Correlation of Cardiovascular Disease and Environmental Factors among Guyanese

Emigrants Word Count: 4,230

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Abstract

Cardiovascular disease is an illness that affects millions of people worldwide and has progressed to be amongst the leading causes of death. Although research has been done concerning the cause of this disease, there have been a lack of research conducted in reference to developing nations. This study aims to analyze a facet of cardiovascular knowledge that has been untouched: *The Correlation Between the Environment and Environmental Factors Among Guyanese Emigrants.* A quantitative questionnaire, assessing the cardiovascular history of Guyanese emigrants, was used and distributed through an online medium with a snowball sampling technique. The researcher initially expected that the high pollution levels of Guyana increased the likelihood of being diagnosed with a cardiovascular problem. The results showed that blood pressure was the most prevalent type of cardiovascular disease. Specifically, this conclusion applies to those with an agricultural background. The industrial background was similar across the board, and therefore restricted a conclusion for that data set to be computed. Overall, this study concludes that the presence of air pollution takes a toll on the cardiovascular health and seems to be in greater concentrations around agricultural settings. This research establishes that a trend does exist between cardiovascular disease and the environment. This information can be used by future researchers as a base for exploring specific subcultures or as a reference for researchers who want to explore other body systems.

Introduction

Cardiovascular disease is a prominent health issue in the United States, being responsible for about 610,000 deaths ("Heart Disease Facts & Statistics," n.d.). According to the American Heart Association, cardiovascular disease refers to any illness that compromises the function of the heart and blood vessels ("What is Cardiovascular Disease?" n.d.). While the disease takes presence in multiple forms, the most common type of cardiovascular disease is ischemic heart disease ("Types of Cardiovascular Disease," 2012). Due to the common occurrence of this type of disease, doctors are continuously attempting to identify the root cause. The most common causes of heart disease include a poor diet, lack of physical activity, and being overweight ("Heart Disease Facts & Statistics," n.d.). However, those risk factors specifically apply to individuals who have spent the majority of their life in America. The risk factors do not apply to patients who come from racial and ethnically contrasting backgrounds ("Heart Disease Facts & Statistics," n.d.). While ischemic heart disease is the leading type of cardiovascular disease in the United States, it is also the leading cause of death in Guyana ("Global Health-Guyana," 2014). America's living condition is much more evolved than Guyana's since Guyana is a developing nation. There are extreme discrepancies between America and Guyana, but the most severe would be the condition of the environment between the two countries. While the effect of interference in the cardiovascular system has been widely researched, there is a lack of knowledge concerning the cause of the disease. There is a lack of medical research within developing nations because research on minorities is limited. The landscape of Guyana is composed of either an industrial or agricultural setting. With the constant release of smoke and pesticides into the air, it is not a surprise that heart disease is prevalent. A lack of proper diagnosis applies to Guyanese residents and immigrants since this developing nation is at a

deficit in terms of medical knowledge. Medicines are either being incorrectly prescribed to ill patients in Guyana or excessive medications are being administered for one illness. In fact, medication prescription has exceeded the standards established by the World Health Organization (Sharma et al., 2016). Residents of Guyana were not diagnosed or treated properly, and as Guyanese individuals move to America, they face the same situation because the environment is not a common risk factor in America. Every country is not as environmentally sanitary as America. Therefore, the correlation between the environment and cardiovascular health among Guyanese immigrants must be explored.

Literature Review

In order to understand why this research will be significant in the medical field, previous research must be analyzed. Previous research has shown a crucial need for this study, yet it has been disregarded. Despite the United States being a developed nation, significant research has been overlooked. A study has been conducted in Madrid, Spain where the urban environment was compared to food, alcohol, tobacco, and physical activity (Bilal et al., 2016). This study suggested that individuals were likely to take better care of themselves when they were farther away from unbeneficial structures, such as alcohol outlets, and in close proximity to open streets for physical activity. The individual's location is a determining factor to the condition of their body. While this study focuses on an individual's location and their health, the select group has been compromised. The study is limited by the health of the individuals that were selected for the study. The study included people that had been diagnosed with diabetes, hypertension, and dyslipidemia. However, the study also included individuals that were completely healthy. By having a sample group with mixed health conditions, the cardiovascular output cannot be measured accurately since there is not a common thread among the individuals in the sample

group. Therefore, the root cause of the individuals' disease cannot be accurately diagnosed. In essence, this study depicted the impact that the local environment has on its residents. The authors of this study explain how social interactions could serve as a solution to decrease the vulnerability that residents have with their environment. Social interaction can only occur when the residents are informed about the severity of the environment on the condition of their health.

