Title: The blood pressure and sugar level characteristics of patients visiting a university eye clinic.

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Submission Date: 12th May 2023

Acknowledgements

We wish to extend our sincere gratitude and appreciation towards our supervisor Dr. Niall Farnon for his unwavering commitment, expert knowledge and guidance throughout the execution of this project. Dr. Farnon went above and beyond in ensuring that all aspects of this project were completed successfully. We would like to thank our friends and classmates for providing emotional support and advice from the very beginning. Finally, we extend our thanks to Mr. Avi Bhagan and Mr. Kriston Harry for always being patient and willing to help us through any technical difficulties using the equipment.

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1.0 Abstract

Objective: This research project aimed to assess the blood pressure and blood sugar level characteristics of patients visiting the Couva Hospital & Multi-Training Facility in Trinidad and Tobago, and to determine their awareness and understanding of these systemic diseases. The study conducted analytical research with a cohort approach and gathered data by testing patients' blood sugar and blood pressure, and by asking brief questions regarding their knowledge and management of their conditions.

Method: The blood pressure and blood sugar was taken from 100 patients via the OMRON IntelliSense Professional Digital Blood Pressure Monitor and the Gluco Perfect LLC Perfect 3 respectively. The blood pressure machine took 3 consecutive readings and produced an average blood pressure reading which was recorded. The patient was then given a random blood sugar testing device and instructed on how to use it to obtain their blood sugar reading.

Results: The results showed that there were 38% more female participants than male participants, and age was the most significant factor contributing to trends such as frequency of taking blood pressure or blood sugar measurements and knowledge of normal blood pressure and blood sugar levels. It was found that older individuals monitored their blood pressure and blood sugar levels more regularly and had a better understanding of what the normal levels for these readings should be.

Conclusion: The research highlighted a higher degree of unfamiliarity with normative blood pressure levels compared to blood sugar levels. Ultimately, the study underscores the importance of raising awareness and educating individuals about hypertension and diabetes, two conditions that can pose serious risks to eye health.

2.0 Introduction

In the twin island republic of Trinidad and Tobago, just as with many other countries in the world, non-communicable diseases (NCD) such as hypertension and diabetes are the leading cause of death yearly [(1)]. These chronic systemic conditions, in conjunction with heart disease, lung disease and stroke, account for an estimated 62% of deaths each year, with the great majority occurring in individuals under 70 years of age. As such, optometrists more and more often find themselves tasked with not only detecting and managing diseases which threaten the ocular health of persons but also systemic diseases which have ocular manifestations. When left uncontrolled, these systemic diseases lead to blindness, organ failure, stroke and a myriad of other health issues. Thus, persons who are diagnosed with these conditions must control their respective blood pressure and blood sugar levels meticulously, to prevent further complications.

Our research aims to assess the blood pressure and blood sugar level characteristics of patients visiting the Couva Hospital & Multi-Training Facility in Couva, Trinidad & Tobago, by testing the individual levels of each patient, ascertaining their awareness of the prevalence of these systemic diseases, their levels of understanding as to what normal blood pressure and blood sugar levels should be, their awareness if their levels are found to be elevated and how frequently these individuals check these levels. According to The World Health Organization (WHO) [(2)], a normal blood sugar level should be between 70 milligrams per decilitre (mg/dL) (3.9 millimoles per litre (mmol/L)) and 100 mg/dL (5.6 mmol/L), while a normal blood pressure reading should be 120/80 millimetres of mercury (mmHg).

3.0 Relevance to Public Health

In a study conducted in 2011 by the World Health Organization (WHO) which analyzed the burden of hypertension in Trinidad & Tobago, it was found that out of approximately 255,000 persons 218,000 of them were not in control of this condition. At the time of this study, the population of Trinidad & Tobago was 1.34 million people, and the study approximated that and it estimated that 27% of individuals aged 15-64 Of the estimated number of individuals with hypertension, 45.2% were aware of the diagnosis, 34.5% were found to be undergoing treatment for their condition and 14.3% had this condition under control [(3)]. Many of those who are aware of their elevated blood pressure levels tend to be blindsided by the ocular implications that come with it. These include hypertensive retinopathy, stroke-induced vision loss, choroidopathy and optic neuropathy [(4).] Prevention is always better than cure, and as such, if patients are educated and encouraged to prioritise their health and keep their blood pressure levels within normal limits, prominent changes in ocular health can be avoided.

In another article released by WHO [(5),] of a brief list of conditions which stem from diabetes, blindness was the condition primarily mentioned. An estimated 1 million of the world's population have fallen victim to blindness as a result of diabetes and its ocular complications. Based on a 2015 study done by Roopnarinesingh et al, the prevalence of diabetes globally was found to be 285 million adults or approximately 6% of the total global population. By 2030 these numbers are expected to inflate, with projections estimating prevalence to reach 7.7%, or approximately 439 million adults [(6)]. A more daunting statistic is that 69% per cent of this projected increase is expected to come from developing countries such as Trinidad & Tobago, with the WHO estimating that the prevalence of diabetes mellitus in Trinidad & Tobago would have more than doubled between the year 2000 and 2030.

At the time of writing, the prevalence of diabetes mellitus in Trinidad & Tobago is an estimated 15% of the population, giving rise to the country's ranking of 37th in the world and 10th amongst the Caribbean and North America, as claimed by the International Diabetes Foundation [(7)]. Out of an estimated 1 million adults in the nation, 149,000 of them suffer from this systemic disease [(7)], which we believe is certainly cause for alarm and for a continued effort towards raising awareness and educating the public about the need to control these conditions.

4.0 Statement of the Problem

A significant number of persons in Trinidad suffer from either elevated blood sugar or blood pressure levels [8]. During a routine eye exam, signs of deterioration in eye health can be seen, but sometimes patients are made aware of the late stages of deterioration. As such, we hope to educate patients on the meaning of their blood sugar and blood sugar characteristics. Analytical research will be conducted with a cohort approach to gather information on participants' blood pressure and blood sugar profiles, as well as their understanding of what constitutes normal levels for these indicators and how frequently they monitor them. Data will be gathered by testing patients' blood sugar and blood pressure as well as having them answer a few brief questions regarding their knowledge and management of their conditions if applicable. This information will grant us the opportunity to observe any trends concerning the patient's blood pressure and blood sugar characteristics and analyse their knowledge of their condition.

5.0 Research Questions

1. What are the blood pressure characteristics of 125 patients visiting the Couva Hospital & Multi-Training Facility?
2. What level of knowledge do 125 patients visiting the Couva Hospital & Multi-Training Facility have regarding their blood pressure and blood sugar levels?
3. How many of the 125 patients are aware of what are normal blood pressure and blood sugar readings?
4. How are the blood sugar and blood pressure characteristics of approximately 125 patients influenced by different ages, genders and ethnicities?

6.0 Aim of Study

This study aims to analyze and heighten awareness as well as educate persons coming to the Couva Hospital & Multi-Training Facility about these systemic diseases, namely hypertension and diabetes mellitus, both of which pose a threat to vision and ocular health.

7.0 Objectives

- To obtain blood sugar and blood pressure characteristics from 125 patients visiting the Couva Hospital & Multi-Training Facility.
- To evaluate the knowledge of the status of the 125 patients' blood sugar and blood pressure levels via a questionnaire.
- To determine how many of the 125 patients are aware of what are normal blood pressure and blood sugar readings.
- To compare the blood sugar and blood pressure characteristics of approximately 125 patients of different ages, genders and ethnicities.

8.0 Hypotheses

Half of the sample will have blood sugar and blood pressure characteristics outside of normal limits.

9.0 Ethical Approval/Considerations

Ethical approval for the study was sought from the research and ethics committee of the University of the West Indies on December 04th 2022 and approval was granted on 11TH January 2023. Informed consent was gained from each participant by way of a consent form which needed to be signed before taking part in the study. This form contained all relevant information about the purpose, benefits and possible risks of participating in the study. Anonymity was maintained as participants' names were not recorded at any point throughout data collection.

10.0 Literature Review

According to a study by King et al. [9], approximately 300 million people are expected to be diagnosed with diabetes by 2025. Concerning blood pressure, a study done by AlAnanzi et al [10] showed that 21% of participants had high blood sugar, and 67% of those persons were unaware. In the study done by King et al, it was predicted that over 75% of people in the world who are diagnosed with diabetes, will live in developing countries. The study done by AlAnanzi, which speaks on the importance of routine blood pressure checks in optometric practice, proved that routinely checking patients' blood pressure before the commencement of their eye exam can be worthwhile for both the practitioner and the patient. It shed light on the fact that some people that had high blood pressure were unaware. What was more concerning was the subjects who were aware that they have high blood pressure, were not controlling their condition very well. One would argue that it is those cases of unknown and uncontrolled diabetes and high blood pressure that are more cause for concern, as they would also be uneducated on the development of related ocular pathologies [10].

