# Could raising Chicago’s high school graduation rates improve women’s health?

**Abstract:**

Chicago is nationally known for having great disparity in socioeconomic status by neighborhood. The impact on women leads to poor health. In order to improve their and their children’s lives, the link between high school diploma rates and four health indicators was evaluated to determine whether focus on high school retention could influence women’s health.

First, two claims from the research were tested. The study confirmed other research findings that low birth weight rate was linked to teen pregnancy (r = 0.6229, p < 0.0001), but did not show that reported incidence of gonorrhea was higher for females than males (df = 63, t = 1.24, p = 0.2185).

In examining the correlation between lack of high school diploma and teen birth rates, diabetes mortality, breast cancer mortality, and female gonorrhea rates, only teen birth rates appeared linked at r = 0.5378. The teen birth rate is also correlated to diabetes mortality (r = 0.7212) and female gonorrhea (0.7451). Diabetes is correlated to female gonorrhea incidence (r = 0.6902). After adjusting for poverty, the relationships were the same but weaker. Possibly, women who do not have children at a young age, gonorrhea infection, or unmanaged diabetes are taking greater self-care measures that explain these links for various age groups. Finally, high school retention rates were found to be better addressed by specific neighborhood rather than geographic region due to large spread in the region groups.

While city leaders should still provide more high school resources to places with less educated populace like Gage Park and South Lawndale, a more direct approach is required to improve women’s health.

**Background:**

While there are currently excellent programs to help target specific conditions, such as the Chicago Southeast Diabetes Community Action Coalition, the study tested whether there was one common factor that would address multiple women’s health indicators. If high school graduation rates are a link to diabetes, gonorrhea, breast cancer, and teen birth rates, government leaders can focus shrinking resources on this one category to have a greater impact on an underserved group.

To this effect, the study examined whether there was statistical significance in association between high school graduation and incidence of diabetes, breast cancer, teen birth rates, and gonorrhea in females. Next, specific regions were evaluated by proportion of the population without high school diplomas.

Diabetes data was collected for both men and women, and included in this study because the disease disproportionally affects women. While diabetes sufferers of both sexes face increased risk of cardiovascular disease, women receive lower quality medical care in the control of associated symptoms such as high cholesterol, even after accounting for covariates in age, race, socioeconomic status, and healthcare plan[[1]](#endnote-1). Both sexes are approximately equally likely to have diabetes, but women reported greater mobility limitations and visual impairment than men[[2]](#endnote-2). Overall, diabetic women see a higher impact to their lifespan, which is reduced on average by 8.2 years as compared to 7.5 years for men[[3]](#endnote-3).

In an American Cancer Society study, the investigators showed that in the 1980s and 1990s diabetes incidence was increasing faster in those with less education. This same study indicated that breast cancer rates were higher among better educated women, though there was a weak trend to higher mortality among less educated persons[[4]](#endnote-4). A later study found that while breast cancer mortality had decreased by 4.3% for women with more than 16 years of education between 1993 and 2001, the decrease was only 1.4% for women with less than 12 years of education, a fact likely related to the importance of early detection and regular screening[[5]](#endnote-5).

The third criterion examined was incidence of teen birth rates. The majority of teen mothers were characterized as unmarried, receiving little financial support from the father, and having parents with little education[[6]](#endnote-6). Teen mothers were found to be 10-12% less likely to finish high school, and a 2011 study in the Journal of School Health suggested that school-based programs could help young women engage in safer sex practices[[7]](#endnote-7). Thus, funding could go both to prevention of teen pregnancy and retention of teen mothers in a twofold approach to improve girls’ health. The health of the offspring would also benefit, as adolescent women are twice as likely to deliver an infant weighing less than 5.5 lbsv.

Gonorrhea infection was also included as an indicator of women’s health. It is the second most reported sexually-transmitted infection in the United States, with higher rates among women than men, and may lead to infertility. Infants may also be at risk because early states maybe asymptomatic. Cases of antibiotic resistance have been reported, underscoring the need for prevention[[8]](#endnote-8).

