on minimum wage, the National Low Income Housing Coalition found in 2018. That's the ninth-highest housing wage in the nation" (Munson, Papp, O'Leary, & Dellinger, 2018). How can we expect to eradicate low-income housing with a situation like this? Do we raise minimum wage? Do we control housing prices? Is there even a solution to this issue?

IV. Results

Different types of analysis were conducted on the datasets in attempts to draw a correlation between the trends. Firstly, the astonishingly positive trend of the accidental death due to drug crisis was displayed. Refer to Table III on Page 18 to see the linear trend of accidental drug deaths between 2012-2018. As seen in the bar chart, there is a glaring increase in the amount of accidental deaths that took place in 2012 as compared to 2018. In fact, there is a 633 person death increase, or a 178% increase in the amount of accidental deaths from 2012 to 2018.

Secondly, the trend of assisted units within Connecticut was analyzed. Refer to Table IV on Page 19 to view the linear trend of governmentally assisted units in Connecticut from 2012-2018. As seen in the chart, there is a somewhat positive trend of government assisted housing in Connecticut. Just by looking at 2012 and comparing it to 2018, we see a jump of 6,532 government assisted homes, or a 4% increase in six years.

When comparing the yearly total of accidental drug deaths versus the yearly total of assisted living, one can visually observe a similar pattern. Refer to Table V on page 20 to view the comparative relationship between the yearly total of accidental deaths and the yearly total of governmentally assisted living units from 2012-2018. Upon first glance there is an obvious positive trend in both data sets. Of course, the difference between the degree to which each dataset's trendline slopes is also noteworthy. However, for the most part, they are both on an upward trajectory with little end in sight. Reiterating that the datasets had a statistically positive yet insignificant relationship as displayed by a correlation of .311, the visual depictions seem otherwise. Coupled with the R-squared of 10%, analysts would be able to predict future data

based on the bar charts current trendlines. External factors that aim to address the two issues faced by Connecticut can hopefully diminish the impacts on citizens statewide.

V. Conclusion

This analysis provided an eye-opening perspective on the well-being of certain demographics in Connecticut. It's definitely interesting to take Connecticut out of the grand scheme of things and be able to interpret the data on a statewide level. It's very disheartening to learn about the vices of opioid usage and the diversion that goes along with it. Similarly, it's unfortunate to learn about how highly our society values wealth as a means of social advancement and material gain.

Fortunately enough, the analysis on the datasets was able to prove a positive linear correlation between the two variables. Although not as strong as originally assumed, it provided an interesting perspective on the external factors influencing the opioid crisis in Connecticut. As noted, the trends in both variables don't seem to be slowing down anytime soon. With the introduction of some of the proposed solutions, there may be potential to halt the progression of both variables. The study of the correlation between these two variables is very important to government agencies and law makers who are attempting to control the situation. By conducting analysis like so, they will gain a leg up on the crisis at hand.

If there was more time to gather data and extend the work, it would be interesting to compare the statistics of Connecticut to another state in the United States. The analysis could even have gone on a different tangent, comparing each individual drug's influence on the drug crisis rather than the drugs as a whole. It might even be interesting to explore the legalization of marijuana as was alluded to briefly in the report. Although there was insufficient knowledge on

how to run one, a regression would be beneficial for the purpose of this study because it would give a more clear-cut relationship between the two variables.

For those that may have the passion to explore these topics further, there are plenty of other avenues to explore. For starters, it would be great to explore the impacts of the potential solutions that were proposed. The “safe injection sites” are particularly interesting because it involves moral questions as well as the other aspects of its logistics. For the purpose of social welfare, it would be smart to go deeper into the demographics of the opioid crisis. Which gender/race/age group is increasing the most? Is it a generational fad? These questions would help researchers get a better grip on the problem because it may be demographic specific.