Despite the availability of effective treatment modalities, blood pressure control rates are not satisfactory globally. It has been suggested that there is a need to develop hypertension screening and education programs aimed at improving the knowledge, attitudes, and behaviours of patients and healthcare practitioners. The ocular manifestations of systemic hypertension involve the retinal, choroidal, and optic nerve head vasculature and the need for routine Blood Pressure (BP) measurement in optometry clinics has long been identified. Incorporating new automated oscillation sphygmomanometers into routine optometry practice can increase the objectivity and repeatability of BP measurements [11].

A meta-analysis done by Di Zhao et al. [12] provided sufficient evidence that diabetes was linked to an increased risk of one's developing glaucoma, ocular hypertension and elevated intraocular pressures. All three of these diagnoses are relatively common in patients today, yet blood pressure and blood sugar levels are not typically checked in the larger chain optometric practices, particularly here in Trinidad and Tobago. This paper suggested that diabetics are more likely to practice getting their eyes examined, however, did not mention the level of education the sample population had on diabetes and its ocular complications. As per another study [13], diabetic retinopathy was the only ocular disease that had not had a decrease in prevalence when compared to cataracts, uncorrected refractive error, glaucoma and macular degeneration as causes of vision impairment linked to diabetes. Given that most of these ocular diseases could have their progression slowed with early detection, it was encouraged that awareness should be raised and proper education should be provided to the general public and eye care professionals, that routine blood sugar and blood pressure testing could be worthwhile to everyone.

The World Health Organization suggests that roughly 46% of the population that have hypertension are unaware of their condition [14]. Just under half of those people are diagnosed and treated accordingly. This is of significance because it means approximately just over 500 million persons are walking around with undiagnosed elevated blood pressure levels. In certain countries, particularly middle and low-income countries, there may be a strain on public health services. The multitude of optometrists in the private health sector can be of aid in this dilemma.

Blood pressure testing during routine eye exams might take an extra minute or two indeed, but it can also increase the chances of singling out those undiagnosed patients with hypertension. The eye is not spared when it comes to the body's decrease in health as a result of elevated blood pressure [15].

Interestingly enough, controlling one's blood pressure has been clinically proven to not only prevent things such as hypertensive retinopathy but also diabetic retinopathy. This further drives the point home that patients need to be educated by their optometrists regarding all the possible outcomes if one does not control their blood pressure and blood sugar levels. If patients just hear the words 'diabetic retinopathy' they can be easily led to think if they are not diabetic or they only control their sugar levels, they will be spared. However, as this study has revealed, even high blood pressure can influence the severity of diabetic retinopathy. While it is of great importance to include blood pressure testing in eye exams, there is a possibility that patients may experience a phenomenon known as white coat syndrome.

White Coat Syndrome, also known as White Coat Hypertension, is when a person's blood pressure readings are higher when measured in a medical setting [(16)], such as an optometry clinic or doctor's office than when measured otherwise. It is commonly observed and affects around one-third of untreated patients with elevated clinical blood pressure (BP). In an article involving the current status of white coat hypertension, it was stated that the exact aetiology of white coat syndrome is not fully understood, but is believed to be related to the body's natural "fight or flight" response to stress, and when a person is in this type of environment, their body may perceive the situation as stressful or threatening, leading to this increase in blood pressure [(17)]. Though white coat syndrome is not a medical disorder in and of itself, it can cause frequent increases in blood pressure which may elicit inaccurate diagnosis.

The article also suggested that White Coat Syndrome (WCS) comprises three different clinical conditions: White Coat Hypertension (WCH), White Coat Effect (WCE) and Masked Hypertension (MH).

WCH and WCE, if not correctly identified, can lead to unnecessary initiation or intensification of antihypertensive treatment, while MH is associated with increased cardiovascular risk and target organ damage. As such, the accurate diagnosis and management of these conditions are important to improve the prognosis of these patients.

In an attempt to mitigate white coat syndrome, healthcare providers may use various techniques to help patients feel more comfortable during blood pressure measurements, such as allowing the patient to relax for several minutes before taking the measurement, or when possible, allowing the patient to take their blood pressure at home. In our research, we will aim to address white coat syndrome by incorporating similar techniques to those used by healthcare providers such as emphasizing the importance of patient comfort during blood pressure measurements and taking steps to ensure that our study participants are relaxed and at ease before their measurements are taken. However, despite being recognized in clinical practice, the effect of white coat syndrome on cardiovascular outcomes is still a topic of discussion and there is currently insufficient evidence from randomized controlled trials to ascertain whether it necessitates treatment.

Regionally, the prevalence of hypertension is quite high [18]. However, the percentage of the Caribbean population that is aware of the significance of hypertension, are treated for their hypertension and that is controlling their condition do not match, nor are they relatively close. Again, the lack of control of the condition due to unawareness or negligence increases the risk of patients developing life and, more specifically for this research, vision-threatening problems.

As for diabetes, one study done in Barbados explicitly mentioned that the rate of ocular comorbidities increased in patients who had diabetes [19]. Among the population of Trinidad and Tobago, the Indo-Trinidadian ethnic group is disproportionately affected by diabetes and

hypertension. This is especially prevalent in individuals aged 51 to 60 years, who are more likely to receive a diagnosis of diabetes or hypertension when compared to other age groups [8].

A significant number of patients in this age bracket are expected to participate in this research project. As such, the information presented in the study done in Trinidad & Tobago helps predict the outcome of the blood pressure and blood sugar characteristics of persons in the university's optometry clinic. Early knowledge of one's blood pressure/sugar characteristics allows them more time to take control of their health overall [20, 21, 22], but more specifically, protect certain aspects of their ocular health. Sight-threatening diseases such as diabetic retinopathy, as seen in the study done in Barbados [16], can be treated if not prevented. As such, optometrists should do everything they can to detect any associated signs as early as possible, for the benefit of the patient.

According to an article encompassing characteristics, risk factors, and treatment practices of known adult hypertensive patients in Saudi Arabia [23] the burden of no communicable diseases (NCD) is increasing rapidly worldwide and has become a significant challenge, especially for the populations of developing countries.

To prevent and control these diseases, the World Health Organization (WHO) developed a global strategy that focuses on assessing the pattern and trends of major NCD risk factors, developing evidence-based strategies to reduce unhealthy behaviours, and implementing cost-effective interventions for the management of common NCDs.

The Kingdom of Saudi Arabia (KSA) is one of the rapidly growing countries affected by lifestyle changes reflected in the change in disease patterns.

Data on NCDs and their risk factors were not adequately collated in the country, so a national situational analysis and a baseline survey of NCD risk factors, including hypertension, were carried out.

The overall prevalence of known adult hypertension in the study was 11.5%, with significant gender and age differences. It was also seen that hypertension prevalence increased with age and body mass index (BMI) and was significantly higher in subjects who were diabetic, hypercholesterolemic and physically inactive. Additionally, about 74% of patients were on prescribed medication, while less than 7% were seeking advice from traditional healers or using herbal remedies. The study concluded that many hypertensive patients are not properly diagnosed or detected, leading to the phenomenon of "masked hypertension," which poses a major public health challenge globally.

Further to this, while it is anticipated that our study will include patients who are taking prescribed medication for hypertension, we acknowledge that a small number of individuals may prefer natural herbs over pharmaceutical agents for managing their condition. This preference for natural remedies may be influenced by cultural or personal beliefs, which should be taken into consideration when developing interventions or treatment plans for hypertensive patients.

While pharmaceutical agents may be the most effective option for many patients, exploring alternative treatment options and educating patients on their potential benefits and risks is essential. Additionally, it explored the beliefs and perceptions of patients with hypertension and the associated barriers to treatment. [(24)], it was revealed that out of the total participants, 42 were male, 44 were female and 37 had both hypertension and diabetes.

Given the statistics for gender in this study, we would also like to determine if there will be more females than males participating or if there is an even distribution. It was stated that most patients denied their diagnosis of being hypertensive and when asked about their general understanding of high blood pressure, the most common answer seemed to be stress. Those patients that were diagnosed with diabetes stated that hypertension was just another health issue that can be treated with pills and adjustments to one's diet in addition to believing that hypertension was less of a disease and more of a risk factor for cardiac illnesses. It also explored the beliefs and perceptions of patients with hypertension and the associated barriers to treatment.