Unlike the study conducted by Bilal et al, the study conducted by Tian et al focuses on factors that individuals cannot physically see because they are not material factors. In this study, air pollution is the area of focus. Also, this study focused on the income of their area of study, rather than whether they were urban or rural. This study analyzed hospital admissions for ischemic stroke over a span of 2 years in 172 cities in China. The rate of ischemic stroke was compared to the air pollutant levels and air temperatures in the area of the selected hospital (Tian et al., 2018). Overall, this experiment wanted to explore the correlation between the inhalation of pollutants and the hospitalization rate. This report is limited by the effect of the discussed air pollutants. The study does not discuss how the air pollutants affect the body and the reasoning behind the study group's hospitalization. Unlike the previous study, the sample group of this survey was more uniform. However, the south region of China included more elderly people. The imbalance in age groups causes for a lack of thorough evaluation among various ages. If the study included information on the specific illness that occurred as a result of inhaling air pollutants, it could have provided insight as to understanding where air pollutants specifically target in the body and whether it has a varying effect on different age groups. The study did not mention the reasoning behind the air pollutants. This information would be beneficial to determining whether the study area was urban or rural, which could facilitate the comparison of the results of the previous study to this study more efficiently.

Focusing specifically on the environmental differences between Guyana and America reveals that Guyana's environmental status is in a horrible condition for its inhabitants. Guyana's air pollution is about 17.39 micrograms per cubic meter when the standard established by the World Health Organization is 10 micrograms per cubic meter (Brauer et al., 2016). The high air pollution rate is most likely due to the country's high industrial and agricultural activity. Agricultural and industrial activity accounts for about one-third of the country's gross domestic product ("Guyana- Agricultural Sector," n.d.). Pairing the high demand of Guyana's agricultural and industrial products with Guyana's area, which is only about 83,000 square miles, is bound to end with a high air pollution rate.

Similar to the study conducted by Tian et al., Akcay and Yuksel center their research around the inhalation of a harmful substance. However, the report considers the intentional inhalation of a harmful and addictive substance. In this article, smoking and cardiovascular disease are compared. The effect that smoking has on the functionality of the cardiovascular system and its responsibility for diseases such as atherosclerosis and endothelial dysfunction are discussed (Akcay and Yuksel, 2017). Essentially, this exposition wanted to convey that smoking is a prime method to ensue cardiovascular disease, yet it is a preventable risk factor. Despite being a preventable risk factor, consumers cannot seem to suspend inhalation of the product due to the addictive nature of nicotine. Eliminating this risk factor could make your cardiovascular health much more manageable. While the claims made in the survey are supported by anatomical perspectives, the authors do not perform an experiment to test their theories. Tian et al and Bilal et al created experiments to evaluate how their theories reacts on the human body, while Akcay and Yuksel only make claims, without considering that there could be variance among human bodies and smoking. The lack of consideration between the varying responses of human beings

makes the claims less convincing since there are no concrete statistics to affirm the claims. If this report had used results from an experiment, it would have been a more effective way of comparing unintentional versus intentional pollutants, with reference to the study by Tian et al.

