

State Public Healthcare Funding and The Effects on Fetal Deaths in Teenage Pregnancy

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Abstract

This research focuses on evaluating how state public healthcare funding directed per person could potentially affect the number of fetal deaths in teenage pregnancy. Teenage pregnancy has become very common in this era, yet it is a topic that isn't frequently mentioned as it is often brushed off as a phenomenon caused by popular culture and easy access to social media, and the lack of appropriate education in middle/high schools. However, these two factors aren't the only reasons. The lack of access to women's healthcare and resources has caused the rise in fetal deaths during birth among teenagers within underrepresented groups in low-income areas. This problem could potentially be mitigated with an increase in healthcare funding allocated to individuals in each state. The results of this study will be obtained using natural language processing, unsupervised machine learning, data analytics, statistical analysis, and data visualization. This study will show how states with lower public healthcare funding allocated to individuals result in a higher percentage of fetal deaths in teenage pregnancy.

Introduction

Teenage pregnancy occurs in women between the ages of 15-19 years old (Healthline, n.d.). Pregnancy can occur as soon as a woman begins their period regularly. Although teenage pregnancy in the United States remains one of the highest in industrialized countries, (Healthline, n.d.), the rate of teenage pregnancy is declining. As of 2017, 194,000 babies were born from mothers ranging between ages 15-19. This number is still relatively high, however, according to the Center for Disease Control and Prevention (CDC), birth rates have declined from 17.4 per 1,000 females in 2018 to 16.7 per 1,000 females in 2019 (Centers for Disease Control and Prevention, n.d.). The declining rate in teenage pregnancy is most likely due to the accessibility of

birth control and how young women today are career focus and understand the consequences of having a child at such young age could potentially disrupt their chances of pursuing the career path they intend to follow. It's important to prevent teenage pregnancy as only 50% of teenage mothers receive their high school diploma and children of teenage mothers have a higher probability of getting lower achievements in school, subject to peer pressure which results in incarceration, and go through teenage pregnancy (Centers of Disease Control and Prevention, n.d.).

Fetal deaths can still happen to teenage mothers, although the rate of teenage pregnancy is slowly declining as time progresses. Early age childbirth is linked to poor maternal, infant, and child health outcomes, and worst, fetal/infant mortality (Cassandra M. Gibbs, 2012). The lack of resources and education in teen mothers resulted in many factors that could increase the chances of fetal deaths, such as extreme weight gain, smoking during pregnancy, no prenatal care, and in some cases, delays in obstetric care. However, these situations can be avoided if teen mothers have the available resources, care, and funds to support the duration of healthy pregnancy till birth. As the Affordable Care Act was enacted in 2010, the government's role in financing and regulating healthcare, which requires most Americans to obtain health insurance and expand Medicaid eligibility with the help of federal subsidies. Medicaid has also made its coverage mandatory for low-income pregnant women and infants (The Commonwealth Fund, 2020). The Affordable Care Act has aided in supporting women from low-income families to receive proper care during their pregnancy.

Although teen mothers are receiving more support and resources than before, we need to ask ourselves, if the support and help provided is enough to reduce the risk of fetal deaths. The focus of this research is to study the correlation between state public healthcare funding and fetal deaths in teenage pregnancy. This research will utilize datasets from the CDC Wonder database and America's Health Rankings. The research questions below will help readers better understand the importance for states and federal governments to increase individual healthcare funds.

The research questions below will answer the focus of this study:

- Most common causes of fetal deaths in teenage pregnancy
- State with the highest fetal deaths
- The relationship between state public healthcare funding and fetal death counts

Literature Review

There are some limitations in finding topics that cover both fetal deaths and the relationship with state public healthcare funding in the same research paper, but there are studies that cover the health consequences of teenage pregnancy and studies on how to reduce fetal mortality. In some cases, funding and resources might not necessarily be the reason behind adverse health consequences in early age childbirth. Most of the time, health consequences occur as young women's underdeveloped bodies do not have the capability of handling childbirth. Many complications such as prematurity, low birth weight, congenital malformations, and perinatal mortality can result from teenage pregnancy. One of the most common causes of fetal/infant mortality is low birth weight and prematurity, which is directly associated with early age childbearing. In some cases, further complications can develop for the child such as the risk of infant mortality, risk of accidents, and cognitive, social, and emotional development (Markinson, 1985). According to a Canadian study of teenage pregnancy, the study shows that younger teenage mothers had a higher risk of hypertension and eclampsia during childbirth. Anemia was also significant for teenagers during admissions (Markinson, 1985). Maternal health and management of labor and delivery, and reviews promising interventions can reduce fetal deaths during childbirth as the most significant risk factors for fetal death could potentially affect maternal and neonatal health (JR Bale, 2003).