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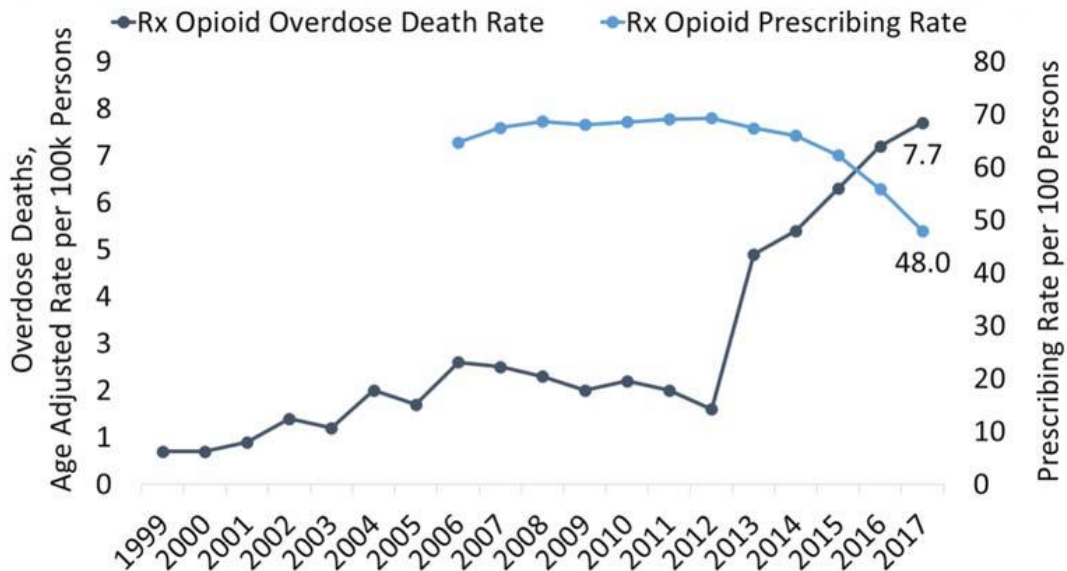
Summary Statistics

Table I

	X Data		Y Data	
Summary Stats	Functions	Manual	Functions	Manual
Mean	1552.57		167083.59	
Median	1781.00		167911.00	
First Quartile	611		164998	
Third Quartile	2491		168655	
IQR		1880		3657
Var Sample	894358.95		9091718.62	
Var Population	766593.39		7792901.67	
SD Sample	945.71		3015.25	
SD Population	875.55		2791.58	
Min	426		161379	
Max	2794		170562.14	
Range		2368		9183.14
Coef. Of Var		61%		2%
Statistics of Association	Functions			
Covariance	888048.282			
Correlation	0.311			
R Squared	10%			