The study had ten focus groups inclusive of patients with and without diabetes in three age ranges to gain an understanding of attitudes towards hypertension and its management. Patients with diabetes were observed to be more likely to accept hypertension as a chronic illness with a minor impact on their routine, while patients without diabetes were most likely to adopt a treatment which is a compromise between their physician's suggestions and their understanding of hypertension. It was shown that non-compliance is a major factor in poor control of blood pressure and blood sugar levels so likewise we aim to determine if the compliance level of the participants in our study affects the values obtained. The intention is to educate patients more on the importance of regular testing of blood pressure and blood sugar levels and the importance of management of these lifestyle diseases.

Hypertension is a common medical condition that affects the eyes, with hypertensive retinopathy being the most common ocular manifestation of the disease.

According to this article [25], hypertensive patients have a 50-80% chance of developing hypertensive retinopathy, and between 3-14% of the non-diabetic population over the age of 40

will have some signs of hypertensive retinopathy. Optometrists may be the first medical professionals to encounter these signs in patients who have not yet received a diagnosis of high blood pressure from a primary care physician. In addition to hypertensive retinopathy, those with hypertension are also more prone to having other ocular manifestations, including anterior ischemic optic neuropathy, central or branch retinal artery occlusions, and glaucoma. Thus, it is important to pay attention to the blood vessels during all ocular fundus examinations. Keith-Wagener-Barker's classification system is often used to determine the stage of the patient's hypertension progression, although other systems exist.

Optometrists check blood pressure regularly as part of a comprehensive examination and may perform the test themselves to educate patients about the importance of blood pressure and how it can potentially affect their eyes. Repeated higher readings or a single extremely high reading are referred to primary care physicians for advanced care and possible medical treatment [(25)]. Hypertensive patients have a 50-80% chance of developing hypertensive retinopathy, and between 3-14% of the nondiabetic population over the age of 40 will have some signs of hypertensive retinopathy.

Hypertension is a major public health problem worldwide, with more than 1.4 billion people affected, leading to complications such as hypertensive retinopathy which results in painless vision deterioration. Besides hypertensive retinopathy, hypertension can also exacerbate diabetic retinopathy, increase intraocular pressure, and trigger the formation of thromboembolic lesions.

The article [(26)] aimed to provide an update on the pathogenesis of hypertensive retinopathy and the use of adaptive optics (AO) combined with optical coherence tomography (OCT) to evaluate the retinal microvasculature changes with hypertensive retinopathy.

The review delves into the most recent advancements and research paths in hypertensive retinopathy. Additionally, it stresses the relevance of identifying even mild retinal changes, like focal or diffuse arteriolar narrowing, as these are indicative of early signs of the disease. To conclude, the importance of the retinal microvasculature as an indicator of the vasculature's condition in the entire body was emphasized as well as the potential of AO combined with OCT in monitoring hypertensive retinopathy.

The objective of diabetes treatment is to reduce hyperglycaemia to minimize the risk of complications associated with the disease. Patients' knowledge and practices regarding diabetes affect compliance and the successful management of the disease. This was highlighted in a study [27] conducted in a single optometric practice in a rural Western Cape town in which most respondents were over 50 years old. The study showed that most diabetic patients had their initial diagnosis done by the general practitioner (GP), indicating the GP's responsibility for educational and awareness programs.

Although many respondents knew that diabetes could affect their eyes and that regular eye examinations were important, only a small proportion reported having an eye examination in the previous year.

Diabetic patients should be aware of the ocular complications of diabetes, as diabetic-related conditions can lead to vision loss and blindness. Despite their awareness of the need for regular eye examinations, privately funded diabetic patients in this study were not adhering to these recommendations, or in some cases, not receiving them. Many diabetic patients within the study regarded an eye examination as important, even if they could still see clearly or their diabetes was well-controlled. The limitation of the study is the possibility of bias caused by the relatively small

number of participants obtained from a single optometric practice, which means the results cannot be generalized for all diabetic patients in the Western Cape of the country. Despite this, the findings of the study emphasize the significance of educating individuals with diabetes about the condition and its impacts, as well as reinforcing the necessity of undergoing routine physical and eye examinations.

11.0 Methodology

- *Ethical Approval*

Ethical approval for the study was sought from the research and ethics committee of the University of the West Indies on December 04th 2022 and approval was granted on 11TH January 2023

- *Study Design*

This was a prospective clinical interventional study, requiring procedures just for the study.

- *Study Setting*

This study was conducted at the Couva Hospital & Multi-Training Facility, Trinidad & Tobago.

- *Study Population*

The patient population of the optometry clinic at the Couva Hospital & Multi-Training Facility was an estimated 10,000 persons.

- *Study Sample*
    - Sample Size

The study sample was calculated to be 96 via the Raosoft Sample Size Calculator software. The non-response rate is estimated to be 30%, as concluded from a meta-analysis of previous studies [28] which brings the sample size to 125. Calculations included a 95% confidence interval, a 10% margin of error and a 30% non-response rate.

- Inclusion Criteria

This study included the adult patient population at the Couva Hospital & Multi-Training Facility.

- Exclusion Criteria

Patients under 18 years of age and patients with diminished mental capacity were excluded from this study.

- *Data Collection*

Data collection was carried out between January 9th 2023 to April 30th 2023, with subjects for the research being selected from adult patients visiting the UWI optometry eye clinic at the Couva Multi-Training Facility. A consent form was issued and explained. Only after consent had been obtained, the data collection began via a data collection sheet. Subsequently, the patient was taken to a cubicle within the clinic and their blood pressure was taken following the guidelines set out by the Pan American Health Organization [(29)]. This saw the patient being prepped for taking the blood pressure by allowing them to sit upright quietly in the cubicle for five minutes before the reading was taken. They were instructed to have their feet flat on the floor and the cuff of the blood pressure monitor was placed onto the patient's arm, which was supported and at heart level. The testing of the blood pressure levels was done via the OMRON IntelliSense Professional Digital Blood Pressure Monitor (Kyoto, Japan) Model: HEM-907XL, which had been validated and certified for use in clinical research. The machine was set to take 3 consecutive readings and then produced an average blood pressure reading which was recorded.

After the blood pressure reading was recorded, the patient was given a random blood sugar testing device and instructed on how to use it to obtain their blood sugar reading. The blood sugar reading was then recorded, and both the blood pressure and blood sugar readings of the participants were recorded on the data collection sheet and entered into a spreadsheet daily. The testing of the blood sugar levels was done by way of a finger-prick utilizing the Gluco Perfect LLC (Richmond Hill, New York) Perfect 3 Model: 6267. The gender, age, ethnicity, blood sugar, blood pressure and what they believe to be normal blood sugar and blood pressure reading, as well as how often they check these levels, were ascertained via the aforementioned data collection sheet.

When the patients participating in the study had either elevated blood pressure and or blood sugar levels when tested, or exhibited unawareness of what the ideal blood pressure and blood sugar levels are, they were given the brochures "What is High Blood Pressure" [18], "How Can I Reduce High Blood Pressure" [19], and "Life's Essential 8 - How to Manage Blood Sugar Fact Sheet" [17], to heighten their awareness and educate them on the prevalence of these systemic diseases and how these levels can be controlled.

- *Data Analysis*

After manual data collection was concluded, the spreadsheet data was entered into the Statistical Package for the Social Sciences (SPSS) version 28.0.1.0 software package to produce graphs illustrating the percentage of patients within the sample size that was aware of what are normal blood pressure and blood sugar readings as well the relationship between age/ethnicities/gender and elevated blood pressure and blood sugar levels.

- *Data Protection*

The data points collected during this study were limited to the gender, age, ethnicity, blood sugar and blood pressure readings of the subject, to protect their identity. All data collected was kept on a password-protected computer used only by the two co-investigators and the sole principal investigator. The data will be retained for a period of seven years, after which it will be erased. Hard-copy data collection sheets are kept in a file viewed only by the 2 co-investigators of this study. The principal investigator will have access to these data collection sheets if necessary. The file is kept in a locked cabinet, the key for which is in the possession of one of the co-investigators.

