Data Science Project 3: **Cardiovascular Disease Outcomes of Black Americans Compared to White Americans**

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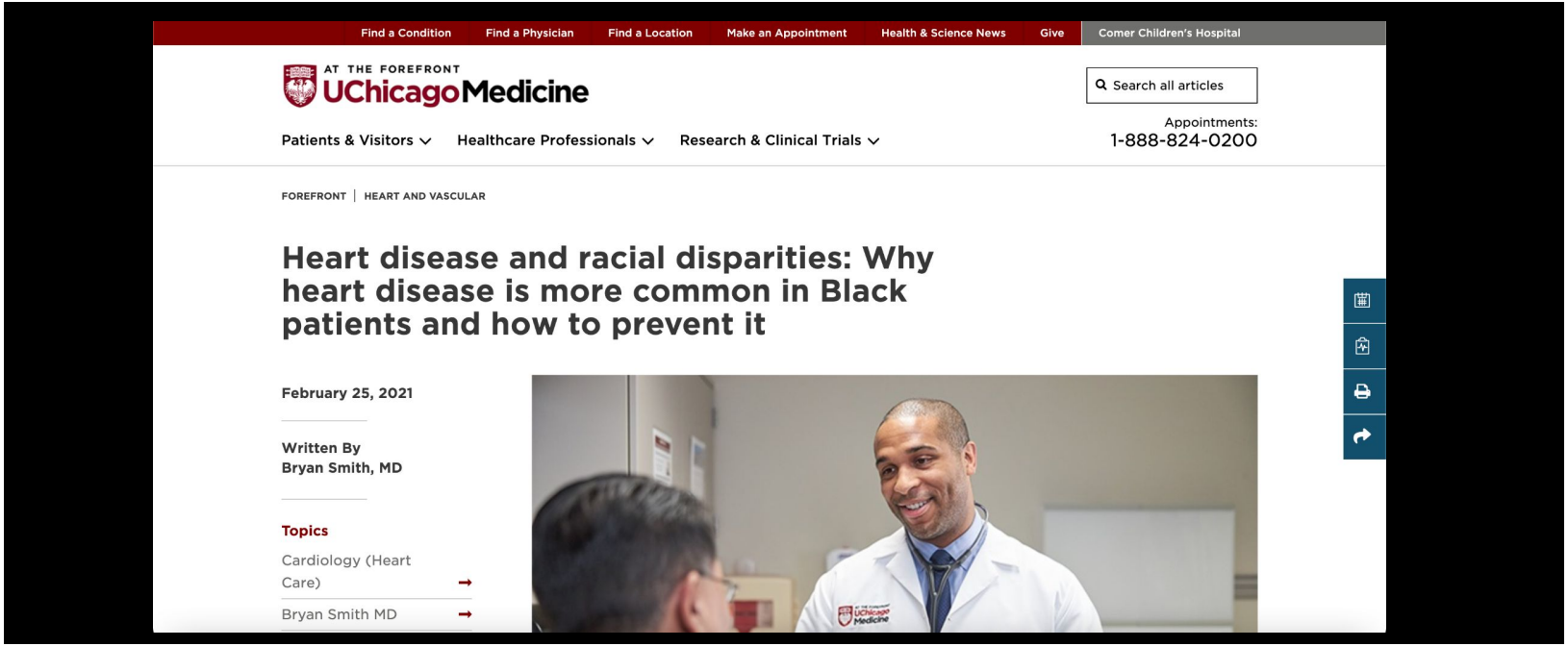
Background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Heart disease and racial disparities: Why heart disease is more common in Black patients and how to prevent it
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Topics
Cardiology (Heart Care)
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Background

African-American patients in the United States are at a higher risk of mortality in hospitals, especially Black women in maternity wards. One study found that Black maternity patients died more often (11.5 per 100,000) than White patients (4.8 per 100,000) (Burris, H. H., et al; 2021).

In response to this study and the aforementioned article,we wanted to examine if there was a disparity in mortality rates pertaining to Black and white people who suffer from heart disease.

Gathering Data

We decided to use a dataset from the CDC with over a million rows that outlined, race, gender, pre existing conditions, and cause of death.

Then we looped through every row and counted the amount of people who died from cardiovascular disease and were African American, total amount of African Americans in the dataset, amount of people who died from cardiovascular disease and were white, and total amount of white people in the dataset.

Gathering Data

What’s more, we downloaded the data set and sorted through the data in an excel spreadsheet. We sorted it by disease (cardiovascular), outcome (mortality or otherwise), and ethnicity (from there, we deleted all other races than white and African-American)

Method and hypothesis

We hypothesised that there is a statistically significant disparity of mortality skewed towards a higher mortality rate of Black patients with heart disease.

We aimed to prove this hypothesis by conducting a chi-square test (a statistical analysis that compares two categorical variables to determine if there is a statistically significant relationship.