Moving on, a research study was conducted on Medicaid and the issues in expanding eligibility to pregnant women. Medicaid has expanded its coverage to include pregnant women from low-income families (The Commonwealth Fund, 2020). However, when Medicaid started expanding their coverage, many women experienced delays in enrollment as it could take weeks between the date of application and the date of approval. This created an obstacle that prevented pregnant women from receiving early care. Approximately 40-60% of women were not covered by Medicaid when they just became pregnant and many women did not receive any prenatal care that was covered by Medicaid, although they had enrollment at the time of their pregnancy (Ellwood, 1993). Moreover, due to the possibility of receiving low Medicaid reimbursement, there was declining participation of Medicaid with obstetricians. This results in yet another obstacle for women in low-income families receiving access to proper care during pregnancy (Ellwood, 1993). This would be interesting to conduct our analysis on how fetal deaths correlates with state public

healthcare funding, as we have an idea of the issues women from low-income families face even with their Medicaid coverage during pregnancy.

Methods

Two datasets were used to conduct the analysis and answer the research questions. The dataset for fetal deaths was obtained from the CDC Wonder database, which calculates summary statistics for fetal deaths at 20 weeks gestation or more (CDC, n.d.). The dataset consists of fetal deaths that occurred between 2014 – 2019. Since the CDC Wonder database allows user to query their results, this process has made it easier for me to clean and transform the dataset. The dataset is relatively small, with only 181 rows of data since the search had to be narrowed down to fetal deaths that occurred with mothers between the age of 15 years old to 19 years old. The dataset for state public healthcare funding per person was obtained from America's Health Ranking, which is associated with the United Health Foundation. This dataset contains state dollars dedicated to public health and federal dollars directed to states per person by the CDC and Health Resources & Services Administration (America's Health Rankings, n.d.). The dataset contains the annual estimate of public health funding per person for states that are present in the fetal death dataset.

All three programming languages, R, Python, and SQL were used to analyze this research paper. The dataset for fetal deaths and state public healthcare funding were already in an appropriate format ready for analysis, there wasn't much data transformation or data cleaning needed to be conducted. Python was used to conduct natural language processing for text data on the most common causes of fetal deaths in teenage pregnancy. MySQL was used to obtain the state with the highest and lowest number of fetal deaths. R was utilized to conduct k-means clustering between fetal deaths and public health funding. Lastly, most of the visualization in this research paper was conducted using Tableau, since it can present data clearly and help our audience visualize and understand data.

