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The Impact of Education on Teen Births and Adverse Birth Outcomes in Ohio in 2020

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Population Health and Public Health

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☒ By checking this box, I indicate that my mentor has read and reviewed my draft proposal prior to submission (I am in the April super short course)

Abstract

Objective: This research study aims to determine the impact of education on teen birth. It also investigates how teen birth is correlated with adverse birth outcomes, including child mortality, infant mortality, and low birthweight. *Methods:* Paired t-test and linear regression statistical tests were conducted using SPSS to explore the relationships between high school completion, teen birth, and adverse birth outcomes. *Results:* The rate of high school completion has increased in Ohio from 2016 to 2020. As the rate of high school completion increases, the teen birth rate decreases. Teen birth rate is positively correlated with markers of adverse birth outcome, including child mortality, infant mortality, and low birth weight.

Key Words: education teen pregnancy adverse birth outcome Ohio

Introduction/Literature Review

Although most pregnancies in the United States are uncomplicated, adverse birth outcomes are more common in the United States than in other developed countries. Adverse birth outcomes include premature births and low birth weight. These adverse birth outcomes can cause not only illness and infection in the newborn, but also a plethora of long-term health problems. In addition to the health and developmental problems, infants with adverse birth outcomes can bring considerable emotional and economic costs to families and have implications for public-sector services, including insurance, education, and other social support systems.[1] Due to these downstream effects of adverse birth outcomes, it is important to study the causes and possible methods of prevention of adverse birth outcomes.

Existing literature links adverse birth outcomes to factors such as race, socioeconomic status, and insurance providers.[1–3] Studies have also shown links between adverse birth outcomes and teenage pregnancy. This is important because even though the rate of teenage pregnancy has been steadily declining due to support of education, contraception, and other pregnancy prevention strategies, approximately 7% of teenage girls in the United States became pregnant in 2008.[4] In a study using national data from 1995-2000, the rates of very pre-term delivery, very low birth weight, low birth weight, SGA (live infants with birth weights below 10th percentile for gestational age and sex), very low Apgar score, low Apgar score and neonatal mortality were higher in teenage pregnancies.[5,6] Teenagers have greater risk of poor nutrition, delayed pregnancy diagnosis, and delayed access to prenatal care which is hypothesized to lead to these poor birth outcomes. In addition, pregnant teens often have poor social support and poor emotional well-being, compared with adult women.[4] For these reasons, it is important to further

explore the link between teenage pregnancy and adverse birth outcome with more recent data in Ohio in 2020.

As previously stated, the decline of teenage pregnancy in the United States has been attributed in part to the support of education. A 2016 study of the Add Health data set collected from 1994-1996 showed that receipt of high school diploma and enrollment in higher education had a negative association with adolescent pregnancy.[7] In addition, a 2020 study of urban Medical Service Study Areas in California from 2000 to 2014 found that an increase in the percentage of young adults who graduated high school was associated with significantly larger declines in adolescent pregnancy.[8] We hope to be able to extend these compelling trends to a more current data set in the state of Ohio through this study.

The goal of this paper is to establish an understanding of how high school completion in Ohio has changed in the last 5 years from 2016-2020, how high school completion correlates with teen birth rate in Ohio in 2020, and how teen birth rate correlates with adverse birth outcomes in Ohio 2020. Because much of the previously published literature was published prior to 2020, it remains to be seen if the previous trends have continued or have changed. Exploring the relationship between education, teenage pregnancy, and adverse birth outcomes in Ohio in 2020 could lead the way towards finding solutions to decrease adverse birth outcomes in the future.

Research Questions

RQ 1: How did the rate of high school completion change between 2016 and 2020 in Ohio?

RQ 2: How does high school completion correlate with teen birth rate in Ohio in 2020?

RQ 3: How do teen birth rates correlate with markers of adverse birth outcomes (eg. child mortality, infant mortality, low birth weight) in Ohio in 2020?

Methods

Context/Protocol

The data used for this study was collected from County Health Rankings & Roadmaps, a Robert Wood Johnson Foundation Program at countyhealthrankings.org.

High school graduation (Health Factors, Social & Economic Factors) data was collected for Ohio in 2016 and 2020. The 2016 data comes from EDFacts, which collects adjusted cohort graduation rates at the school district level. The 2020 data comes from the Ohio Department of Education. The 2016 County Health Rankings used data from 2012-2013 for this measure. The 2020 County Health Rankings used data from 2017-2018 for this measure.