**Purpose:** To test for links between high school graduation rates and select health factors that disproportionally impact women to find ways to direct resources.

**Objectives:** This study examined the association between high school graduation and incidence of diabetes, gonorrhea in females, breast cancer, and teen birth rates, then determined whether these health factors are correlated to each other, and assessed whether geographic groupings for neighborhoods could direct funding.

**Sample Collection:**

The Chicago Department of Public Health created a dataset of 27 variables with health measures relating to birth, diseases, and economic status for each of the 77 Chicago communities. The indicators came from: birth and death certificate data from the Illinois Department of Public Health, US Census Bureau 2000 and 2010 censuses, 2006-2010 American Community Survey, reports filed under the notifiable disease rules of the Illinois Administrative Code, and more that were not named. The data represents the time period from 2005 to 2011. The percentages and rates are point estimates, and margin of error percentages were not listed.

An additional categorical variable, Region, was coded to divide the neighborhoods into 9 districts based on the divisions found on The Chicago 77 real estate website.

**List of Variables and Responses:**

Of the 27 variables provided by the Department of Public Health, the ones used in this study included the name of the neighborhood, the region the neighborhood fell into, the low birth weight as a percent of live births, the teen birth rate per 1,000 females aged 15-19, the diabetes-related mortality rate per 100,000 persons (age-adjusted), the breast cancer in females mortality rate per 100,000 females (age-adjusted), the gonorrhea rate separated by males and females per 100,000 persons aged 15 to 44 years, the percent of persons over 25 without a high school diploma, and the percent of households below poverty level.

All tests will be run at α = 0.05.

**SAS Routines:**

SAS 9.4 was used to evaluate proc means, proc ttest, proc glm, and proc corr.

**Descriptives:**

Table 1 characterizes the variables in the study. Most variables had a Pearson skew coefficient of 0.7 or less, so the mean was used as a descriptor. Female gonorrhea rates were the only criterion with a skew greater, at 0.9. Each of the means calculated from the neighborhood data was higher than the national average, with the exception of diabetes-related mortality (µ = 71.9, σ = 21.5, standard error = 2.4). The largest deviation from the US Mean was for gonorrhea infection in both sexes, which was more than 3 times the national average in Chicago.

All variables had large ranges, indicating large differences in characteristics between neighborhoods. In Mount Greenwood in the Far Southwest Side, for example, the poverty rate was the minimum of only 3.1%, whereas Fuller Park on the South Side and Riverdale on the Far South Side had poverty rates of more than half their citizens at 55.5% and 61.4%, respectively. Mount Greenwood had a teen birth rate of 7.7 per 1,000 females aged 15-19, diabetes-related mortality rate of 66.5 per 100,000 persons (age-adjusted), breast cancer in females mortality rate 34.6 per 100,000 females (age-adjusted), and gonorrhea rate unlisted. While breast cancer is above the city and national mean, the teen birth rate and diabetes-related mortality are both much lower. In contrast, Riverdale had a teen birth rate of 61.4, diabetes-related mortality at 115.9, breast cancer rate at 25, and female gonorrhea at 1699.7 and male gonorrhea at 1397.9 per 100,000 persons aged 15 to 44 years. Except for breast cancer rate, these numbers are greater than the city and national average.

Similarly, the percent of persons without a high school diploma also encompassed a broad range. While those in Lakeview on the North Side were only 2.9% without a high school diploma, Gage Park on the Southwest Side and South Lawndale on the West Side lacked diplomas for over half their citizens at 54.1% and 58.7%, respectively. Lakeview had below mean teen birth rate (15.8), breast cancer mortality (20.1), diabetes-related mortality (38.5), and gonorrhea infections (81.8 in females and 357.6 in males). South Lawndale rated lower than the city and national mean for breast cancer (13.2), diabetes (65), gonorrhea (289.5 in females and 106.8 in males), but higher in teen birth rate (77.5).