12.0 Results

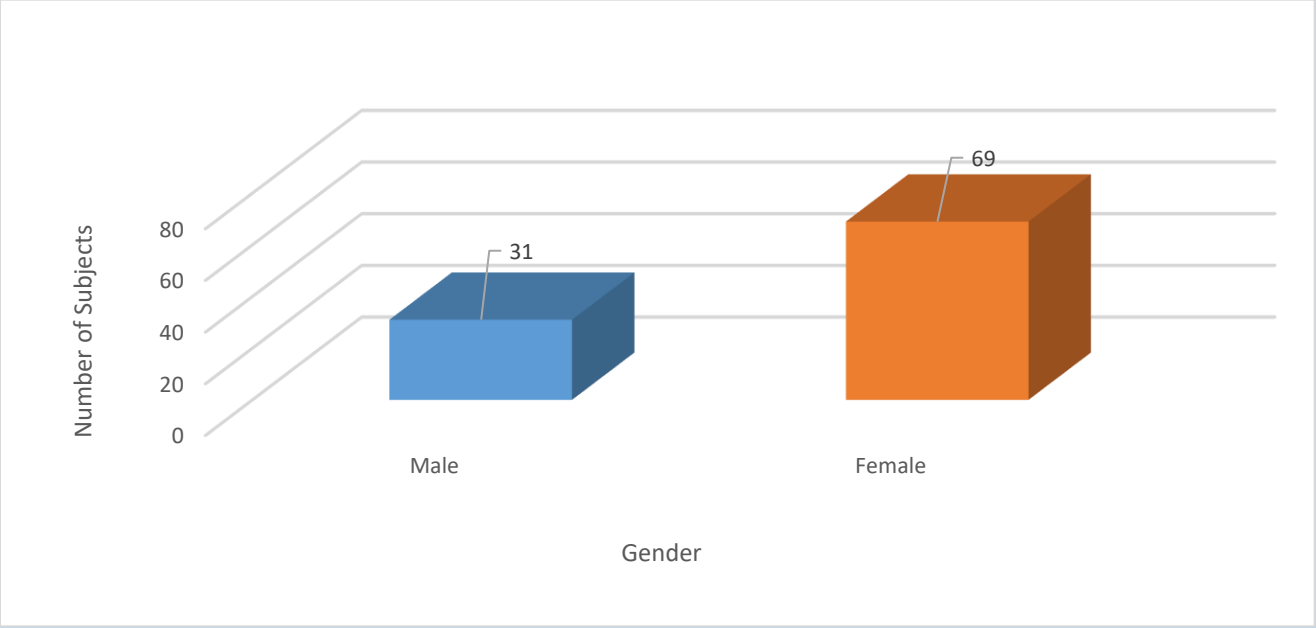


Figure 1: Bar Chart Showing Gender Distribution

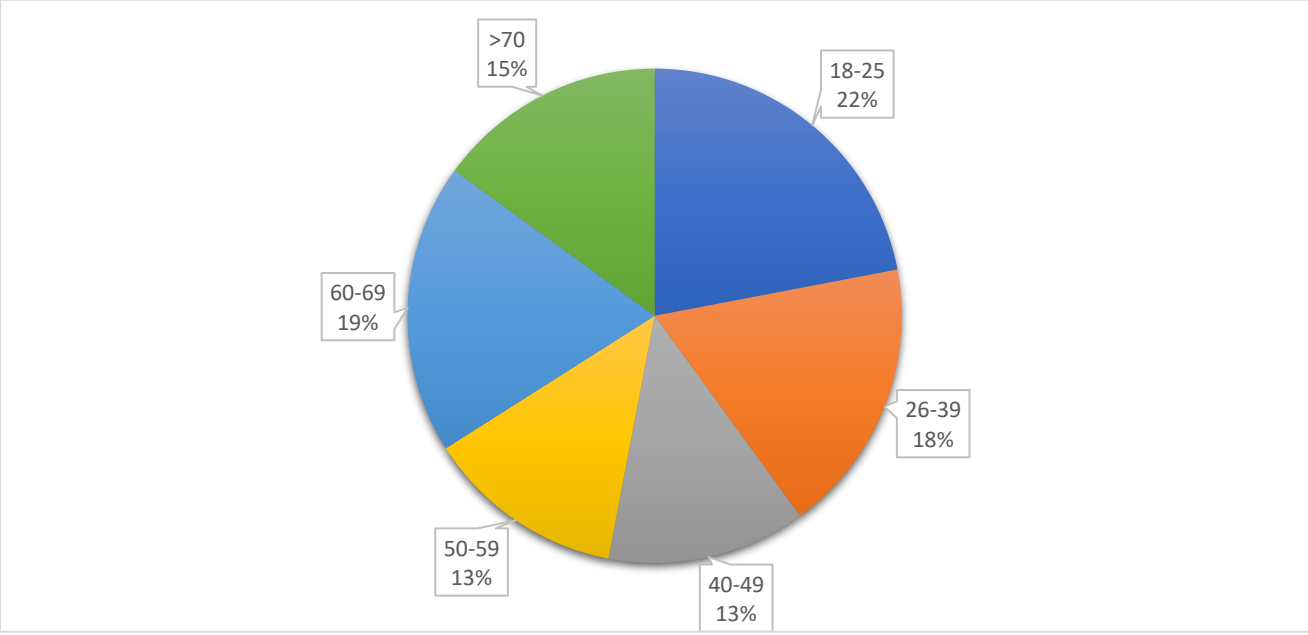


Figure 2: Pie Chart Showing the Age Groups of Subjects

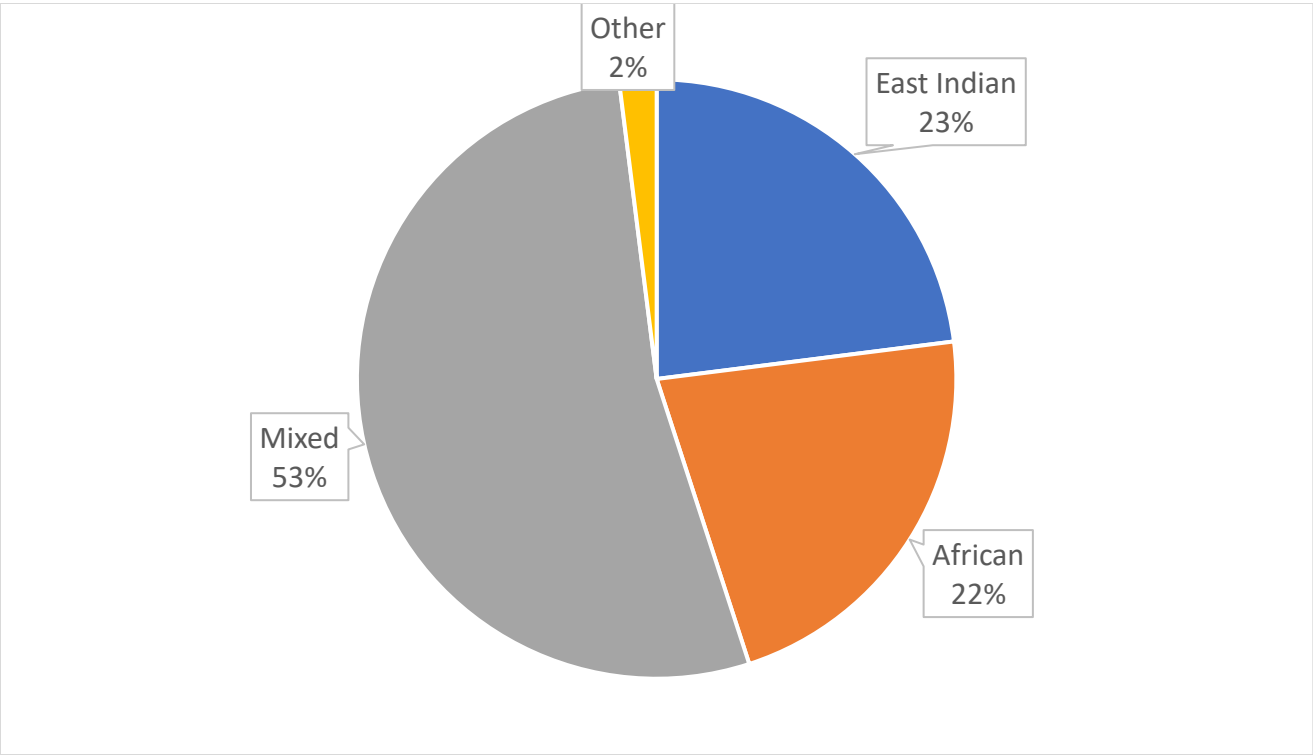


Figure 3: Pie Chart Showing the Distribution of Subject's Ethnicities

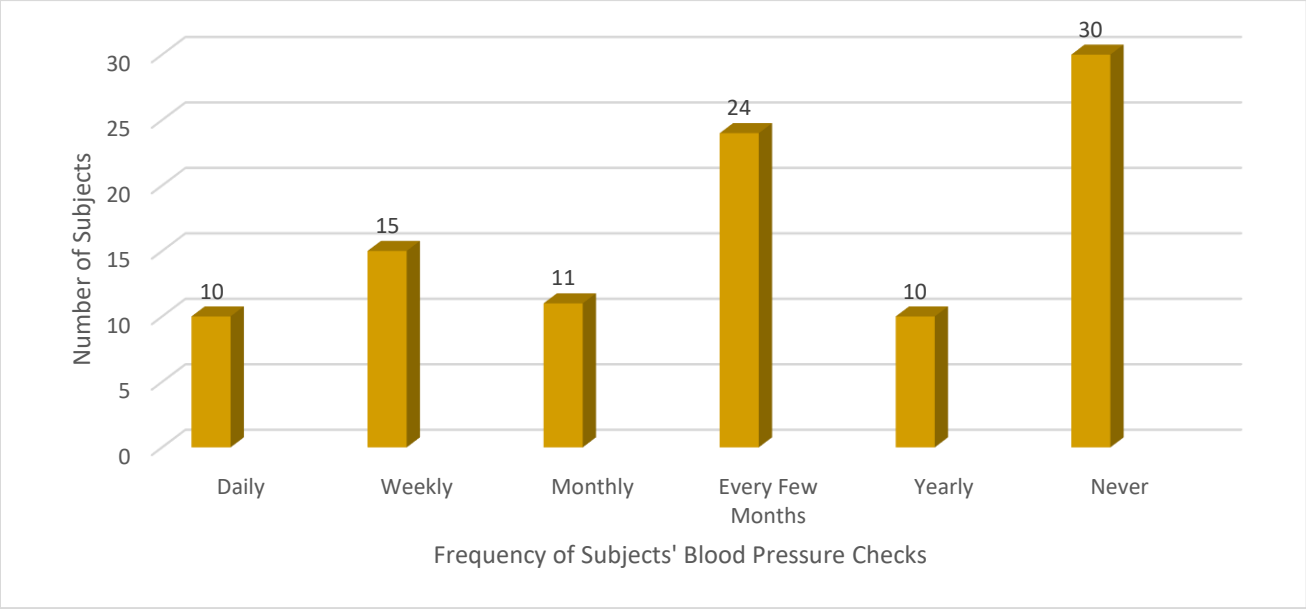


Figure 4: Bar Chart Showing Frequency at which Subjects Check Their Blood Pressure Levels

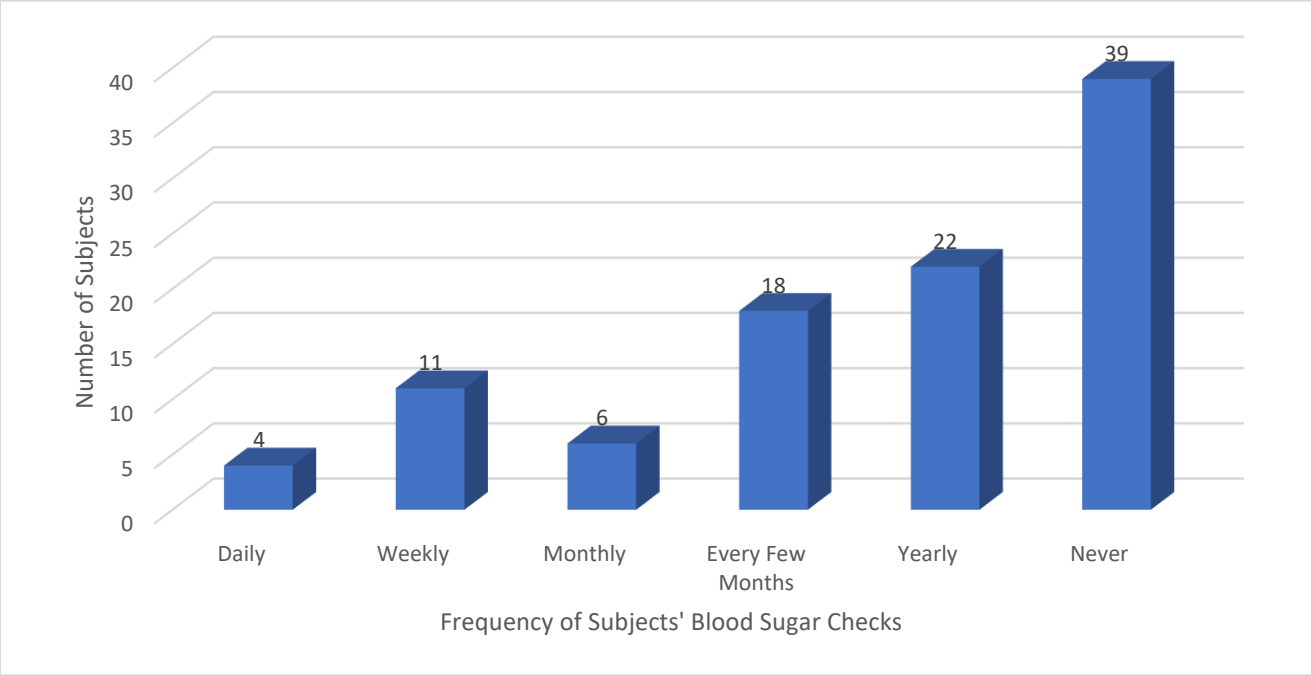


Figure 5: Bar Chart Showing Frequency at which Subjects Check Their Blood Sugar Levels

		Frequency n (%)