Results and Findings

A. Fetal Death Counts in Each State

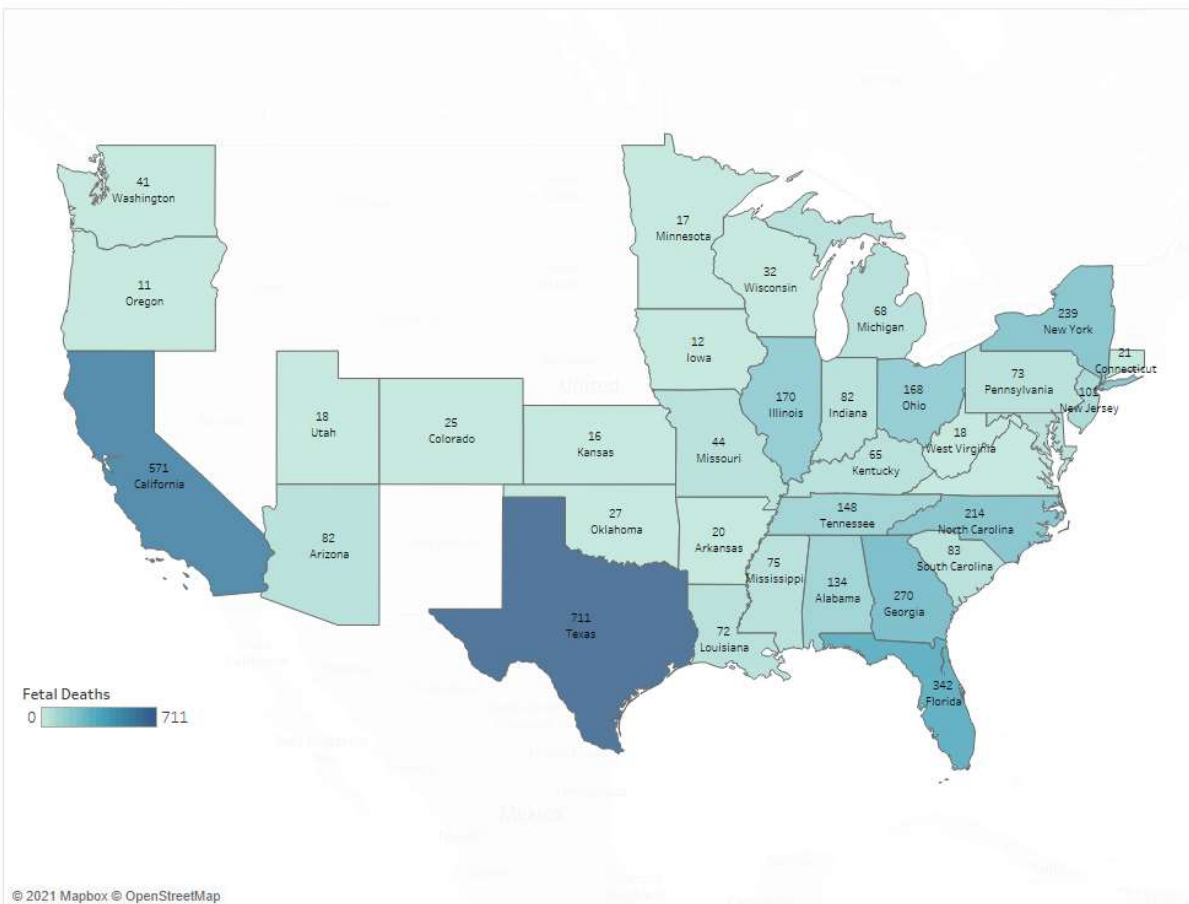
Top 5 State with Lowest Fetal Death

MINState	FetalDeaths
Oregon	11
Iowa	12
Kansas	16
Virginia	17
Minnesota	17

Top 5 State with Highest Fetal Death

MAXState	FetalDeaths
Texas	711
California	571
Florida	342
Georgia	270
New York	239