Maintaining your health becomes much easier when you eliminate factors that are not necessary, as mentioned by Akcay and Yuksel. However, certain aspects can only be controlled to a certain extent. Diets must be adjusted depending on the way every individual processes the food. Doctors should be able to modify a patient's diet depending on their personal response. This can only be done if doctors have adequate education to evaluate specific components of a diet and how to alter it so that the consumer can be positively affected. A study conducted by Griffin and Nichols tested the knowledge of general physicians who acknowledged the importance of a healthy diet along with drug therapy. The study reported that general physicians were neglecting the diet aspect of cardiovascular disease and focused more on drug therapy (Griffin and Nichols, 2018). The general physicians who were apart of the sample set claimed that they were not as educated about nutrition when compared to their knowledge of drug therapy. Unlike the previously mentioned studies, this experiment evaluated the physician instead of the patient. The overall purpose of this article was to show that physicians are not completely informed of every aspect concerning a system of diseases. Due to this lack of knowledge, doctors tend to lean towards one direction when diagnosing and treating a patient. Once again, the variance among patients has been ignored. With the results of this survey, it is evident that there is the possibility that patients have been diagnosed incorrectly and that they were not treated efficiently. With the proven impact of the environment, from previously mentioned studies, and the gap of knowledge concerning areas of cardiovascular disease, a correlation study between the two aspects will be a major advancement in medical research.

Methodology

The method of my research addresses the question of: *What are the cardiovascular repercussions of Guyana's environment on its emigrants?* Therefore, a correlation research study will be conducted since data is being collected and correlated between various variables. In terms of data collection, snowball sampling will be utilized. Snowball sampling is a "...highly effective sampling technique that allows for the study of difficult to reach or 'hidden' populations" (Waters 2015). Snowball sampling becomes ideal in this case because Guyanese immigrants can be accessed from all around the country, in order to gain a broader range of data. An online survey was created to be distributed with the snowball sampling technique. An online survey was chosen since it would make the process of sharing to people around the country more accessible. The consent form to this study was embedded within the survey in order to ensure that participants were knowledgeable about the study that they were participating in. This method of snowball sampling was considered to be the traditional format. On the other hand, Baltar and Brunet proposed an opposing viewpoint of the traditional snowball sampling method by claiming that using social media to advocate the product is much more effective since a larger sample set can be achieved (Baltar and Brunet, 2012). However, advocating the questionnaire on social media increased the probability of assessing someone that was not Guyanese. In order to maintain the integrity and eligibility of the sample set, social media was not used. The survey link was given to a group of Guyanese immigrants that were in close proximity. Upon completion, the initial survey respondents were requested to share the survey link with anyone that was a Guyanese immigrant.

The quantitative questionnaire was adapted from the Healthy Heart Questionnaire, which was distributed by the Urban Indian Heart Program. The questionnaire collected data concerning

the respondents' general health, cardiovascular history, smoking history, and lifestyle in Guyana, while keeping their identity anonymous. General health was questioned to ensure that the respondent was following a healthy lifestyle, such as consuming fruits and vegetables daily and having an adequate amount of exercise, in order to ensure that their cardiovascular health was not affected by the lack of a healthy lifestyle. The assessed diseases differed from the Heart Healthy Questionnaire in order to fit the scenario of the study. To evaluate the respondent's cardiovascular history, they were asked about their blood pressure, whether or not they experienced a heart attack, atherosclerosis, abnormal heart beats, angina, or abnormal stress tests. Every type of cardiovascular disease shared the thread of damaged blood vessels and the heart that could potentially be caused by the inhalation of smoke or other forms of chemicals. There has been some type of blockage in the blood vessels of each type of disease that prevents efficient blood flow to the body. These types of diseases were specifically chosen because they are common issues for smokers ("Smoking and Your Heart," n.d.). Smoking closely resembles the effects of the environment since you are inhaling a substance that wreaks havoc on your health. It is already proven that smoking promotes the discussed diseases, therefore the study seeks to determine if the inhalation of substances and chemicals in the environment terminate with similar results. The respondent will have to answer follow-up questions concerning each type of disease, depending on whether or not they experienced the condition. The purpose of the follow-up questions is to determine an estimate of how long the diseases take to become evident in the body. The questions will also be comparing health advice in Guyana compared to health advice in America in order to differentiate the level of medical expertise in a developed nation versus a developing nation. Smoking was questioned to eliminate ineligible responders. Tobacco harms blood cells and ruins the heart and blood vessels ("Smoking and Your Heart," n.d.). The