	Normal	6 (6)
	Elevated	9 (9)
	Hypertension Stage 1	51 (51)
	Hypertension Stage 2	27 (27)
	Hypertensive Crisis	2 (2)
	Unsure	5 (5)
	Total	100 (100)

Table 1: Distribution of Categories Based On What Participants Felt was a Normal Blood Pressure Level

	Frequency n (%)
Normal	85 (85)
Increased Risk of Diabetes	7 (7)
Unsure	8 (8)
Total	100 (100)

Table 2: Distribution of Categories Based On What Participants Felt was a Normal Blood Sugar Level

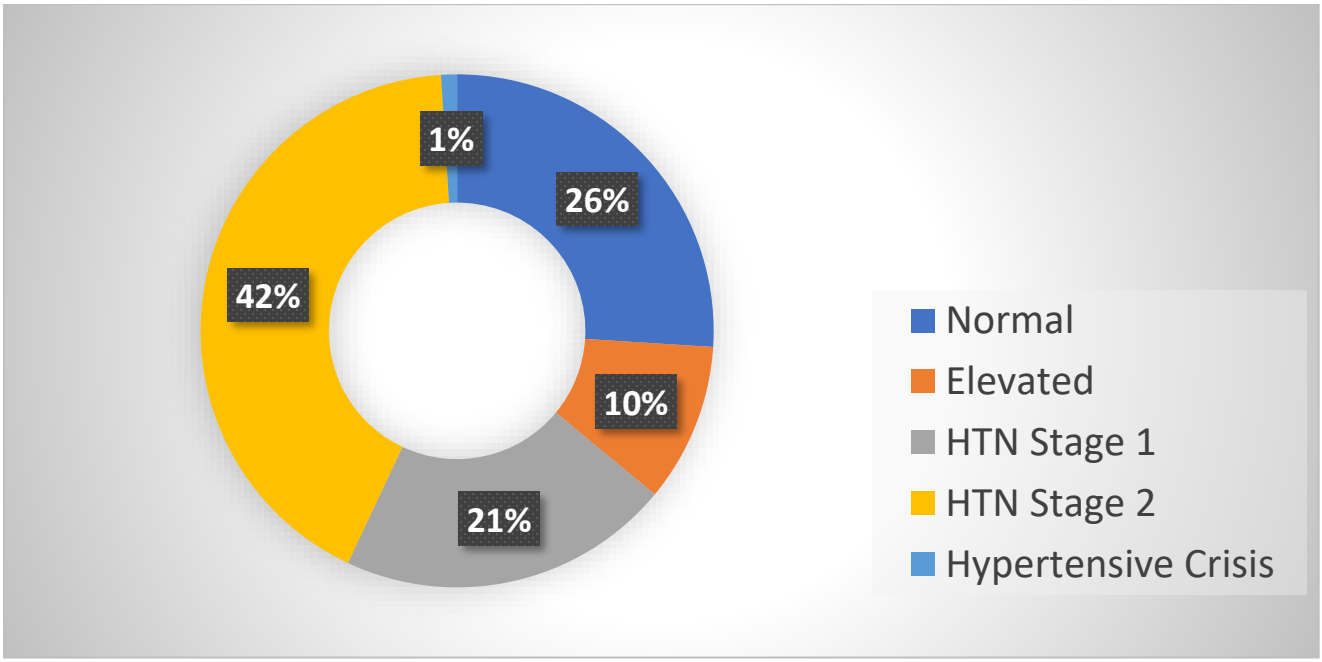


Figure 6: Pie Chart Showing the Distribution of Measured Blood Pressure Categories among Study Participants