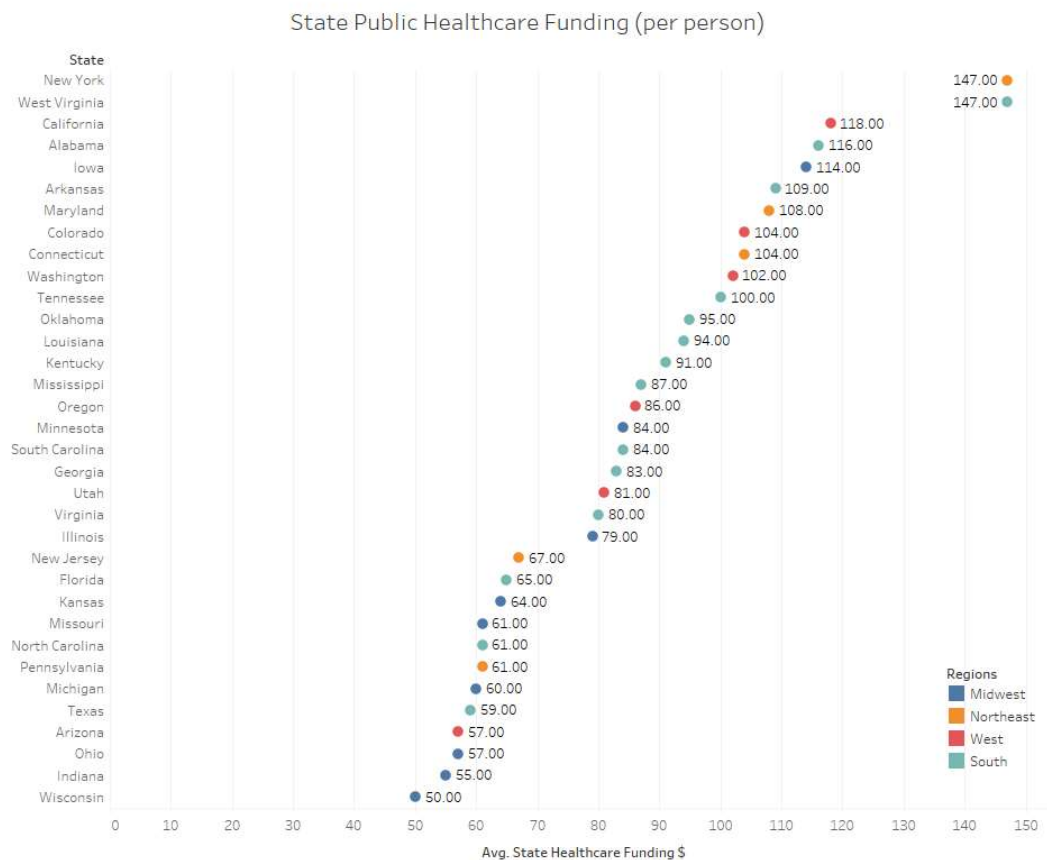
Fetal Deaths by State



Based on the fetal death dataset, there are a total of 4,032 fetal deaths in the country for teenage mothers between the age of 15 – 19 years old. Since the CDC Wonder database is unable to query fetal death counts in individual years, we're only able to evaluate total death counts between the

years of 2014 – 2019 in this analysis. The states with the top 5 highest and lowest fetal deaths were outputted. Texas has the highest fetal death count, at 711 and Oregon has the lowest fetal death count in the country, at only 11. The count is presented as a heat map that gives us a visualization of regions that have the highest number of fetal deaths. The darker the color, the higher the counts. The states that were not colored in the map represent no data collected for fetal death counts. The Southeast and Southwest region has the highest rate, whereas the West has the lowest rate of fetal death in the country, except for California, which is where most of the death counts are pooled as indicated in the heatmap.

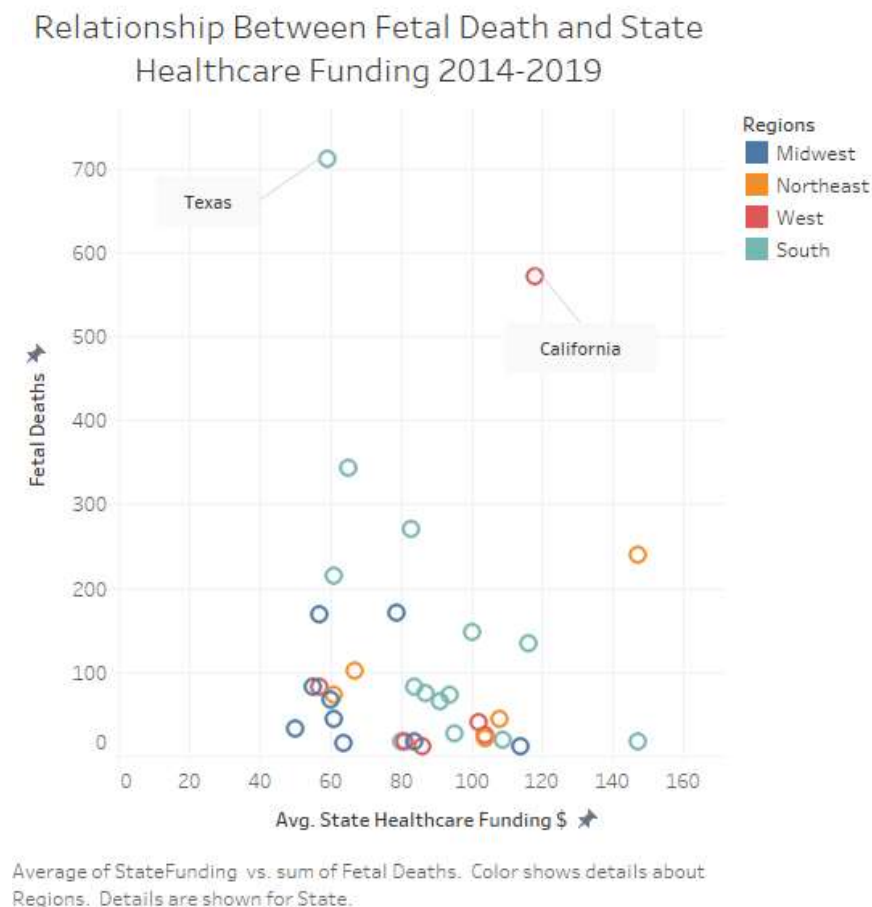
B. State Healthcare Funding



Based on this graph, New York and West Virginia is ranked the highest in terms of state public healthcare funding individuals receive, at \$147.00 respectively. Although New York is one of the highest payouts in the country per person, the state is ranked No. 5 for the highest fetal deaths in