From this initial glance at extremes, the breast cancer rate does not appear to be raised by increased poverty or lack of high school diploma, though the teen birth rate does appear to be related to these factors. Additional analysis on the question of correlation is provided in the next section.

Table 1. Descriptives of select public health criteria for Chicago's 77 communities

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **N** | **Minimum** | **Maximum** | **Mean** | **Std Dev** | **Lower 95% CL for Mean** | **Upper 95% CL for Mean** | **Std Error** | **US Mean 2009** |
| LowBirthWt TeenBirthRt BrstCancer Diabetes FGonorrhea MGonorrhea NoDiploma Poverty | 77 77 77 77 65 65 77 77 | 3.5 1.3 7.6 26.8 50.3 52.7 2.9 3.1 | 19.7 116.9 54.7 119.1 3193.3 2545.7 58.7 61.4 | 10.1 50.1 26.0 71.9 894.3 840.7 21.6 20.3 | 3.9 28.1 9.6 21.5 894.9 774.8 12.4 11.5 | 9.2 43.7 23.8 67.1 672.5 648.7 18.8 17.7 | 11.0 56.4 28.1 76.8 1116.0 1032.7 24.4 22.9 | 0.4 3.2 1.1 2.4 111.0 96.1 1.4 1.3 | 8.2 39.1 22.9 73.1 285 220 14.6  13.3 |

**Inferential Procedures:**

In the first step, two claims from the literature were tested for the Chicago data. A paired t-test was performed to evaluate whether females had higher incidence of gonorrhea infection than males, and a correlation test was used to evaluate whether teen birth rates were linked to lower birth weight.

In the paired t-test, no significant difference (df = 63, t = 1.24, p = 0.2185) was found in the mean gonorrhea rate in females versus males for each neighborhood. This is surprising because the US Mean shows that the infection is more commonly reported in women, at 285 per 100,000 women aged 15 to 44 years, versus 220 per 100,000 men aged 15 to 44 years. However, the 95% confidence interval for the difference in means is -32.431, 139.1. Some neighborhoods like West Garfield Park on the West Side and Burnside on the Far South Side feature reported gonorrhea infection rates over 3000 women, whereas the men’s maximum is reported at 2545.7 in West Englewood on the South West Side.

Teen birth rate was found to be correlated to low birth weight, as predicted. The r was 0.6229, with p < 0.0001. This places the infant at greater risk of health complications.

Next, a correlation was performed to determine whether the four female health indicators (diabetes mortality, teen birth rates, female gonorrhea, and breast cancer) were linked to lack of high school diploma rates. This correlation was run again, adjusting for the effect of the poverty level.

If any p < 0.05 and r > 0.5 are considered to be correlated, then Table 2 illustrates that lack of high school diploma is correlated only to teen birth rate at an r = 0.5378, and not to the other factors. Interestingly, there is possibly a weak negative influence of no high school diploma on the breast cancer rate. The teen birth rate is also correlated to diabetes mortality (r = 0.7212) and female gonorrhea (0.7451). Diabetes is correlated to female gonorrhea incidence (r = 0.6902).

In Table 3, which performs the same function with an adjustment for poverty level, the correlations are not as strong. In this result, no high school diploma has only a weak r = 0.3536 for teen birth rate and low negative correlations for the other variables. Teen birth rate still correlates to diabetes mortality (r = 0.5066) and female gonorrhea (r = 0.5936), while diabetes correlation to female gonorrhea is no longer as strong (r = 0.4881).