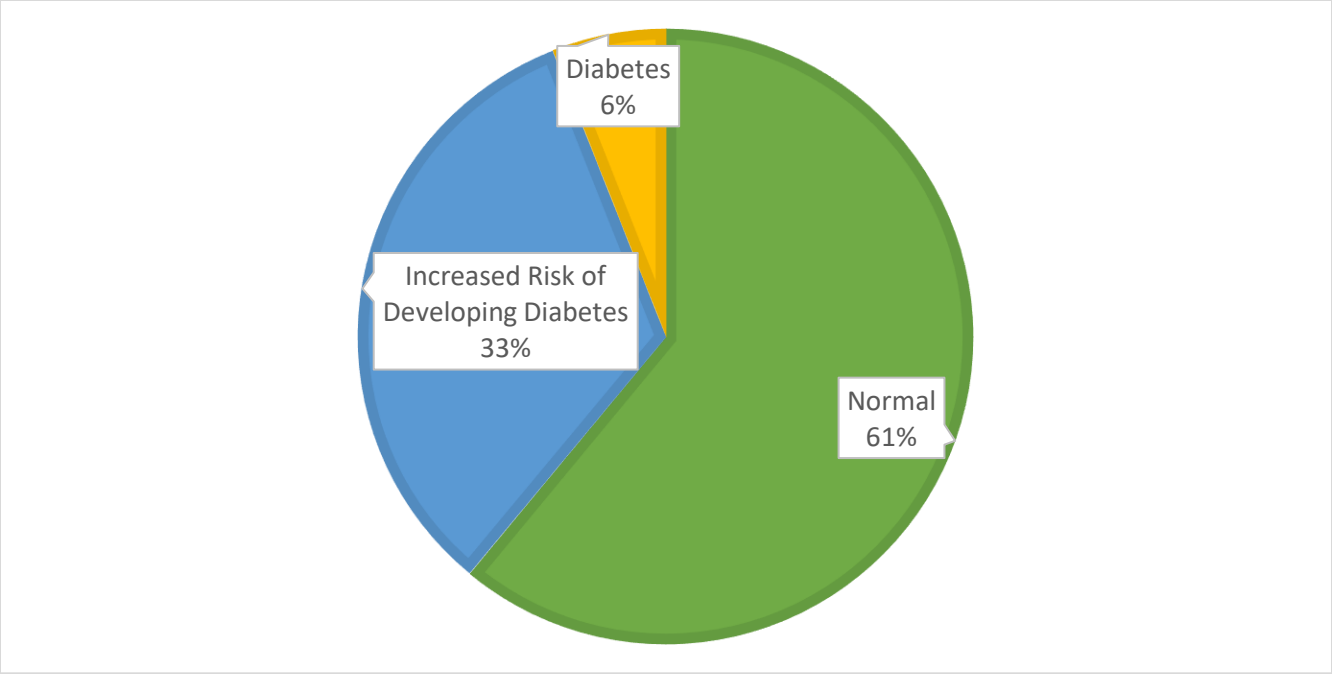


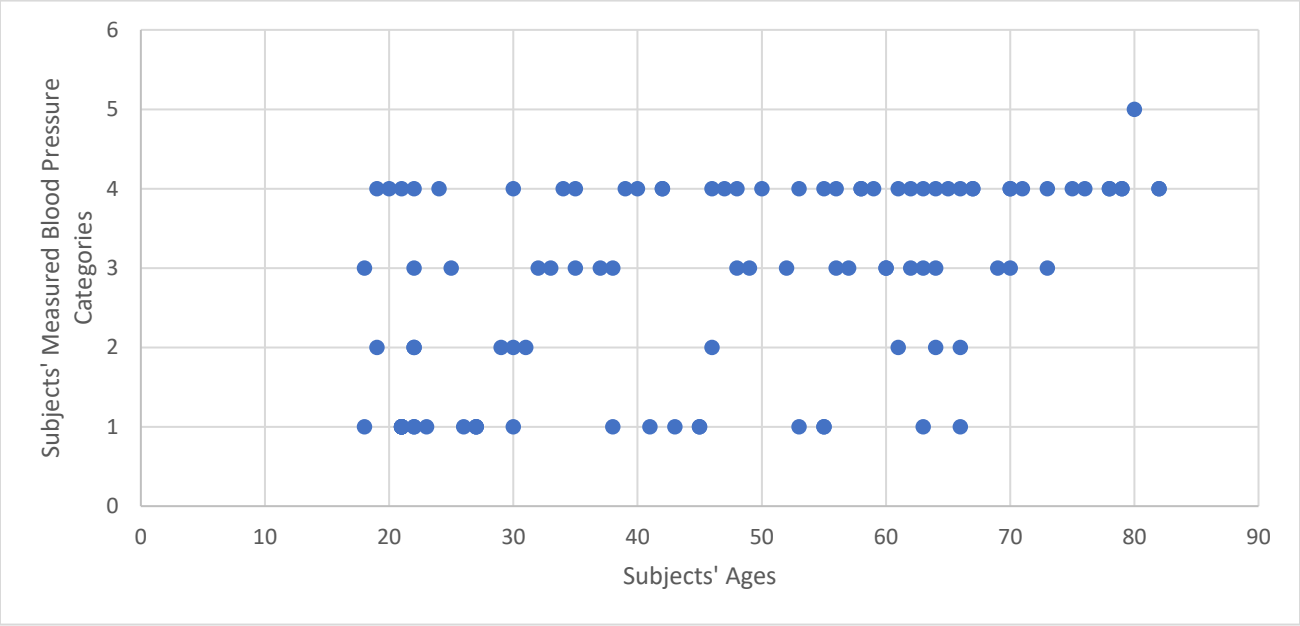
Figure 7: Pie Chart Showing the Distribution of Measured Blood Sugar Categories among Study Participants

		Groupings for Subjects' Measured Blood Pressure Levels				
		Normal Count	Elevated Count	Hypertension Stage 1 Count	Hypertension Stage 2 Count	Hypertensive Crisis Count
Age Group	18-25	11	3	3	5	0
	26-39	6	3	5	4	0
	40-49	4	1	2	6	0
	50-59	3	0	3	7	0
	60-69	2	3	6	8	0
	>70	0	0	2	12	1

Table 3: Table Showing the Relationship Between Subjects Age Groups and Respective Blood Pressure Level Measurements

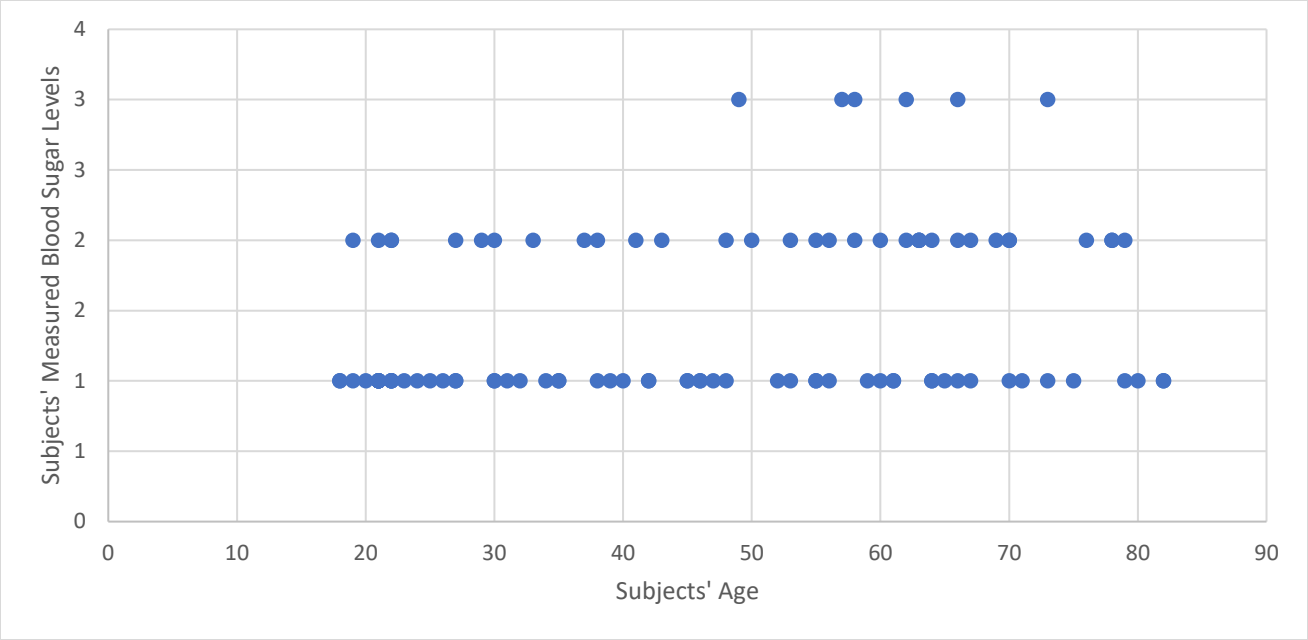
		Groupings for Subjects' Measured Blood Sugar Levels		
		Normal Count	Increased Risk of Developing Diabetes Count	Diabetes Count
Age Group	18-25	18	4	0
	26-39	12	6	0
	40-49	9	3	1
	50-59	6	5	2
	60-69	8	9	2
	>70	8	6	1

