**Introduction**

From 1993 to 2003 a growing number of studies showed that vigorous and moderate physical activity reduced the risk of coronary heart disease (CHD). The Study of British Civil Servants by Morris *et al*. observed 17,944 office workers between ages 45 and 65 that were free of CHD. After 8.5 years 3.1% of the workers who reported vigorous exercise had an occurrence of CHD while 6.9% among those who did not (Press, et al, 2003). Other studies including the well-known Harvard Alumni Study have also shown that vigorous exercise helps to reduce the risk of CHD. Moderate physical activity has also proven to decrease the risk of CHD. Moderate exercises include activities such as brisk walking, swimming, and cycling. A study that began in 1978 referred to as The British Regional Heart Study observed 7,735 men between the ages of 40 and 59. A questionnaire was given to the men and completed which asked questions on each participants leisure time physical activities. After 8 years, results showed that those who participated in moderate or moderately vigorous exercises had 50% reduction in risk of CHD, compared to those who were inactive (Press, et al, 2003).

The goal of this research paper is to explore the potential relationships between exercise patterns and race, and coronary heart disease and race. This paper will also aim to determine whether exercise mediates the impact of race on health outcomes.

Studies conducted by the Center for Disease Control and Prevention (CDC) from 1999 to 2017 suggest that the above variables have an effect on coronary heart disease. The CDC presented data in April 2019 that showed that the rate for heart disease is highest among Blacks/not Hispanic, then whites/not Hispanic, Hispanic, Asian or Pacific Islander/not Hispanic respectively. The studies conducted on physical activity and coronary heart disease suggest that more intense exercise decreases the risk of CHD. However, does more time spent exercising also decrease the risk of CHD? If time spent engaging in a physical activity per week is a significant factor for the rate of heart disease among individuals then based on the CDC's studies the race that exercises the most will likely have the least risk of CHD. However, if the statistics do not resemble this data, then other variables might play a role in the risk of CHD.

**Background**

Previous studies on this topic have shown that there is a positive association between exercise and lowered risk of coronary heart disease. According to The National Center for Biotechnology Information (NCBI) studies have also shown that mortality rate is 30% higher among Blacks than Whites in regard to CHD (Saffer, Henry, et al). The racial gaps between heart diseases and other chronic diseases mortality have mainly failed to narrow over the past four decades (Saffer, Henry, et al). According to the NCBI, numerous studies have explored plausible factors for the underlying cause of the racial gap including, racial and ethnic differences in income and education, smoking and drinking prevalence, participation in other risky activities, and access to less or lower-quality medical care (Saffer, Henry, et al). However, the association between race and chronic health conditions such as CHD continue even when the individuals are within the same economic status and are insured. Thus, there must be another variable that explains the reason for the gap. According to the NCBI, one variable that has been understudied is engagement in physical activity and different forms of physical activity (Saffer, Henry, et al).

A large study proposes that physical activity performed outside of work environments have significant direct and indirect effects on mental and physical health (Saffer, Henry, et al). Statistics posted through the U.S. Department of Health & Human Services state that in 2002, 12.6 million people had coronary heart disease (“Physical Activity Fundamental to Preventing Disease.”*, 2017*). A more recent study from the CDC in 2020 showed that 18.2 million adults over the age of 20 had coronary heart disease (“Heart Disease Facts.”, 2020). This suggest that CHD has increased and may still be increasing among Americans.

**Research Question:**

In this paper, I plan to analyze the differences in exercise patterns by race, differences in health outcomes by race, and see whether exercise duration per week mediates the impact of race on health outcomes. Data from the Behavioral Risk Fact Surveillance System (“CDC - BRFSS.”, 2019) will be used to answer the following questions:

* What race exercises the most and least on average?
* What race in 2019 has the highest and lowest percentage for coronary heart disease?
* Does the percentage of people in the U.S. and the strength of their association with coronary heart disease differ by minutes of physical activity per week?
* Does an increase in exercise duration per week correlate with a lowered risk of coronary heart disease? Does race positively or negatively impact this correlation?