study aims to focus solely on the way that the environment has affected cardiovascular health. Preceding damage by smoking would be an interference in the study and would ruin the accuracy of the study. Respondents who have smoked will be removed from the sample set. The survey also aimed to collect specific data concerning the respondent's lifestyle when they resided in Guyana. Determining whether the responder was exposed to an industrial or agricultural atmosphere affects the data. The inhalation of smoke from a factory or the inhalation of chemicals from pesticides can affect the cardiovascular system. The results of this specific data set will show the effect that an industrial versus an agricultural atmosphere has on the heart and blood vessels. In order to gain a more detailed distinction of industrial and agricultural areas, the respondents will be able to select the specific village that they associate with. The list was provided by the Guyana Medical Relief Corporation based on their experience of providing healthcare assistance to Guyana. The list included Georgetown, Linden, Corriverton, Mahdia, Mabaruma, Anna Regina, Bartica, New Amsterdam, and Baramarita. These were villages that the program noticed had residents that suffered from significant cardiovascular problems or were either heavily industrial or agricultural.

The collected data from the entire survey will be analyzed through network analysis. The diagnosis rate of a heart attack, blood pressure issues, atherosclerosis, angina, abnormal stress tests and heart beats will be explained through the exposure of certain environmental aspects in Guyana. Specifically, the parts of Guyana that differ from developed nations will be discussed because those aspects are typically neglected in developed nations. Overall, the study aims to reveal the possibility of how contrasting environments react upon the body.

Results

Questionnaires from forty-six participants were collected, but only the responses from forty participants were analyzed. Six participants were disqualified due to either skipping/ refusing the consent form or leaving the majority of the questionnaire unanswered. The discrepancies between the cardiovascular health of Guyanese emigrants based off of the setting of their residence was the primary rationale for addressing the correlation between the environment and cardiovascular health.

The credibility of my participants was ensured by acquiring the number of years that they spent living in Guyana, which resulted in significant findings. Fifty-five percent of participants had lived in Guyana for more than twenty years, thirteen percent of participants had lived in Guyana for fifteen to twenty years, eight percent of participants had lived in Guyana for eleven to fifteen years, twelve percent of participants had lived in Guyana for six to ten years, and twelve percent of participants lived in Guyana for one to five years. It is evident that the majority of participants lived in Guyana for a significant amount of time. With eight-seven percent of participants living in Guyana for over five years, it is clear that these participants are qualified to participate in the study since they have been exposed to Guyana's environment for a significant period of time. **Chart 1** represent the distribution of the years of residency among the participants.
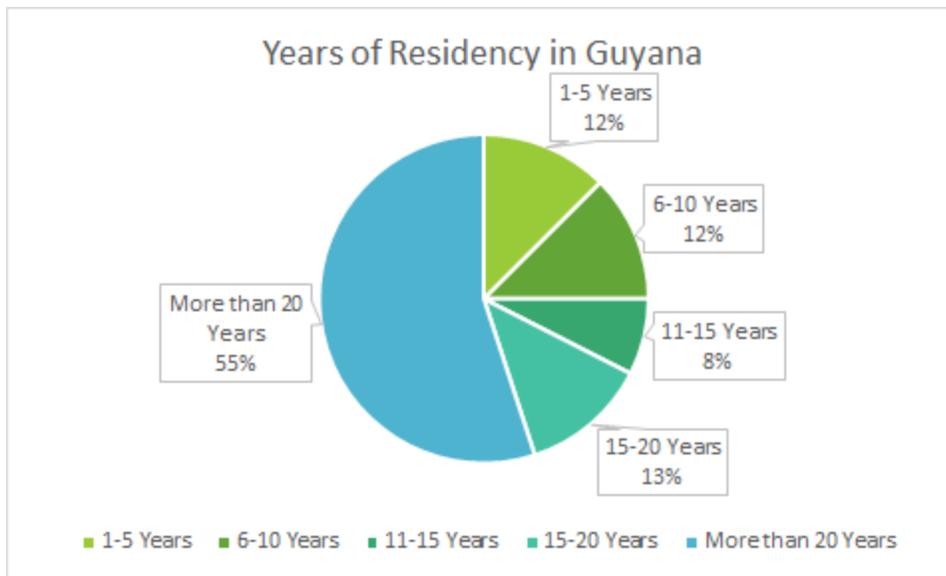
Chart 1