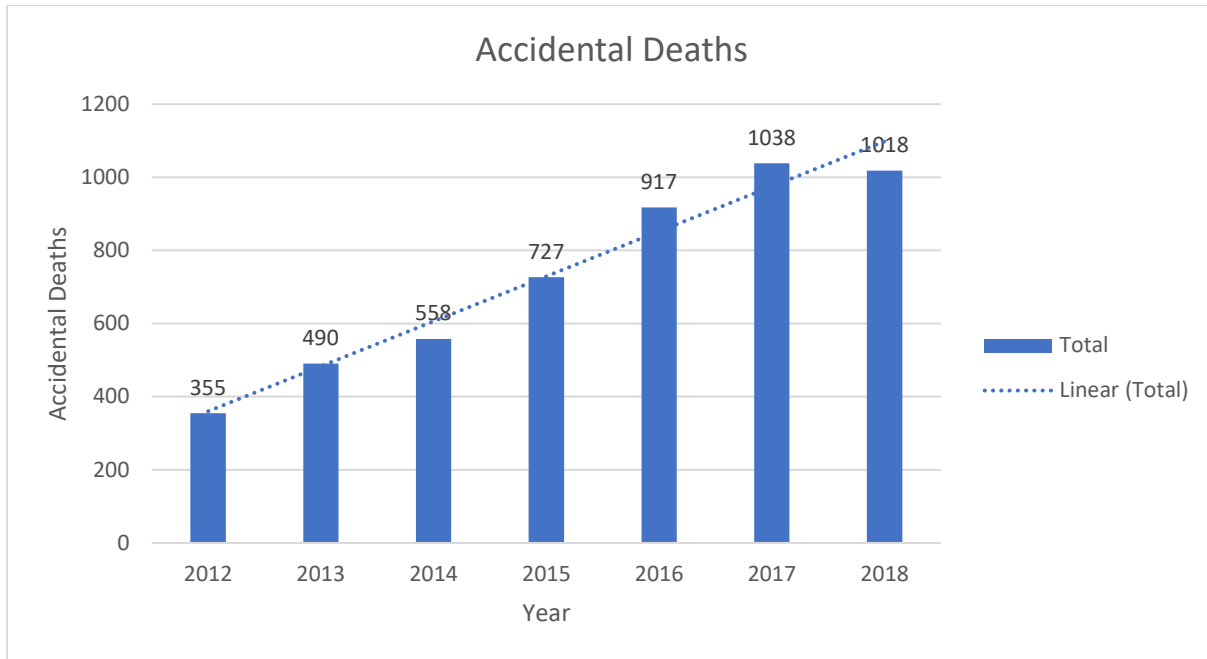
Perscription Rates v. Overdose Death

Table II



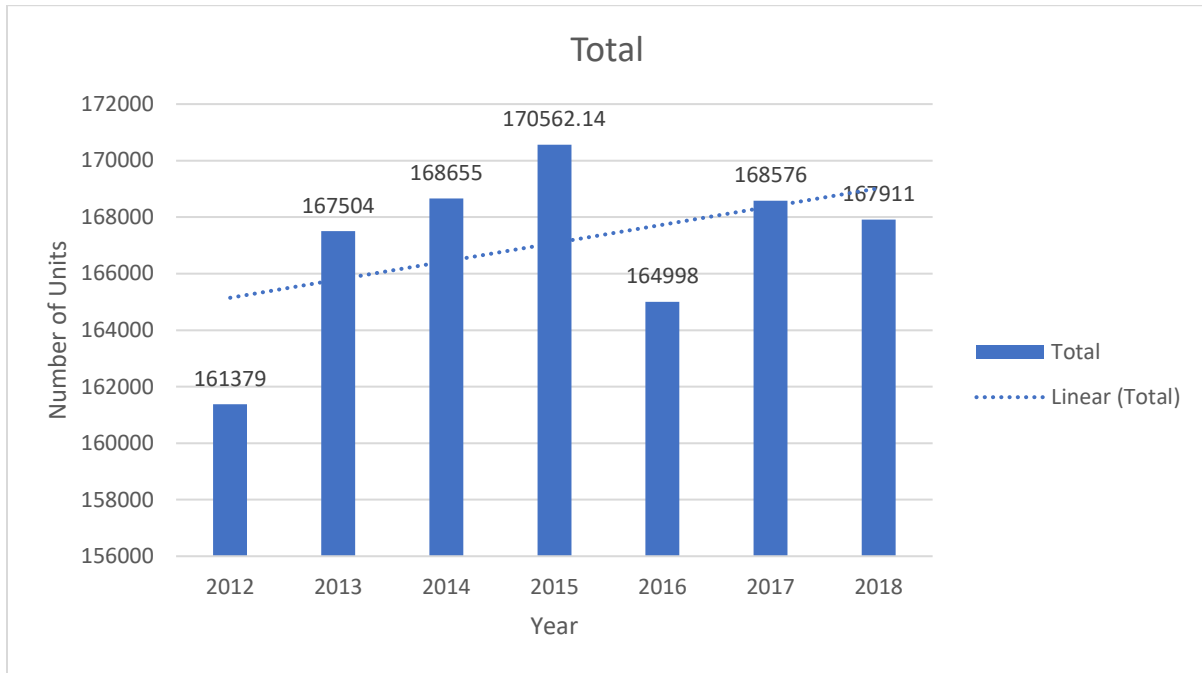
Accidental Deaths Per Year

Table III



Governmentally Assisted Housing Units: 2012-2018

Table IV



Yearly Total: Accidental Deaths v. Governmentally Assisted Living Units (2012-2018)

Table V