**Data Descriptions**

The dataset I have employed is the Behavioral Risk Fact Surveillance System (BRFSS), which is the U.S premier system of health-related telephone surveys that collect state data about U.S. residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services (“CDC - BRFSS.”, 2020). Each unit of observation in the dataset is a person, and the dataset contains a total of 418,268 respondents with a total of 342 variables before recoding and 351 after. All data from this set was gathered within 2019. The data export from the BRFSS places some variables as nominal categorical variables. In order to run statistical methods, some of the data was transformed into new variables using SPSS so that instead of nominal categorical variables there is a series of indicator binary variables.

* **\_RACE1** - The computed variable for respondents preferred race category. The value is listed as 1, 2, 3, 4, 5, 6, 7, 8, 9 if their response is White, Black or African American, American Indian or Alaskan Native, Asian, Native Hawaiian or other Pacific Islander, other race, Multiracial, Hispanic, don’t know/ not sure/refused respectively.
* **RACE\_WHITE** - re-coded dichotomous variable for \_RACE, coded as 1 when preferred race is white and 0 for all other races.
* **RACE\_BLACK** - re-coded dichotomous variable for \_RACE, coded as 1 when preferred race is black and 0 for all other races.
* **RACE\_AMERICAN\_INDIAN** - re-coded dichotomous variable for \_RACE, coded as 1 when preferred race is American Indian or Alaskan Native and 0 for all other races.
* **RACE\_NT\_HAWAIIAN\_PC\_ISLANDER** - re-coded dichotomous variable for \_RACE, coded as 1 when preferred race is Native Hawaiian or Pacific Islander and 0 for all other races.
* **RACE\_ASIAN** - re-coded dichotomous variable for \_RACE, coded as 1 when preferred race is Asian and 0 for all other races.
* **RACE\_HISPANC** - re-coded dichotomous variable for \_RACE, coded as 1 when preferred race is Hispanic, Latino/a, or Spanish origin and 0 for all other races.
* **RACE\_OTHER** - re-coded dichotomous variable for \_RACE, coded as 1 when preferred race is listed as other race, no preferred race, multiracial but preferred race not answered and 0 for all other races.
* **\_MINAC11** - The computed variable for minutes of physical activity per week for first activity. The value is listed as 0 or 1- 99999 for minutes of activity per week.
* **\_MINAC21** - The computed variable for minutes of physical activity per week for second activity. The value is listed as 0 or 1- 99999 for minutes of activity per week.
* **\_MICHD** - The computed variable for respondents that have ever reported having coronary heart disease (chd) or myocardial infarction (mi). The value is listed as 1, 2, or 9 if the subject’s response is reported having MI or CHD, did not report having MI or CHD, or not asked/missing respectively
* **MICHD\_RECODED** - re-coded dichotomous variable for \_MICHD, coded as 1 if the respondent reported having coronary heart disease (chd) or myocardial infarction (mi) and 0 if they reported not having it. Lastly SPSS listed the value as SYS-MISSING if the subject’s response is reported not asked/missing.

**Analysis & Results**

The descriptive statistics show that out of the 418,268 respondents 310,750 are White, 31,423 are Black, 6,569 are American Indian/Alaskan Indian, 2,379 are Native Hawaiian/Pacific Islander, 9,179 are Asian, and 37,410 are Hispanic.

The descriptive statistics show that the mean amount of time in minutes that each race engages in physical activity per week for the first activity is White = 264.61, Black = 237.91, American Indian/Alaskan Indian = 355.60, Native Hawaiian/Pacific Islander = 288.52, Asian = 210.58, Multiracial = 286.69, and Hispanic, Latino/a = 242.24. The mean amount of time in minutes that each race engages in physical activity per week for the second activity is White = 162.85, Black = 113.43, American Indian/Alaskan Indian = 203.80, Native Hawaiian/Pacific Islander = 172.89, Asian = 115.55, Multiracial = 137.80, and Hispanic, Latino/a = 112.30.