Our mathematical hypothesis is as followed:

H_0 (null hypothesis): There is a statistically significant relationship in cardiovascular disease mortality rates between African-Americans and white-Americans.

H_1 (alternate hypothesis): No there isn't

Interpreting Results

In a Chi-square test, we can conclude statistical significance in a few ways, but the easiest way is comparing values.

The first comparison we could make is between something called a “p-value” and an “alpha-level”. A p-value measures the probability of obtaining the observed results, assuming that the null hypothesis is true. An alpha level is the probability of making a wrong decision in statistical analysis, and we chose to use a probability of 0.05%, which is common practice in statistical analysis. If our calculated p-value is greater than our alpha-level of 0.05, we would fail to reject the null hypothesis and conclude that our results are NOT statistically significant. If the p-value is less than our alpha-level of 0.05, we would reject the null hypothesis and conclude that our results ARE statistically significant.

Interpreting Results

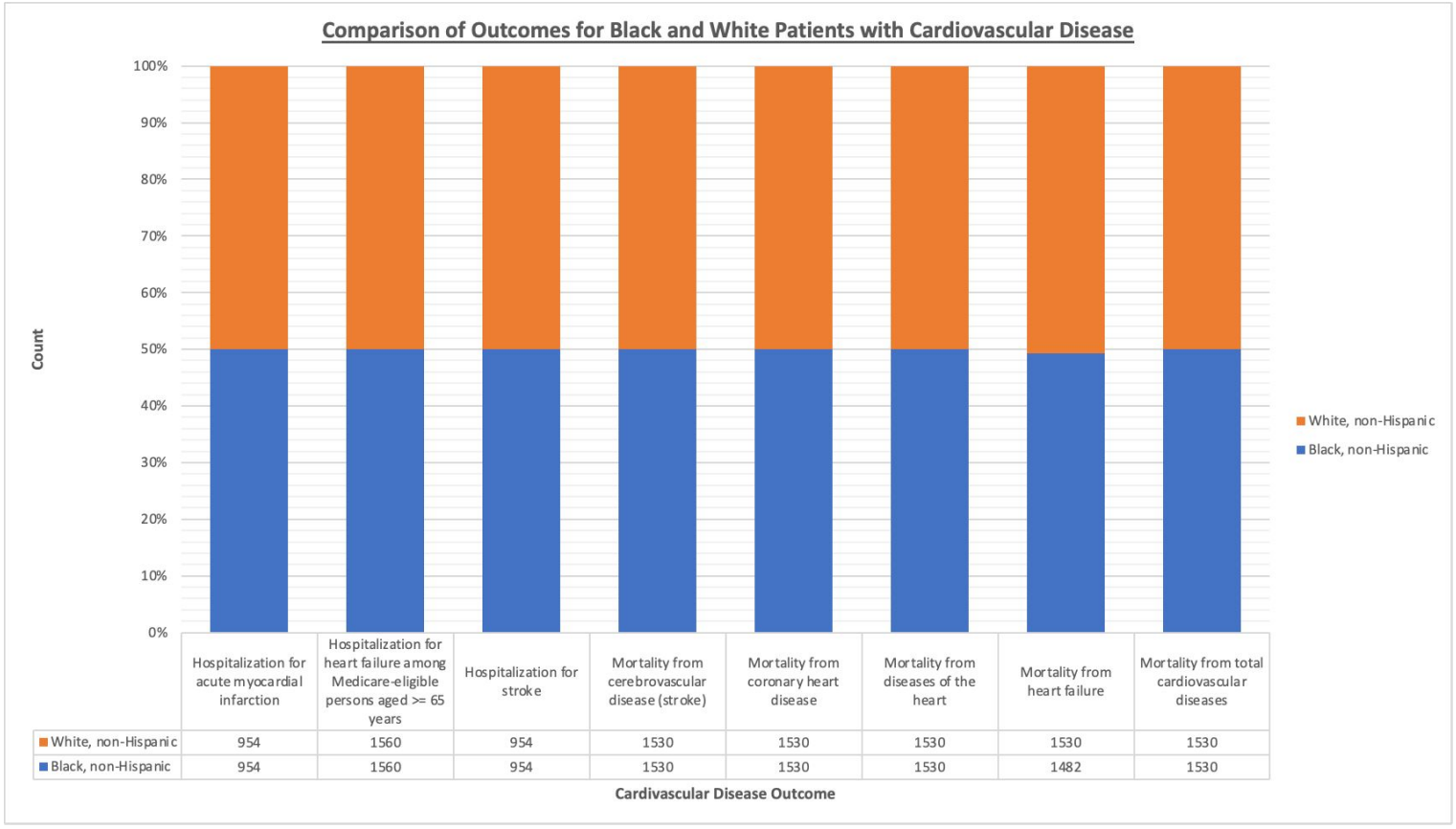
The second comparison we could make is between something called a “chi-square statistic” and a “chi-square critical”. The chi-square critical is the value is the cutoff between retaining or rejecting the null hypothesis. The chi-square statistic is the calculated difference represented in units of standard error. If our calculated chi-square critical is greater than our chi-square statistic, we would fail to reject the null hypothesis and conclude that our results are NOT statistically significant. If our chi-square statistic is greater than our chi-square critical, we would reject the null hypothesis and conclude that our results are NOT statistically significant.