Table 2. Female health factors as they correlate to high school diploma rates

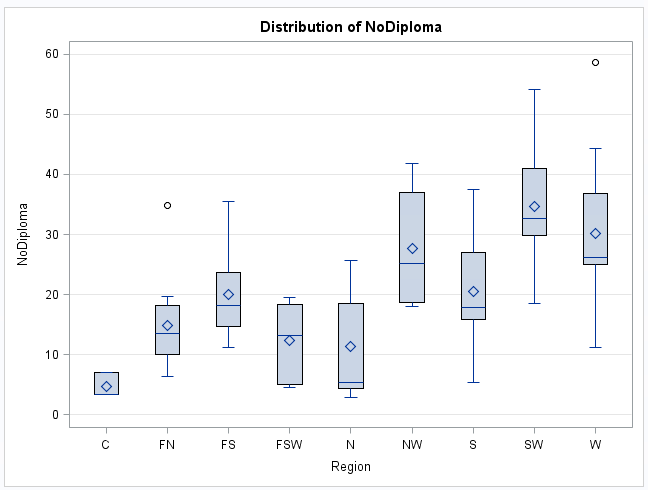
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Pearson Correlation Coefficients Prob > |r| under H0: Rho=0 Number of Observations** | | | | | |
|  | **TeenBirthRt** | **BrstCancer** | **Diabetes** | **FGonorrhea** | **NoDiploma** |
| **TeenBirthRt** | 1.00000  77 | 0.31911 0.0047 77 | 0.72123 <.0001 77 | 0.74511 <.0001 65 | 0.53778 <.0001 77 |
| **BrstCancer** | 0.31911 0.0047 77 | 1.00000  77 | 0.32657 0.0037 77 | 0.44146 0.0002 65 | -0.18455 0.1081 77 |
| **Diabetes** | 0.72123 <.0001 77 | 0.32657 0.0037 77 | 1.00000  77 | 0.69022 <.0001 65 | 0.27491 0.0155 77 |
| **FGonorrhea** | 0.74511 <.0001 65 | 0.44146 0.0002 65 | 0.69022 <.0001 65 | 1.00000  65 | 0.01931 0.8787 65 |
| **NoDiploma** | 0.53778 <.0001 77 | -0.18455 0.1081 77 | 0.27491 0.0155 77 | 0.01931 0.8787 65 | 1.00000  77 |

Table 3. Female health and high school diploma, adjusted for poverty level

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Pearson Partial Correlation Coefficients, N = 65 Prob > |r| under H0: Partial Rho=0** | | | | | |
|  | **TeenBirthRt** | **BrstCancer** | **Diabetes** | **FGonorrhea** | **NoDiploma** |
| **TeenBirthRt** | 1.00000 | 0.33260 0.0072 | 0.50662 <.0001 | 0.59357 <.0001 | 0.35363 0.0041 |
| **BrstCancer** | 0.33260 0.0072 | 1.00000 | 0.34672 0.0050 | 0.52767 <.0001 | -0.27822 0.0260 |
| **Diabetes** | 0.50662 <.0001 | 0.34672 0.0050 | 1.00000 | 0.48811 <.0001 | -0.03422 0.7884 |
| **FGonorrhea** | 0.59357 <.0001 | 0.52767 <.0001 | 0.48811 <.0001 | 1.00000 | -0.30006 0.0160 |
| **NoDiploma** | 0.35363 0.0041 | -0.27822 0.0260 | -0.03422 0.7884 | -0.30006 0.0160 | 1.00000 |

Finally, a one-way ANOVA was used to determine whether specific regions of the city should receive high school resources based on proportions of the population lacking a high school diploma. Figure 1 shows the box plot result, in which the Northwest, Southwest, and West Sides all have the highest means and maximums. This illustrates a general trend of fewer adults with high school diplomas as one moves away from the lake, with the exception of the Far Southwest Side. Because of the broad ranges of these variables, however, it may be preferable to address high school graduation rates by specific neighborhood rather than targeting regions.