Table 4: Table Showing the Relationship Between Subjects Age Groups and Respective Blood Sugar Level Measurements



Legend (y-axis): 1 – Normal, 2 – Elevated, 3 – Hypertension Stage 1, 4 – Hypertension Stage 2, 5 – Hypertensive Crisis

Figure 8: Scatter Plot Showing the Relationship Between Subjects' Ages and Respective Blood Pressure Categories



Legend (y-axis): 1 – Normal, 2 – Increased Risk of Diabetes, 3 – Diabetes

Figure 9: Scatter Plot Showing the Relationship Between Subjects' Ages and Respective Blood Sugar Categories

		Frequency at which the Subject Checks Their Blood Pressure Levels					
		Daily Count	Weekly Count	Monthly Count	Every few months Count	Yearly Count	Never Count
Age Group	18-25	0	0	3	4	3	12
	26-39	0	0	1	5	3	9
	40-49	0	1	3	3	0	6
	50-59	3	1	2	5	0	2
	60-69	1	9	1	4	3	1
	>70	6	4	1	3	1	0

Table 5: Table Showing the Relationship Between Subjects Age Groups and Frequency of Blood Pressure Level Checks

		Frequency at which the Subject Checks Their Blood Sugar Levels					
		Daily Count	Weekly Count	Monthly Count	Every few months Count	Yearly Count	Never Count
Age Group	18-25	0	0	0	4	2	16
	26-39	0	0	1	0	6	11
	40-49	0	1	0	1	4	7
	50-59	2	2	1	3	1	4
	60-69	0	4	2	6	6	1
	>70	2	4	2	4	3	0

Table 6: Table Showing the Relationship Between Subjects Age Groups and Frequency of Blood Sugar Level Checks

		Categories for Subjects' Knowledge on Normal Blood Pressure Levels			
		Normal Count	Increased Risk of Developing Diabetes Count	Diabetes Count	Unsure Count
Age Group	18-25	22	0	0	0
	26-39	16	0	0	2
	40-49	8	1	0	4
	50-59	9	2	0	2
	60-69	19	0	0	0
	>70	11	4	0	0

Table 7: Table Showing the Relationship Between Subjects Age Groups and Frequency of Blood Sugar Level Checks

		Frequency at which the Subject Checks Their Blood Pressure Levels					
		Daily Count	Weekly Count	Monthly Count	Every few months Count	Yearly Count	Never Count
Frequency at which the Subject Checks Their Blood Sugar Levels	Daily	4	0	0	0	0	0
	Weekly	1	6	0	4	0	0
	Monthly	1	1	2	2	0	0
	Every few months	3	5	2	6	1	1
	Yearly	1	3	2	8	7	1
	Never	0	0	5	4	2	28

Table 8: Table Showing the Relationship Between Subjects' Frequency of Blood Pressure Level Checks and Frequency of Blood Sugar Level Checks

		Frequency at which the Subject Checks Their Blood Pressure Levels					
		Daily Count	Weekly Count	Monthly Count	Every few months Count	Yearly Count	Never Count
Categories for Subjects' Knowledge on Normal Blood Pressure Level	Normal	0	0	0	0	1	5
	Elevated	0	0	2	3	2	2
	HTN Stage 1	6	10	8	15	1	11
	HTN Stage 2	4	4	1	5	6	7
	Hypertensive Crisis	0	1	0	1	0	0
	Unsure	0	0	0	0	0	5

Table 9: Table Showing the Relationship Between Subjects' Frequency of Blood Pressure Level Checks and Their Knowledge on Normal Blood Pressure Levels

		Frequency at which the Subject Checks Their Blood Pressure Levels					
		Daily Count	Weekly Count	Monthly Count	Every few months Count	Yearly Count	Never Count
Categories for Subjects' Knowledge on Normal Blood Sugar Level	Normal	5	14	10	21	10	25
	Increased Risk of Developing Diabetes	4	1	1	1	0	0
	Diabetes	0	0	0	0	0	0
	Unsure	1	0	0	2	0	5

Table 10: Table Showing the Relationship Between Subjects' Frequency of Blood Pressure Level Checks and Their Knowledge on Normal Blood Sugar Levels

		Frequency at which the Subject Checks Their Blood Pressure Levels					
		Daily Count	Weekly Count	Monthly Count	Every few months Count	Yearly Count	Never Count
Groupings for Subjects' Measured Blood Pressure Levels	Normal	0	0	5	6	3	12
	Elevated	0	1	0	4	3	2
	HTN Stage 1	3	2	2	6	2	6
	HTN Stage 2	6	12	4	8	2	10
	Hypertensive Crisis	1	0	0	0	0	0

Table 11: Table Showing the Relationship Between Subjects' Frequency of Blood Pressure Level Checks and Respective Blood Pressure Level Measurements

		Frequency at which the Subject Checks Their Blood Sugar Levels					
		Daily Count	Weekly Count	Monthly Count	Every few months Count	Yearly Count	Never Count
Categories for Subjects' Knowledge on Normal Blood Sugar Level	Normal	1	9	6	16	18	35
	Increased Risk of Developing Diabetes	2	2	0	1	2	0
	Diabetes	0	0	0	0	0	0
	Unsure	1	0	0	1	2	4

Table 12: Table Showing the Relationship Between Subjects' Frequency of Blood Sugar Level Checks and Respective Blood Sugar Level Measurements

	Gender	Age	Ethnicity	How often the subject checks BP levels	How often subject checks blood sugar levels
How often the subject checks their sugar levels	0.874	<0.001	0.271	<0.001	-
How often the subject checks their blood pressure levels	0.553	<0.001	0.450	-	<0.001
Subject's Knowledge of a Normal Blood Pressure Level	0.823	0.411	0.121	0.013	0.858
Subject's Knowledge of a Normal Blood Sugar Level	0.915	<0.001	0.080	0.003	0.020
Blood Pressure Categories	0.431	0.032	0.852	0.014	0.249
Blood Sugar Categories	0.145	0.289	0.149	0.136	0.098

Table 13: Table Showing Chi-squared Values

	Gender	Age	Ethnicity	How often the subject checks BP levels	How often subject checks blood sugar levels
How often the subject checks their sugar levels	0.135	0.339	0.244	0.491	-
How often the subject checks their blood pressure levels	0.199	0.374	0.224	-	0.491
Subject's Knowledge of a Normal Blood Pressure Level	0.148	0.228	0.268	0.294	0.188
Subject's Knowledge of a Normal Blood Sugar Level	0.042	0.389	0.238	0.363	0.325
Blood Pressure Categories	0.195	0.288	0.154	0.301	0.244
Blood Sugar Categories	0.196	0.244	0.218	0.273	0.283

Table 14: Table Showing the Results for the Phi and Cramer's V Test

Cramer's V interpretations:

0 – no relation

≤ 0.2 – weak relation

Between 0.2 and 0.3 – moderate relation

>0.3 – strong relation

13.0 Discussion

In this study, there were 38% more female participants than male participants, as seen in Figure 1. This can be justified by the trend of women being more likely to seek help or accept intervention medically, for reasons about the social construction of diseases, worse state of health concerning men and placing a higher value on sight tests, as this relates to optometry [30, 31]. There was found to be a relatively even spread of ages among study participants, which is depicted in Figure 2. Over half of the sample population identified as being mixed race (53%), and the rest of the sample population was almost split evenly between persons of East Indian and African descent (23% and 22% respectively) with the final 2% not identifying with the ethnicities provided.

Of the demographic data attained, it was found that age was the most significant factor contributing to trends such as frequency of taking blood pressure or blood sugar measurements, knowledge of normal blood pressure/sugar levels and subjects' actual blood pressure/sugar measurements on the day of participation. From Figure 4, the 10% of participants who check their blood pressure levels either daily or weekly were over 70 years old, while the 12% of participants who never check their blood pressure levels were between 18 and 25 years of age. Concerning Figure 5, 27% of the sample population never checks their sugar levels. These participants were between the ages of 18 and 39. 10% of the sample population check their sugar levels daily or weekly and were above the age of 60. When looking at Table 4, 11% of the participants were aged 18 to 25 and had a normal blood pressure level at the time of measurement. 12% of participants had blood pressure which fell into the hypertension stage 2 category, and these patients were all over the age of 70. Interestingly, the only subject whose blood pressure fell into the hypertensive crisis category was also above the age of 70 and claimed to be checking their blood pressure levels daily. Ethnicity

was not a majorly significant factor influencing the blood pressure and blood sugar characteristics of participants, as was the case in other studies [32].