Results

Below are our observed results, which are literally just the results from the data set.

Observed Counts	Race/Ethnicity	
Outcome	**Black, non-Hispanic**	**White, non-Hispanic**
Hospitalization for acute myocardial infarction	954	954
Hospitalization for heart failure among Medicare-eligible persons aged >= 65 years	1560	1560
Hospitalization for stroke	954	954
Mortality from cerebrovascular disease (stroke)	1530	1530
Mortality from coronary heart disease	1530	1530
Mortality from diseases of the heart	1530	1530
Mortality from heart failure	1482	1530
Mortality from total cardiovascular diseases	1530	1530

Results



	Hospitalization for acute myocardial infarction	Hospitalization for heart failure among Medicare-eligible persons aged >= 65 years	Hospitalization for stroke	Mortality from cerebrovascular disease (stroke)	Mortality from coronary heart disease	Mortality from diseases of the heart	Mortality from heart failure	Mortality from total cardiovascular diseases
White, non-Hispanic	954	1560	954	1530	1530	1530	1530	1530
Black, non-Hispanic	954	1560	954	1530	1530	1530	1482	1530

Results

Below are our expected results, which is the calculated values that over the long term of doing an experiment multiple times, you would "expect" these number.

Expected Counts	**Race/Ethnicity**	
Outcome	**Black, non-Hispanic**	**White, non-Hispanic**
Hospitalization for acute myocardial infarction	951.9361817	956.0638183
Hospitalization for heart failure among Medicare-eligible persons aged >= 65 years	1556.625203	1563.374797
Hospitalization for stroke	951.9361817	956.0638183
Mortality from cerebrovascular disease (stroke)	1526.690103	1533.309897
Mortality from coronary heart disease	1526.690103	1533.309897
Mortality from diseases of the heart	1526.690103	1533.309897
Mortality from heart failure	1502.742023	1509.257977
Mortality from total cardiovascular diseases	1526.690103	1533.309897

Results

Below are our Chi-squared test results, which tells us how much difference exists between your observed counts and the expected counts if there were no relationship at all in the population.

Chi-Square	Race/Ethnicity	
Outcome	**Black, non-Hispanic**	**White, non-Hispanic**
Hospitalization for acute myocardial infarction	0.004474403	0.004455085
Hospitalization for heart failure among Medicare-eligible persons aged >= 65 years	0.007316633	0.007285045
Hospitalization for stroke	0.004474403	0.004455085
Mortality from cerebrovascular disease (stroke)	0.007175929	0.007144948
Mortality from coronary heart disease	0.007175929	0.007144948
Mortality from diseases of the heart	0.007175929	0.007144948
Mortality from heart failure	0.286297648	0.285061608
Mortality from total cardiovascular diseases	0.007175929	0.007144948

Results

Below are our further calculations for the Chi-squared test that we will use to determine out outcome.

Chi-Square Statistic	0.66110342
Degrees of Freedom	7
Chi-Square Critical Value	14.06714045
P-Value	0.998617077

Conclusion

Since out P-Value is greater than our alpha level and our chi-square critical value is greater than our chi-square statistic, we can fail to reject our null hypothesis and determine that there is NOT a statistically significant relationship between these two populations.

Chi-Square Statistic	0.66110342
Alpha Level	0.05
Chi-Square Critical Value	14.06714045
P-Value	0.998617077

Considerations

Though our data did not reflect what our original hypothesis was, we still maintain and recognize that African-Americans do suffer at the hands of medical professionals, and that this data set was provided by an American body, who might pose a bias in reporting data.

Recommendations

This is a complex issue that requires thinking from an intersectional framework. It's been proven that when Black doctors care for Black patients, the mortality rate for the patients are halved compared to that of white doctors (Greenwood, et al; 2020). Employing more Black doctors, nurses, and other hospital workers can aid the mortality rate of Black patients.

References

- Greenwood, B. N., Hardeman, R. R., Huang, L., & Sojourner, A. (2020). Physician-patient racial concordance and disparities in birthing mortality for newborns. Proceedings of the National Academy of Sciences, 117(35), 21194-21200. https://doi.org/10.1073/pnas.1913405117

- Burris, H. H., Passarella, M., Handley, S. C., Srinivas, S. K., & Lorch, S. A.(2021). Black-White disparities in maternal in-hospital mortality according to teaching and black-serving hospital status. American Journal of Obstetrics and Gynecology, 225(1), 83.e1-83.e9. https://doi.org/10.1016/j.ajog.2021.01.004

Thank You