Teen births (Health Factors, Health Behaviors) data was collected for Ohio in 2020. The 2020 rankings used data from 2012-2018 for this measure. The 2020 data was provided by the National Center for Health Statistics and drawn from the National Vital Statistics System (NVSS).

Child mortality (Additional Measures, Length of Life) data was collected for Ohio in 2020. The 2020 rankings used data from 2015-2018 for this measure. The 2020 data was provided by the National Center for Health Statistics and drawn from the National Vital Statistics System (NVSS).

Infant mortality (Additional Measures, Length of Life) data was collected for Ohio in 2020. The 2020 rankings used data from 2012-2018 for this measure. The 2020 data was

provided by the National Center for Health Statistics and drawn from the National Vital Statistics System (NVSS).

Low birthweight (Health Outcomes, Quality of Life) data was collected for Ohio in 2020. The 2020 rankings used data from 2012 to 2018 for this measure. The 2020 data was provided by the National Center for Health Statistics and drawn from the National Vital Statistics System (NVSS).

Data Collection

In order to assess the relationship between education and birth outcome in Ohio, I used data from countyhealthrankings.org in a retrospective function. The variables I assessed are high school graduation, teen births, child mortality, infant mortality, and low birthweight.

High school graduation is the percentage of the ninth-grade cohort that graduates from high school in four years. Definitions of cohorts and graduates, and suppression criteria may vary from state to state resulting in non-comparable estimates from state to state. There are limitations to this measure due to definitions, determining if students are transfers or dropouts, and rules about certain student groups, including those who are incarcerated or have special needs. In addition, some states include online schools and there can be problems assigning an online school to a specific county if students don't necessarily reside in the same county as the online school's mailing address.

Teen birth rate is the number of births per 1,000 female population ages 15-19. Births are counted in the county corresponding to the mother's address on the child's birth certificate, not the county the child was born in. If there are fewer than 10 teen births in the time frame, a missing value is reported. The primary limitation of this metric is that it does not capture births

among teens younger than 15. In addition, this rate is often confused with teen pregnancy. Although all births are the culmination of a pregnancy, not all pregnancies lead to a birth.

Child mortality is the number of deaths among children under the age of 18 per a 100,000 population. This is a rate that is relatively rare in most counties. Therefore, counties with smaller populations can see a lot of change in their rates of child death from year to year even though the changes are usually due to normal variation. The provided error margins can help determine if the change in rate is due to normal variation or real change. Because child death is relatively rare and statistics depend on large numbers of events to detect small changes, the estimate provided is a 4-year average. The deaths are counted in the county where the individual lived. If there are fewer than 10 child deaths in the time frame, a missing value is reported.

Infant mortality is the number of all infant deaths (within 1 year of age) per 1,000 live births. This is a rate that is relatively rare in most counties. Therefore, counties with smaller populations can see a lot of change in their rates of infant death from year to year even though the changes are usually due to normal variation. The provided error margins can help determine if the change in rate is due to normal variation or real change. Because infant death is relatively rare and statistics depend on large numbers of events to detect small changes, the estimate provided is a 7-year average. The deaths are counted in the county where the infant lived. If there are fewer than 20 infant deaths in the time frame, a missing value is reported.

Low birthweight is the percentage of live births with low birthweight (<2,500 grams). Births were counted in the county corresponding to the mother's address on the child's birth certificate, not the county the child was born in. If there were fewer than 10 low birthweight births in the time frame, a missing value is reported.

Data Analysis

RQ 1: How did the rate of high school completion change between 2016 and 2020 in Ohio? To answer this research question, I used a paired sample t-test. I reported the mean and standard deviation for the rate of high school completion for 2016 and 2020. Then I also reported the t, df, and significance after the paired sample t-test was run. If the significance was <0.05, the variables were statistically significantly different.

RQ 2: How does high school completion correlate with teen birth rate in Ohio in 2020? To answer this research question, I conducted a Spearman correlation. Based on the right skew as seen in Figure S1, it was determined that the data were not normally distributed. Therefore, the Spearman correlation test was conducted in lieu of the Pearson correlation test. The correlation strength is determined by the value of the correlation coefficient. If the absolute value of the correlation coefficient is above 0.7, it is a strong correlation; above 0.5 is a moderate correlation, above 0.3 is a weak correlation, and below 0.3 is essentially no correlation. If the result is positive, we can conclude that a higher rate of high school completion is associated with an increase in teen birth rate. If the result is negative, we can conclude that a higher rate of high school completion is associated with a decrease in teen birth rate.