Relative to the first activity American Indians/Alaskan Indians exercise the most amount of time per week while Asians exercise the least on average. Relative to the second activity American Indians/Alaskan Indians exercise the most amount of time per week while Hispanic, Latino/a’s exercise the least on average.

The percentage of each race that has CHD was found by dividing the total number of respondents that have CHD by race over their total number of respondents within that race. The statistics show that 9.2% of non-Hispanic whites, 8.0% of non-Hispanic blacks, 12.0% of American Indians/Alaskan Indians, 7.4% of Native Hawaiians/Pacific Islanders, 3.5% of Asians, and 5.6% of Hispanics have coronary heart disease. When comparing these statistics with those that the CDC collected in 2017, non-Hispanic whites with CHD have dropped by 2.3%, non-Hispanic blacks by 1.5%, and Hispanics by 1.8%.

The group statistics output from the independent t-test to compare means of 2019 respondents reported having coronary heart disease and explanatory variables shows that the mean minutes of physical activity per week for the first activity among respondents having coronary heart disease in the U.S. is 281.58, which is slightly higher than the mean 262.71 for those who do not have CHD. The t-test implies that this difference is statistically significant with a p-value less than 0.001. The null hypothesis, , assumes that there is no difference between the means, thus the p-value supplies enough evidence to reject the null hypothesis.

According to the independent t-test to compare means of 2019 respondents reported having coronary heart disease and explanatory variables shows that the mean minutes of physical activity per week for the second activity among respondents having coronary heart disease in the U.S. is 164.08, which is higher than the mean 156.94 for those who do not have CHD. The t-test implies that this difference is statistically significant with a p-value less than 0.001. The null hypothesis, , assumes that there is no difference between the means, thus the p-value supplies enough evidence to reject the null hypothesis.

 An increase in minutes of physical activity per week for both activities have weak positive correlations. The correlation between physical activity per week for the first activity and CHD is 0.010 and the correlation for the second activity and CHD is 0.004.

There is a positive association between coronary heart disease and almost all races and between minutes of physical activity per week for both activities and almost all races. Native Hawaiians / Pacific Islanders and people who fall under other are the two races that are exempt. These two categories of race have negative associations.

**Conclusions & Recommendations**

According to the CDC, heart disease is the leading cause of death among men, women, and people most racial and ethnic groups in the United States (“Heart Disease Facts”, 2020). Recently data taken from the CDC and BRFSS dataset suggest that the percentage of people having CHD has decreased among different races include Whites, Blacks, Hispanics and Asians. Research conducted by the CDC has shown that factors such as income and health insurance does not have an effect on coronary heart disease and suggested that more analyses needed to be conducted on physical activity.

The analyses suggest statistically significant differences between respondents in 2019 reported having coronary heart disease and explanatory variable minutes of physical activity per week. This suggests that new variables may need to be analyzed to determine what caused the reduction in respondents having CHD in the U.S.

The bivariate logistic regression correlation matrix suggests that minutes of physical activity per week has a weak correlation with coronary heart disease. There is a positive association between CHD and most races and between minutes of physical activity per week and most races. However, these associations are weak and likely have little effect on CHD.

**Works Cited**

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**Descriptive Statistics:**

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**\_MINAC11: Minutes of physical activity per week for first activity**

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**\_MINAC21: Minutes of physical activity per week for second activity**

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**Independent t-test by respondents with CHD:**

**Activity 1:**

Timeline

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**Activity 2:**

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**Correlations:**

**Activity 1**

Table

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**Activity 2**

**Graphical user interface, table

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**Binary Logistic Regression:**

**Activity 1:**

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**Activity 2:**

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