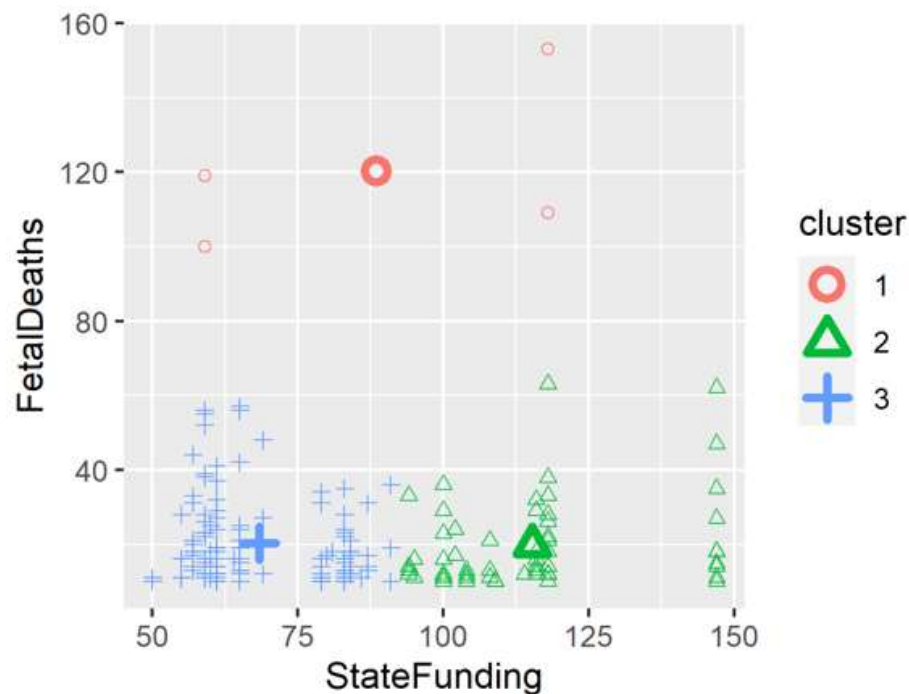
the country. There is the same trend for California, which provides one of the highest state public healthcare funding, at \$118.00 per person yet, is ranked 2nd in the highest fetal death count. There is a possibility that the high cost of living in both New York and California results in teenage mothers in low-income families not being able to have access to proper care, despite receiving more healthcare funds compared to other states. On the other hand, Texas is ranked bottom 5 for receiving the lowest public healthcare funding in the country, at \$59.00 per person. Comparing this graph to the heatmap, you can slowly see the correlation on how state public healthcare funding is affecting the fetal death counts in teenage mothers.