RQ 3: How do teen birth rates correlate with markers of adverse birth outcomes (eg. child mortality, infant mortality, low birth weight) in Ohio in 2020? To answer this research question, I ran independent correlation tests between teen birth rate and each of the markers of birth outcomes. The correlation strength is determined by the value of the correlation coefficient. If the absolute value of the correlation coefficient is above 0.7, it is a strong correlation; above 0.5 is a moderate correlation, above 0.3 is a weak correlation, and below 0.3 is essentially no

correlation. Depending on the sign of the correlation coefficient, the relationship will either be a positive association or a negative association.

Results

RQ1: How did the rate of high school completion change between 2016 and 2020 in Ohio?

A paired t-test was used to compare the rates of high school completion in 2016 and 2020 in Ohio. High school completion rates were reported as the percentage of the ninth-grade cohort that graduates from high school in four years. Table 1 shows the mean high school graduation rates in 2016 and 2020 in all of the Ohio counties. The paired t-test indicated that there was a statistically significant increase in the high school graduation rate from 2016 to 2020 in Ohio ($t = 4.985$, $p < .001$).

Table 1. Descriptive Statistics of High School Graduation Rates in 2016 and 2020 in Ohio Counties

Year	N	Mean	Standard Deviation
2016	88	89.20	7.33
2020	88	92.35*	3.27

* indicates a statistically significant difference from 2016 (p <0 .001)

RQ2: How does high school completion correlate with teen birth rate in Ohio in 2020?

A Spearman correlation test was conducted to correlate high school completion with teen birth rate in Ohio in 2020. High school completion was significantly weakly correlated with teen birth rate ($r = -0.398$, $p < .001$). The analysis demonstrates that an increase in high school education rate is associated with a decrease in teen birth rate in Ohio in 2020 (Figure 1).