There were noticeable patterns in city of residency for the participants. Eight-seven percent of participants identified Georgetown as their residential city, eight percent of participants identified New Amsterdam as their residential city, two percent of participants identified Anna Regina as their residential city, and three percent of participants identified an extraneous city, that was not provided on the list, as their residential city. The results show that a significant amount of participants represent Georgetown. Therefore, the majority of results will be relevant to Georgetown, rather than being distributed relatively evenly among the other cities in Guyana. There were eight cities that the participants could have chosen from, but only three of those cities are represented by participants. It is clear there is an extreme amount of underrepresentation from the other cities. **Chart 2** shows the ratio between the city of residency for the participants.
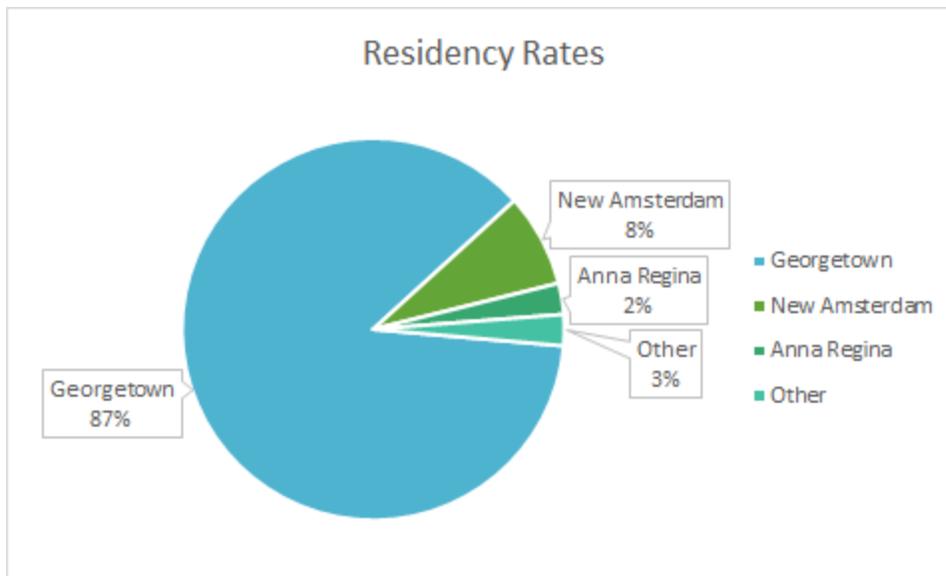
Chart 2

The two significant data sets were the amount of participants that characterized their area

of residency as agricultural versus those who characterized their area of residency as industrial.

There were thirty participants who referenced to their area of residency as being agricultural.

Among that group of thirty participants, thirteen participants reported having some type of

cardiovascular problem. On the contrary, there were six participants who referenced their area of

residency as being industrial. Among that group of six participants, only two participants

reported having a cardiovascular issue. **Chart 3** shows the way that these rates compare against

one another. While it seems as though the amount of diagnosed participants is less than half of

the number of overall participants in each category, the differences in scales becomes crucial. A

scale of thirty people in the agricultural setting versus a scale a six people in the industrial setting

implies that it is more credible to draw results from the agricultural setting since there is more

evidence. A closer view into the composition of the diagnosed participants revealed important

trends. Some participants reported having more than one type of cardiovascular disease. In

reference to those with an agricultural upbringing, ten people reported having blood pressure

issues, one person reported experiencing a heart attack, three people people were diagnosed with

atherosclerosis, three people were diagnosed with abnormal heart beats, three people were

diagnosed with angina, and two participants reported having an abnormal stress test. In reference

to those with an industrial upbringing, one person reported having blood pressure issues, one

person reported experiencing a heart attack, one person was diagnosed with atherosclerosis, one

person was diagnosed abnormal heart beats, one person was diagnosed with angina, and two

participants reported having an abnormal stress test. **Chart 4** shows the drastic differences

between the diagnosis rate of cardiovascular issues in an agricultural setting and an industrial

setting. Agricultural upbringing seems to more likely create a cardiovascular problem.