C. Relationship between Fetal Death and State Healthcare Funding



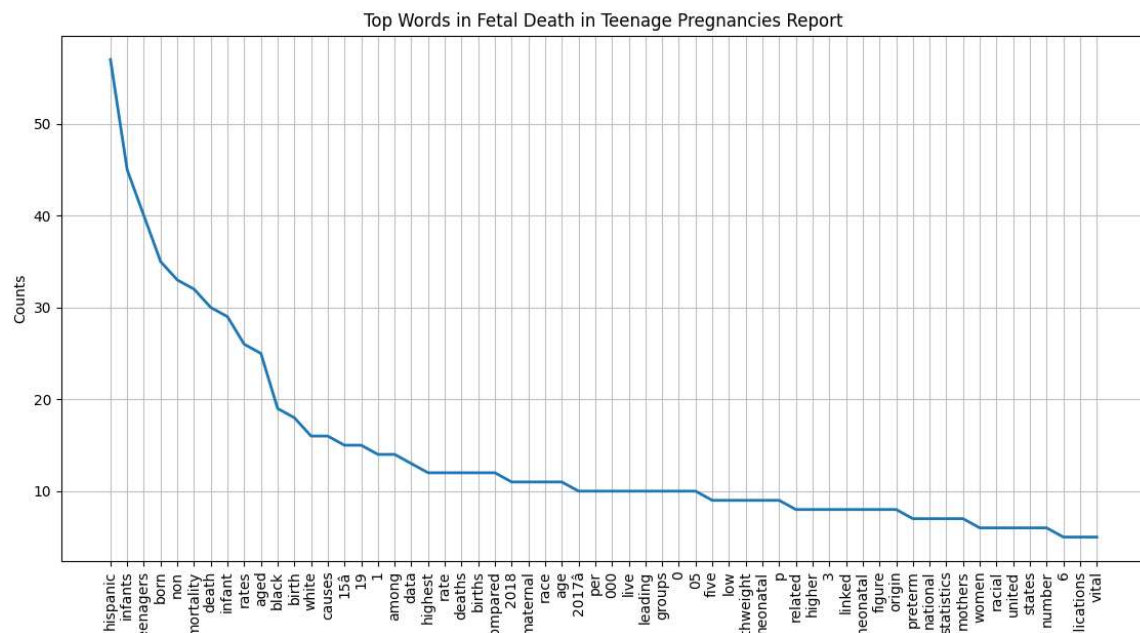
The relationship between fetal death and state healthcare funding is graphed as a scatterplot. Each point in the graph indicates a state. As seen in the scatterplot, it shows a positive relationship between state healthcare funding and fetal death counts. States with the highest state healthcare funding indicate a lower number of fetal deaths in teenage mothers. However, what's

interesting here is that in some cases, although state healthcare funding is low, the fetal death count is also low, whereas some states with higher state healthcare funding have higher fetal death counts. One indication could factor into a high state healthcare funding and high fetal death count relationship, which is these states are home to bigger and more populated cities in the country. For example, California (Population: 39,613,493), Texas (Population: 29,730,311), Florida (Population: 21,944,577) and New York (Population: 19,299,981) are one of the highest populated states in the country (World Population Review , n.d.). as of 2021. These 4 states are also part of the top 5 highest fetal death counts in the country. As seen in the second graph, there is a clear cluster between the 3 groups. The centroid is the graph that indicates a similarity between each point in the same group. For instance, cluster 2 centroid is similar as it indicates highest state healthcare funding will result in lower fetal deaths.



The two graphs have indicated that there is a positive correlation between fetal deaths and state funding, but additional calculations are made to prove the relationship exists. A chi-squared test was conducted between fetal deaths and state healthcare funding. The p-value is 1, which means we fail to reject the null hypothesis as there is no statistical significance due to the low power test, which could be improved with larger data collection.

D. Text Analytics on Causes of Fetal Death in Teenage Pregnancy



There were very few credible articles/journals regarding the causes of fetal deaths in teenage pregnancy. I am unable to use common causes in fetal deaths in women ages 20 and up as there would have been a significant difference in what would cause fetal deaths in older pregnant women. Many of the most frequent words used in an article according to the CDC is insignificant to our analysis. However, if you look closely enough, 'low', 'birthweight', 'neonatal', 'preterm', and 'complications' are part of the most frequently used words in the article about fetal deaths. These words can potentially give us additional insight on the most common causes of fetal deaths in teenage pregnancy, as it gives us further evidence to research closely on why this could happen.

Discussion

The statistical and data analytics that were conducted on the fetal death and state public healthcare funding dataset has given us insights into how these two variables relate to one another. This discussion will go through the research question and answer it according to the results and finding based on the analysis.

1. Most common causes of fetal deaths in teenage pregnancy

Running the text analysis through natural language processing indicates that the leading causes of fetal deaths in teenage pregnancy are low birth weight, preterm births, neonatal, and complications during birth. According to research conducted by Carolyn Makison, a study on fetal death was conducted on teenage mothers from the United States, Sweden, and Canada, it shows that low birth weight is highly associated with early age pregnancy among all three countries as first birth usually have a higher chance of prematurity. The lack of prenatal care in teenage mothers indicates a high possibility of prematurity and low birth weight (Markinson, 1985), which most of the time, results in mortality. Moreover, the neonatal mortality rate is highest among teenage mothers, compared to older maternal groups (Ashley M. Woodall, 2020).

The text analysis has proved to us that low birth weight, neonatal, preterm births, and complications are the most common causes of fetal deaths among teenage pregnancies. The underdeveloped body of teenage girls isn't as capable of handling childbirth as compared to an older woman. Socioeconomic factors can also factor into teenage mothers in low-income areas/families not being able to receive the proper care they need to maintain a healthy pregnancy.