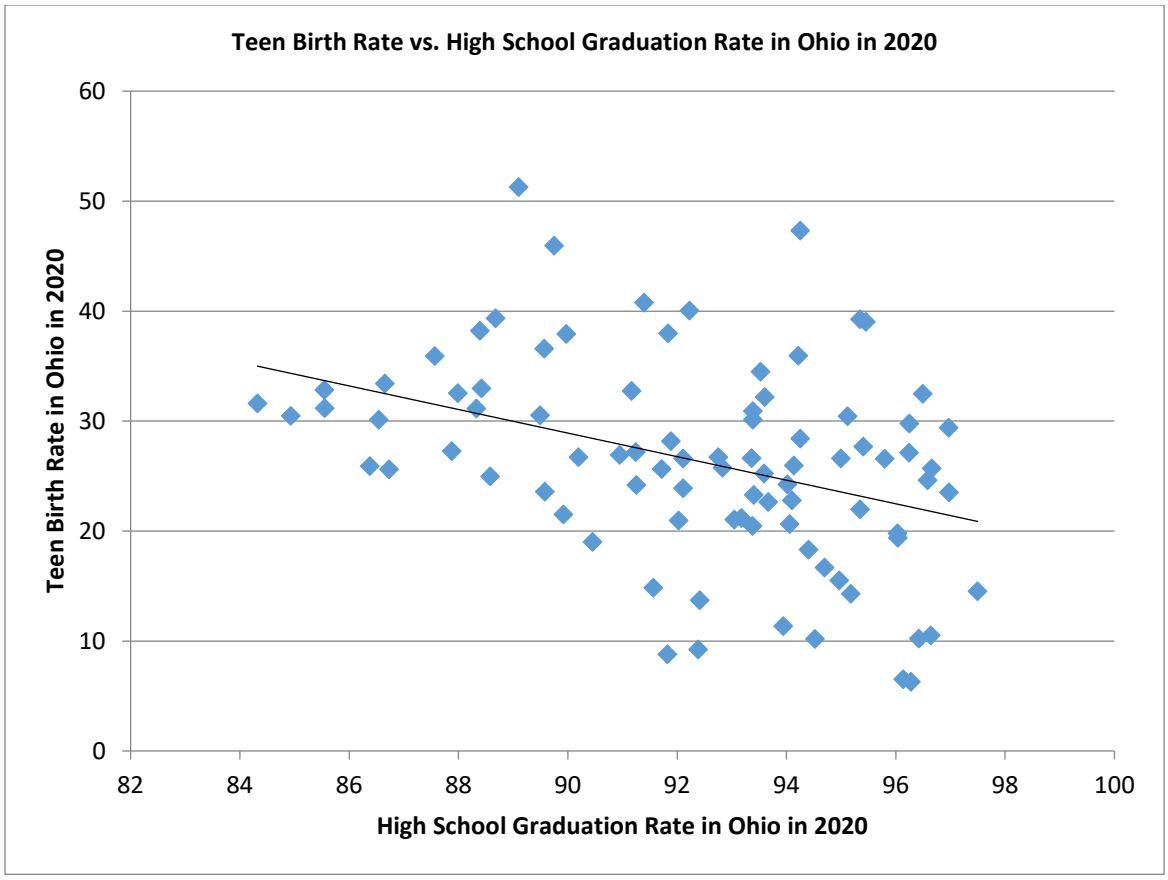

Figure 1. Correlation between Teen Birth Rate and High School Graduation Rate in Ohio in 2020

RQ3: How do teen birth rates correlate with markers of adverse birth outcomes (eg. child mortality, infant mortality, low birth weight) in Ohio in 2020?

The final research questions asked if teen birth rates correlated with markers of adverse birth outcomes in Ohio in 2020. In order to determine the correlations, I ran independent Pearson correlation tests between teen birth rate and each of the markers of adverse birth outcomes. Teen birth rate was found to have weak but highly significant correlations with child mortality rate in Ohio in 2020 ($r = 0.441$, $p < 0.001$), infant mortality rate in Ohio in 2020 ($r = 0.461$, $p < 0.001$), and percent with low birthweight in Ohio in 2020 ($r = 0.422$, $p < 0.001$). Because all three of the correlation coefficients are positive, we can conclude that a higher teen birth rate is associated

with higher adverse birth outcome rates. Through this analysis, it can be concluded that an increase in teen birth rate is associated with a statistically significant increase in adverse birth outcomes (as measured by child mortality, infant mortality, percent with low birth weight) in Ohio in 2020.

Discussion

Previous studies have shown that as education rates increase, teen birth rate decreases.[7,8] Studies across the United States and in California have shown that adverse birth outcomes (including child mortality, infant mortality, and low birthweight) occur more often in teen pregnancies.[5,6] Because adverse birth outcomes lead to both short and long-term medical conditions, as well as financial and emotional distress for children, their families, and their communities, we aimed to assess the validity of these previously studied trends in Ohio in 2020. This research study sought to determine the impact of high school completion on teen birth in Ohio in 2020 in the hopes of finding potential avenues to decrease adverse birth outcomes.

Through the analysis of the data collected on countyhealthrankings.org, we found that the previously described trends hold true in Ohio. To determine a little bit of background about the state of education in Ohio, we saw a statistically significant increase in high school completion rate in Ohio from 2016 to 2020. This is heartening as we continue the analysis of how education impacts teen birth rate. Using correlation statistical tests, we saw a significant negative relationship between high school completion and teen birth rate. This suggests that in Ohio in 2020, as high school completion rates increase, the teen birth rate decreases. Finally, our correlation analyses showed that teen birth rate is indeed significantly correlated with an increase

in adverse birth outcomes in Ohio in 2020. These analyses point toward education as a leading factor in decreasing teen birth rates and subsequent adverse birth outcomes.

This is an important finding because it indicates that education is the key to making a difference in teen birth rate and adverse birth outcomes in Ohio right now. We see that since 2016, Ohio has already increased the high school graduation rate. We speculate that as we continue to put resources towards increasing the high school graduation rate, the trend of decreasing teen pregnancy will continue. This brings the distribution of high school graduation rate into discussion. As seen in Figure S1, high school graduation rate has a right skew. This means that there are many counties that already have very large high school graduation rates and then there are other counties lagging behind. This is important to recognize as the state allocates resources towards promoting education. A prioritarian approach may suggest that the improvement of high school graduation rate is a function of overall well-being across all counties with extra weight given to the counties struggling with lower high school graduation rates. This approach applies the idiom "a chain is only as strong as its weakest link" to practical scenarios.

Overall, this research study indicates that supporting high school education is a promising avenue to decreasing teen pregnancy and adverse birth outcomes in Ohio. We hope this data will encourage state leaders to promote high school education in Ohio communities in order to provide for a healthier, safer Ohio.

Conclusion

Approximately 7% of teenage girls in the United States became pregnant in 2008.[4] These teenage pregnancies have a higher rate of adverse birth outcomes.[5,6] In this study, we found data that point towards promoting high school graduation as the key to decreasing teen pregnancy and

adverse birth outcomes in current day Ohio. This is an exciting prospect and gives community leaders an angle with which to tackle this issue. However, there are potential limitations to the conclusions drawn from this study.