Specifically, blood pressure problems seem to be a prominent effect of agricultural life since

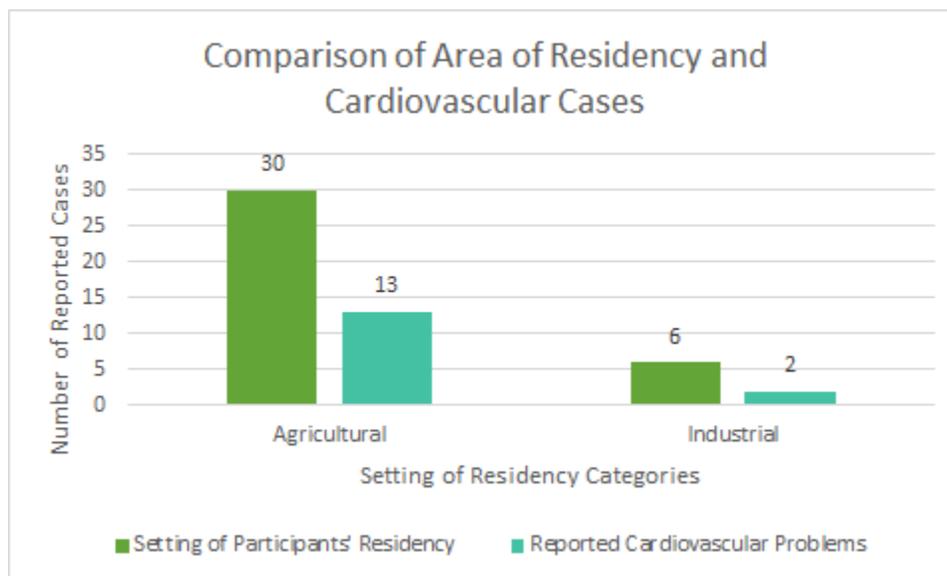there are nine more diagnoses reported when compared to industrial cases.
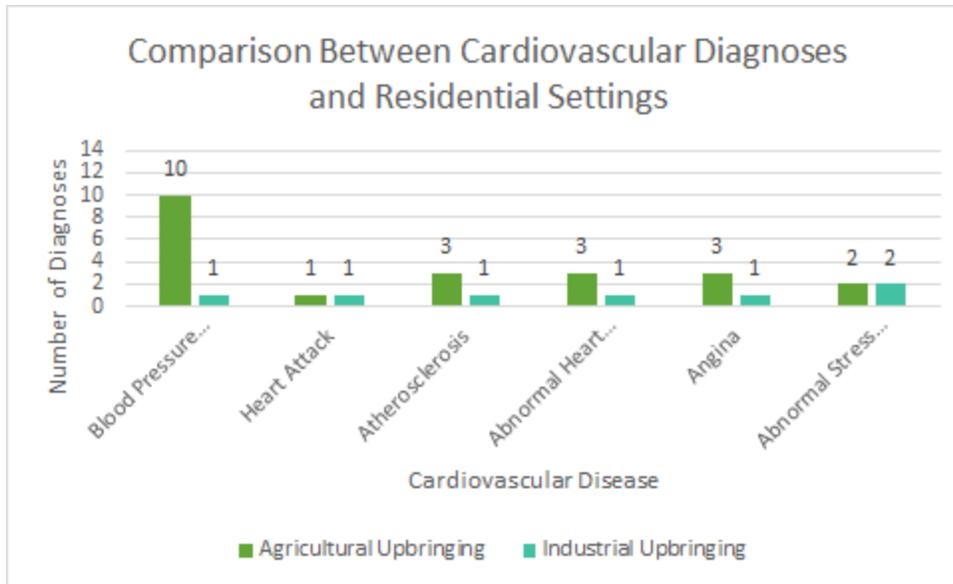