Figure 1. Boxplot of no high school diploma by geographic region



**Conclusion:**

Chicago is nationally known for having great disparity in socioeconomic status by neighborhood. Neighborhoods like Lakeview and Mount Greenwood have low poverty rates and more adults with high school diplomas, while more than half of Fuller Park and Riverdale live in poverty. Gage Park on the Southwest Side and South Lawndale on the West Side lacked diplomas for over half their citizens at 54.1% and 58.7%, respectively. Unfortunately, these harsh environments impact the health of women residing there. In order to improve their and their children’s lives, the link between high school diploma rates and four health indicators was evaluated to determine whether focusing on high school retention could affect women’s health.

First, two claims from the research were tested. The study confirmed other research findings that low birth weight rate was linked to teen pregnancy (r = 0.6229, p < 0.0001), but did not show that reported incidence of gonorrhea was higher for females than males (df = 63, t = 1.24, p = 0.2185). Low birth weight in infants cause health complications and is explained by the immaturity of the female body in teenage years, and by other risky behaviors like drinking and smoking that commonly appear alongside less safe sex practicesvi. The second result, that females did not have a greater mean reported incidence of gonorrhea by neighborhood, surprisingly did not agree with the national data that indicated greater incidence in women. However, the female incidence had a greater range with a higher maximum. This may be due to women having less access to healthcare in certain neighborhoods, so that they are not diagnosed as frequently. As well, numbers were not reported for 12 communities, so this snapshot may not be wholly accurate for all of Chicago.

In examining the correlation between lack of high school diploma and teen birth rates, diabetes mortality, breast cancer mortality, and female gonorrhea rates, only teen birth rates appeared linked at r = 0.5378. Interestingly, there is possibly a weak negative influence of no high school diploma on the breast cancer rate. The teen birth rate is also correlated to diabetes mortality (r = 0.7212) and female gonorrhea (0.7451). Diabetes is correlated to female gonorrhea incidence (r = 0.6902). After adjusting for poverty, the relationships were the same but weaker.

Possibly breast cancer is negatively or not at all related to education level. As Steenland, Henley, and Thun found in their study, the fact that women with higher education have children later and approach breast feeding differently may actually slightly increase their susceptibilityiv. More research is necessary to determine whether there is actually a connection.

With the teen birth rate correlation to education level, one cannot easily determine which factor causes the other. While young mothers may find it difficult or impossible to stay in school, young women who are not thriving in school may also engage in risky behaviors as a result. Because it is unclear which is the dependent variable, a regression analysis was not performed. The relationship between teen birth rate and female gonorrhea is more clear, as they are both results of less safe sex practices, albeit for different age groups. A complicated group of factors like family involvement, substance use, or community role models is likely driving these rates. The diabetes mortality rate also has a relationship with these two factors, and the reason for this is not clear. In a broad sense, these health factors are all more preventable than breast cancer, which is often attributed largely to genetics. Possibly, women who do not have children at a young age, gonorrhea infection, or unmanaged diabetes are taking greater self-care measures that explain these links for various age groups.

Finally, we determined that high school retention rates would better be addressed by specific neighborhood rather than geographic region. Although the West Side has the highest percentage of population lacking high school diploma both to the Northwest and Southwest, the spread among the regions is too high to direct resources.

**Recommendations:**

While city leaders should still provide more high school resources to places like Gage Park and South Lawndale, a more direct approach is required to improve women’s health. Programs to establish healthier sex practices, nutrition, and exercise will help women take care of themselves and their children throughout their lifetimes. These programs can be implemented in high schools, but then retention rate must be addressed so that more women benefit. If high schools receive additional funding or other resources, additional analysis should be performed to determine whether this spending improves women’s health. Adjustments should be made for concurrent programs that target specific conditions, like community diabetes initiatives. Other options to reach a broad audience include bus or radio campaigns.

**Limitations:**

No data regarding race and ethnic makeup was included in the survey. Additionally, college and graduate school rates would also have been useful in addressing the impact of education on women’s health factors. Gonorrhea rates were not available for every neighborhood. As well, confidence intervals around each estimate, including US data, would have provided a more accurate snapshot.