2. State with the highest fetal deaths

From the year 2014 – 2019, Texas has the highest fetal deaths at 711, followed by California at 571, Florida at 342, Georgia at 270, and New York at 239. State population could potentially factor into the increased numbers of fetal deaths as California, Texas, and Florida and top 3 of the highest populated states in the country. I did some further analysis on prenatal care in the 5 states to identify if it could potentially factor into the fetal death counts. According to the analysis, the rate of fetal death count that was contributed by no prenatal care is, 4.78% in Texas, 2.10% in California, 10.23% in Florida, and 20.37% in Georgia. I was unable to analyze New York, as prenatal care was not reported in New York. Although the rate seems rather insignificant in both Texas and California, however, Florida and Georgia have a staggering rate of fetal deaths that were contributed by no prenatal care.

Women from low-income families have a higher risk of delivering low-birthweight and premature babies due to lower education levels which causes limited to no access to

prenatal care as they have less reinforcement to receiving proper care. Although the United States is the leading country with the best prenatal care, it surprisingly has a higher rate of low birthweight babies and preterm deliveries (Stout, 1997). These two factors are the leading causes of fetal deaths in teenage pregnancy. Prenatal care is essential during pregnancy as, without it, the risk of prematurity and low birth weight is higher (Markinson, 1985). Many teenage mothers do not receive appropriate prenatal care, which contributes to higher fetal death counts in states with lower income levels.

3. *The relationship between state healthcare funding and fetal death counts*

There is a positive relationship between state healthcare funding and fetal death counts. The higher the state healthcare funding per person, the lower the fetal death counts in the state. There are some outliers in our analysis as some states that have high state healthcare funding per person, also have high fetal death counts. Although there were some outliers, however this is most likely affected by the cost of living in the state. This phenomenon occurs only in New York and California, which are known to be the most expensive states to live in in the United States. Since the fetal death dataset is relatively small as it only has 181 rows of data, we are unable to use the p-value to determine the relationship between fetal death counts and state healthcare funding. It is statistically insignificant due to the low power test which is caused by small data collection. P-value could improve if there is a larger dataset to analyze. This analysis proves that additional state healthcare funding can be essential in improving teenage mothers' access to better maternal care, which will lower fetal deaths. Fetal death counts should not be contingent to state population size. With a larger population, there should be additional resources and help to mitigate this issue within teenage pregnancy.

Conclusion

This research attempts to prove that the relationship between state public healthcare funding and fetal death exists. Some limitations were faced during this research. Since there is a lack of previous research on this specific topic, it was difficult to find a large dataset to analyze

fetal deaths. The small dataset was unable to provide me with an insightful p-value, which could have further proved the relationship between state healthcare funding and fetal deaths. Instead, visually looking at the scatterplot was able to show us the correlation between these two variables. The existence of prenatal care is one of the data variables that was essential for this research. If further research is to be conducted, gathering more information on what kind of treatment and care was received during the pregnancy could potentially give us valuable insights on what other factors could increase the risk of fetal deaths in teenage pregnancy.

According to the analysis, it indicates a positive relationship between public healthcare funding and fetal death counts, as fetal death counts increase as state public healthcare funding decreases. Additionally, other findings in this research also indicate that fetal death in teenage pregnancy is caused by a lack of accessibility to proper maternal care and treatment as many women in low-income families can't afford it. Hence, lifestyle barriers and socioeconomic status can result in an increase in fetal mortality during birth. Although teenage pregnancy rates are slowly decreasing, local/federal government should continue to put additional weight on this matter and plan on increasing coverage and funding to pregnant women, as well as affordable resources, in hopes that fetal death rates will decrease as more teenage mothers have access to proper treatment during early stages of pregnancy.

Glossary

1. Prematurity
When a baby is born before 37 weeks of pregnancy is completed
2. Congenital malformations
Birth defects that cause abnormalities that have medical, surgical, and cosmetic significance
3. Perinatal mortality
The number of fetal deaths past completed weeks of pregnancy and the number of deaths among babies that were alive for 7 complete days per 1000 total births (ScienceDirect, 2008).
4. Eclampsia
Seizures that occur in pregnant women during pregnancy or after birth (Medline Plus, n.d.)
5. Neonatal
Newborn baby

Citations

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