Chart 3

Chart 4

Discussion

The results of this study show that blood pressure problems was the most recurrent type of cardiovascular disease among Guyanese emigrants. As seen from the results, blood pressure issues was the most common type of cardiovascular disease. Specifically, the results from the study apply dominantly to those from an agricultural setting. The results clearly show that the overall diagnosis rates in an industrial setting was not as significant when compared to the findings in an agricultural setting. The questionnaires revealed that there is an evident correlation between the environment and cardiovascular disease rates. Overall, agricultural settings draw a higher rate of cardiovascular diagnoses. The amount of pesticides that are involved in agriculture most likely takes a toll on the high diagnosis rates, specifically for blood pressure. A study was conducted by Goncharov et al., where the blood pressure levels of residents that lived in close proximity to a factory that manufactured man-made chemicals were observed. The participants' blood pressure levels were compared to their exposure to the chemical, age, sex, race, and other factors. It was found that chemical exposure was strongly associated with hypertension and

organic pollutants and pesticides have been found to terminate in hypertension (Goncharov et al.). The findings of this study support previously published data. Additionally, the results of this study support the initial hypothesis that the cardiovascular disease rates was due to pollution in Guyana.

The impact that the environment has had on those from industrial settings cannot be deciphered due to the lack of recurrence in any type of cardiovascular disease. While the majority of participants identified Georgetown, a highly industrial city, as their place of residency, the agricultural portion of the city seemed to be represented more in this study. The lack of distribution served as a limitation throughout this study. Not only was the distribution between those who represented an agricultural or an industrial society unbalanced, the overall distribution of cities that were represented was unbalanced. The results show that Georgetown was represented the most in the study. Therefore, the results of this study applies dominantly to Georgetown, rather than Guyana as a whole. Another limitation in that the researcher originally only wanted to consider that data collected from non-smokers. While this seemed to be a choice that would remove the possibility of factors that could obscure the data, the removal of this data set would drastically decrease the sample size. Another limitation of the study was the distribution of time spent in Guyana by the participants. The majority of the participants spent more than 20 years in Guyana. The distribution of participants that spent less than 20 years in Guyana was significantly less than those that spent more than 20 years in Guyana. Therefore, the research could not analyze how fast the effects of the environment set in.

A delimitation in this study was differentiating between the subculture groups in Guyana. Making the subculture groups evident would have caused for a disconnect when comparing the results due to the discrepancies in the cultural lifestyle of the groups. Some groups would have

been more prone to taking apart in agricultural work, while some would have been prone to being involved in industrial work. The purpose of the study was to assess if a trend even existed. By filtering the study to only include a specific subgroup, there has been an assumption that a trend has already existed.

Future researchers on this topic should take the previously stated limitations and delimitations into consideration before initiating a study. Having a more diverse and evenly distributed sample set would cause for results that could be applied to the entire Guyanese population, rather than a specific portion of the population. Repeating this study will be more successful if it addressed the question of, "How significant was the impact of the environment on cardiovascular health among Guyanese emigrants?" The data collected through this study would have been useful to measuring the significance of the environment, rather than finding out the types of cardiovascular diseases that were the most present due to the environment. As mentioned before, Georgetown is heavily represented in the study. However, the majority of participants who identified Guyana as their residential city claimed to have an agricultural background. Georgetown is dominantly the industrial city of Guyana, so the results were interesting. Future research could subdivide Georgetown into smaller villages and town in order to understand the agricultural input into a city that is dominantly industrial. Additionally, since the study shows that there is a correlation between the environment and cardiovascular disease, future researchers can now filter the sample sit to include subculture groups. Doing this will allow for a deeper analysis into the results that were found in the study. Future research can also analyze another body system's reaction to the environment. The respiratory system is often associated with environmental issues, and this study showed that there is more than the respiratory system that becomes affected by the environment. Knowing that pesticides are

responsible for a portion of cardiovascular problems can be analyzed further by investigating how the digestive system is affected since consumers are ingesting products that were exposed to those pesticides.