First of all, it remains to be seen if the act of being in school is what decreases teen pregnancy rates or contraceptive education. If the former is true, community leaders can move towards promoting high school graduation with college scholarships or job incentives. However, if the latter is true, contraceptive education is a hot-button topic. Many communities struggle with debates about the place of contraceptive education in school education.

Second of all, it would be interesting to delve further into the communities that are struggling with lower high school graduation rates. It may be naïve to assume a statewide push and support of education would increase high school graduation rates to decrease teen pregnancy. Perhaps the counties that have lower high school graduation rates have barriers due to being in a rural environment where older children are needed to help families with farming or environments where the nearest high school is too far to commute to. By taking a more individualized approach and stratifying the communities that are struggling to graduate high proportions of their students, we may be able to find more concrete solutions.

In addition, a future study could look at higher education attendance rates for these communities. County Health Rankings provides data measuring the percentage of adults aged 25-44 with some post-secondary education (vocational/technical schools, junior colleges, or four-year colleges). Though this data might not directly contribute to teen pregnancy as the age range is past teenager-hood, it could be indirectly related to the support systems and role models in place in communities. For example, if a community is mostly comprised of adults without

post-secondary education, that may be a deterring factor for younger students in the community and may lead to lower rates of high school completion.

Overall, high school education proves to be a powerful tool for decreasing teen birth rate and resulting adverse birth outcomes. We hope the data presented here can help educators, leaders, health care providers and community members promote education to help improve the health and well-being of Ohioans.

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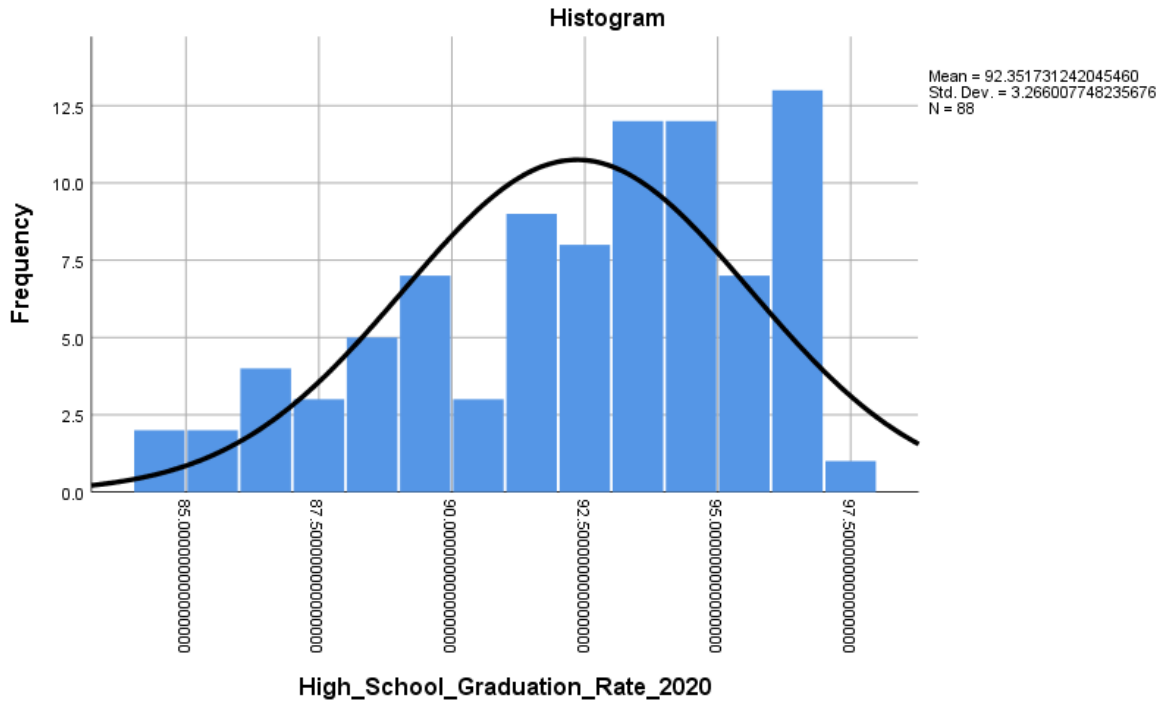
Supplemental Figures



Supplemental Figure 1. Distribution of High School Graduation Rate in Ohio in 2020