**Data Sources:**

"Public Health Statistics- Selected Public Health Indicators by Chicago Community Area." City of Chicago | Data Portal. June 4, 2013. Accessed November 22, 2015. https://data.cityofchicago.org/Health-Human-Services/Public-Health-Statistics-Selected-public-health-in/iqnk-2tcu.

A linked document provides a description of the data source here:

<https://data.cityofchicago.org/api/assets/2107948F-357D-4ED7-ACC2-2E9266BBFFA2>

Chicago regions coded using the divisions here:

"Chicago Neighborhoods." The Chicago 77. 2015. Accessed November 22, 2015. http://www.thechicago77.com/chicago-neighborhoods/.

**Works Cited:**

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2. Division of Diabetes Translation, National Center for Chronic Disease Prevention and Health Promotion. *Diabetes Public Health Resource.* December 2, 2012. Accessed November 21, 2015. http://www.cdc.gov.ezproxy.depaul.edu/diabetes/statistics/mobility/health\_status/fig4.htm. [↑](#endnote-ref-2)
3. Gebel, PhD, Erika. "How Diabetes Differs for Men and Women." *Diabetes Forecast.* October 1, 2011. Accessed November 21, 2015. http://www.diabetesforecast.org/2011/oct/how-diabetes-differs-for-men-and-women.html. [↑](#endnote-ref-3)
4. Steenland K, J Henley, and M Thun. 2002. "All-cause and cause-specific death rates by educational status for two million people in two American Cancer Society cohorts, 1959-1996". American Journal of Epidemiology. 156 (1): 11-21. [↑](#endnote-ref-4)
5. Kinsey, T., A. Jemal, J. Liff, E. Ward, and M. Thun. "Secular Trends in Mortality From Common Cancers in the United States by Educational Attainment, 1993-2001." *JNCI Journal of the National Cancer Institute* 100, no. 14 (2008): 1003-1012. doi:10.1093/jnci/djn207. [↑](#endnote-ref-5)
6. Roth, Jeffrey, Jo Hendrickson, Max Schilling, and Daniel W. Stowell. 1998. "The Risk of Teen Mothers Having Low Birth Weight Babies: Implications of Recent Medical Research for School Health Personnel". Journal of School Health. 68 (7): 271-275. [↑](#endnote-ref-6)
7. Basch, Charles E. 2011. "Teen Pregnancy and the Achievement Gap Among Urban Minority Youth". Journal of School Health. 81 (10): 614-618. [↑](#endnote-ref-7)
8. Walker CK, and RL Sweet. 2011. "Gonorrhea infection in women: prevalence, effects, screening, and management". *International Journal of Women's Health.*3: 197-206.

   **SAS Output:**

   **proc** **sort** data = ChiHealth;

   by NoDiploma;

   **run**;

   **Proc** **means** data = ChiHealth n min max mean std median Q1 Q3 Skew clm maxdec = **1**;

   var LowBirthWt TeenBirthRt BrstCancer Diabetes FGonorrhea MGonorrhea NoDiploma;

   **Run**;

   **Proc** **ttest** data = ChiHealth;

   Paired FGonorrhea\*MGonorrhea;

   **run**;

   **PROC** **CORR** DATA=ChiHealth NOSIMPLE;

   TITLE 'Correlations between health indicators and education';

   VAR TeenBirthRt BrstCancer Diabetes FGonorrhea NoDiploma;

   **RUN**;

   **PROC** **CORR** DATA=ChiHealth NOSIMPLE;

   TITLE 'Correlations between health and education, removing effects of poverty, dependency, and unemployment';

   VAR TeenBirthRt BrstCancer Diabetes FGonorrhea NoDiploma;

   PARTIAL Poverty Dependency Unemployment;

   **RUN**;

   **proc** **glm** data=ChiHealth;

   class Region;

   model NoDiploma = Region;

   means Region /snk;

   **run**; [↑](#endnote-ref-8)