Conclusion

The data displays that blood pressure problems were the most evident type of cardiovascular problems among Guyanese emigrants. Also, an agricultural background is more likely to culminate with cardiovascular problems rather than an industrial background. Exposure to pesticides stands as a possible explanation for this occurrence. The conclusion matches with the hypothesis that was mentioned in the methodology, along with specification on who the conclusion would apply to. Overall, the results have provided valuable contribution to the field of cardiovascular medicine.

Appendix A

Instructions: Please indicate your answer or type in the space provided.

- Please state your age

- Have you ever smoked?
  - ❑ Yes
       Please specify the number of years:
  - ❑ No
- Indicate how many days per week you exercise and the duration of your activity.

- Do you have your daily intake of fruits/ vegetables?
  - ❑ Yes
  - ❑ No

- How many years did you live in Guyana?
  - ❑ 1-5 years
  - ❑ 6-10 years
  - ❑ 11-15 years
  - ❑ 15-20 years
  - ❑ More than 20 years

- Please describe your area of residency in Guyana.

- Which type of setting best describes your residency?
  - ❑ Agricultural
  - ❑ Industrial

- Do you experience blood pressure issues?
  - ❑ Yes
  - ❑ No

  Please answer the following questions if your answer to the previous question was "yes."

  - Is your blood pressure usually high or low?
    - ❑ High
    - ❑ Low
  - ❑ Were you diagnosed with this problem in Guyana?
    - ❑ Yes
    - ❑ No
  - If the answer to the previous questions is "no," how many years after moving to America were you diagnosed with this problem?

- How many years have you experienced this condition?

- On a scale of 1-10 (1 being the worst and 10 being the best) how well have you followed your doctor's instructions?

- Have you ever experienced a heart attack?
  - ❑ Yes
  - ❑ No

  Please answer the following questions if your answer to the previous question was "yes."

  - Did you experience this problem in Guyana?
    - ❑ Yes
    - ❑ No
  - If the answer to the previous questions is "no," how many years after moving to America were you diagnosed with this problem?

  - How many years has it been since you have experienced this condition?

  - On a scale of 1-10 (1 being the worst and 10 being the best) how well have you followed your doctor's instructions?

- Have you ever been diagnosed with atherosclerosis?
  - ❑ Yes
  - ❑ No

  Please answer the following questions if your answer to the previous question was "yes."

  - Did you experience this problem in Guyana?
    - ❑ Yes
    - ❑ No
  - If the answer to the previous questions is "no," how many years after moving to America were you diagnosed with this problem?

  - How many years has it been since you have experienced this condition?

  - On a scale of 1-10 (1 being the worst and 10 being the best) how well have you followed your doctor's instructions?

- Have you ever been diagnosed with abnormal heart beats?
  - ❑ Yes
  - ❑ No

Please answer the following questions if your answer to the previous question was "yes."

- Did you experience this problem in Guyana?
  - ❑ Yes
  - ❑ No
- If the answer to the previous questions is "no," how many years after moving to America were you diagnosed with this problem?

- How many years has it been since you have experienced this condition?

- On a scale of 1-10 (1 being the worst and 10 being the best) how well have you followed your doctor's instructions?

- Have you ever experienced angina (chest pain)?
  - ❑ Yes
  - ❑ No

Please answer the following questions if your answer to the previous question was "yes."

- Did you experience this problem in Guyana?
  - ❑ Yes
  - ❑ No
- If the answer to the previous questions is "no," how many years after moving to America were you diagnosed with this problem?

- How many years has it been since you have experienced this condition?

- On a scale of 1-10 (1 being the worst and 10 being the best) how well have you followed your doctor's instructions?

- Have you ever been diagnosed with an abnormal stress test (EKG or ECG)?
  - ❑ Yes
    Please specify which test:
  - ❑ No

Please answer the following questions if your answer to the previous question was "yes."

- Did you experience this problem in Guyana?
  - ❑ Yes
  - ❑ No

- If the answer to the previous questions is "no," how many years after moving to America were you diagnosed with this problem?

- How many years has it been since you have experienced this condition?

- On a scale of 1-10 (1 being the worst and 10 being the best) how well have you followed your doctor's instructions?

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