From Figure 4, just under a third (30%) of the sample population never checked their blood pressure levels, which was the highest frequency out of the six options as per the study questionnaire. Similarly, 39% of participants never check their sugar levels, as is depicted in Figure 5. In both instances, as the time intervals between checks became longer, more participants fell into that category. When subjects were enquired about what they felt were normal blood pressure and blood sugar levels, we discovered from Table 1 that the majority of the sample population (78%) expressed blood pressure levels which they thought were normal but fell either into the hypertensive stage 1 or 2 categories.

Only 6% of the sample population seemed to know what a normal blood pressure level was. In contrast, Table 2 shows that most participants (85%) expressed blood sugar level values which they thought were normal, and those values actually fell into the "normal" category. This could have been due to the considerably wider ranges of blood sugar values per category, as compared to those of blood pressure levels [33, 34]. Evidently, there seems to be a greater lack of knowledge on normative blood pressure levels than blood sugar levels among patients visiting the UWI Optometry Clinic. Contrarily, studies have shown that more people tend to know about hypertension than diabetes [35].

Table 3 revealed that individuals aged 18-25 were more likely to have normal blood pressure, while those over age 70 were more likely to have hypertension stage 2. Furthermore, only one participant in the entire study was identified as having a hypertensive crisis, and this individual was also over 70 years old. This participant was the eldest of the 10 participants who check their blood pressure levels daily, though her blood pressure characteristic could be the reason behind her daily checks.

Figure 8 depicted that out of 96 patients, 42 had hypertension stage 2, with ages ranging from 18-70. Table 4 showed that 61 participants had normal blood sugar levels, 33 were at risk of developing diabetes, and only 6 could have been categorized as diabetic. Based on the collected data, it can be inferred that there were more individuals in the normal category for blood sugar levels compared to those in the normal category for blood pressure levels.

A study done in Ethiopia supports these findings, as it wielded similar results whereby more adults were found to be hypertensive than diabetic [35]. Analysis of the data showed that over 50% of the study population had blood pressure levels that fell outside of the normal range, whereas more than 50% of the population had blood sugar levels that were within the normal range. This suggests that the hypothesis was only partially accurate, as it was confirmed only for blood pressure.

According to the data presented in Table 5, individuals aged over 60 tended to check their blood pressure levels at least once a week, while those aged between 18-49 were more likely to never check their blood pressure levels. Table 6 data revealed that individuals aged over 60 were more inclined to check their blood sugar levels at least once a week, whereas those aged between 18-49 were more prone to never check their blood sugar levels. Therefore, the collected data suggests that older participants tend to monitor their blood pressure and blood sugar levels more frequently than younger participants, which is likely due to them being more susceptible to developing diabetes and hypertension [36, 37, 38].

In Table 8, it was found that 28% of the participants never checked their blood pressure or blood sugar levels, 4% checked both their blood pressure and blood sugar levels daily, 6% checked both their blood pressure and blood sugar levels weekly, 2% checked their blood pressure and blood sugar levels monthly, 6% checked their blood pressure and blood sugar levels every few months and 7% checked their blood pressure and blood sugar levels yearly. In Table 11, of the 30% of

participants who never checked their blood pressure levels, 2% of them were found to have elevated blood pressure levels, 6% were in the hypertension stage 1 category and 10% were in the hypertension stage 2 category when their blood pressure was measured, which shows that a notable number of people can be suffering from hypertension yet be unaware [14]. Of the 15% of participants who checked their blood pressure weekly, 12% were in the hypertension stage 2 category and 2% were in the hypertension stage 1 category when their blood pressure was measured. On the contrary, of the 39% that never checked their blood sugar levels, 35% had blood sugar levels within the normal range.

14.0 Limitations

- The number of participants may be limited due to access to the Couva Hospital & Multi-Training Facility. Though located just off a highway, it is situated on the more rural side and can be difficult to access at times using public transportation.
- Ideally, blood sugar levels are supposed to be tested before a meal, the patients who are at the clinic and agree to be a part of the study might have eaten a short while before being tested, thus reducing the accuracy of the readings.
- The possible anxiety that may come about before participants get their blood pressure taken could cause inaccuracies in the readings.
- Some of the blood pressure readings may be taken by other individuals who may not have the cuff of the blood pressure monitor in the correct position or have the patient in the appropriate position when sitting.
- The study included more female than male participants due to the higher probability of female patients visiting the university eye clinic.

15.0 Conclusions

This study proved there is a higher degree of unfamiliarity with normative blood pressure levels compared to blood sugar levels. Of the 100 participants, 6% were clear on what a normal blood pressure level is meant to be, while 85% were clear on what a normal blood sugar level is meant to be. 26% of the sample population had normal blood pressure levels when measured, while 61% of participants had normal blood sugar levels. Age was evidently the most significant contributing factor to both the knowledge of normative values as well as the actual blood pressure and blood sugar measurements. Overall, the study underscores the importance of raising awareness and educating individuals about hypertension and diabetes, as said conditions have great potential to compromise ocular health.

16.0 Recommendations

- This study should be repeated in the future with a larger sample size in Trinidad and Tobago as well as other Caribbean islands whose population are at higher risk of developing hypertension and diabetes.
- Another study like this should be done using fasting blood sugar levels, given its stricter parameters regarding what is a normal sugar level. This may produce a more precise analysis of the sample population's health status specifically related to hypertension and diabetes.
- Similar studies should also ascertain whether participants have been previously diagnosed with hypertension or diabetes. This would allow for more specific categories of participants with respect to what their measured blood pressure and blood sugar levels mean for them.
- A study should be conducted whereby data collection includes visual characteristics, for example, visual acuity and/or fundoscopy, to compare blood pressure and blood sugar level characteristics to ocular health.

17.0 Next Steps

- This research project will be presented to 3rd year optometry students and optometrists to emphasize the importance of knowing the blood pressure and blood sugar characteristics of their patients.
- Poster(s) can be made with a summary of the study's most relevant findings, so that it may be displayed in the University's optometry clinic, in hopes of stimulating self-awareness of patients' blood pressure and blood sugar characteristics.
- In the event that this study is published, it will be used as a foundation for further research to be done on the topic as well as encourage optometrists to implement routine blood pressure and blood sugar checks in their eye exams.

18.0 Appendices

INFORMED CONSENT AND PRIVACY AUTHORIZATION FORM FOR CLINICAL STUDIES

Protocol Title: The blood pressure and sugar level characteristics of patients visiting a university eye clinic.

Application No.: CREC-SA.1858/

Sponsor: N/A

Principal Investigator: Dr. Niall Farnon
niall.farnon@sta.uwi.edu
Office #: (1 868) 225 1016

Fax: 225 1676

Couva Hospital and Multi-Training Facility. Region: North Central Regional Health Authority (NCRHA) Address: Sir Solomon Hochoy Highway, Preysal, Couva.

University Ethics Committee: (1 868) 662 2002 Ext: 82755

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1. What should you know about this study?

a. You are being asked to join a research study.

b. This consent form explains the research study and your participation in the study.

c. Please read it carefully and take as much time as you need.

d. Please ask questions at any time about anything you do not understand.

e. Your participation is voluntary. If you join the study, you can change your mind later. You can decide not to take part, or you can quit at any time. There will be no penalty or loss of benefits if you decide to quit the study.

f. During the study, we will tell you if we learn any new information that might affect whether you wish to continue to be in the study.

g. Ask your study doctor or the study team to explain any words or information in this informed consent that you do not understand.

2. Why is this research being done?

This research is being done to analyze the awareness of persons coming to the Couva Hospital & Multi-Training Facility about these systemic diseases, namely hypertension and diabetes mellitus, both of which pose a threat to vision and the health of the eye.

3. What will happen if you join this study?

If you agree to be in this study, we will ask you to do the following things:

You will first complete a data collection sheet and questionnaire. Afterwards, you will be taken to a cubicle within the clinic and your blood pressure will be taken, followed by a blood sugar test.

How long will you be in the study?

You will be in this study for approximately 15 minutes.

How many people will be in this study?

Approximately 96 people.

4. What are the risks or discomforts of the study?

There is a risk of a breach of confidentiality, however, hard copies of questionnaires and data collection sheets will be kept only by the three investigators. All softcopy data will be kept on a password-protected computer used only by the three investigators. The data will be kept for seven years, after which it will be erased/disposed of permanently.

5. Are there risks related to pregnancy?

There are no risks related to pregnancy.

6. Are there any benefits to you being in the study?

By participating in this study, you will be made aware of your blood pressure and blood sugar levels which should be checked regularly and is useful knowledge when one is trying to keep themselves in good health.

7. What are your options if you do not want to be in the study?

You do not have to join this study. If you do not join, your care will not be affected.

8. Will it cost you anything to be in this study?

Yes ☐ No ☑

9. Will you be paid if you join this study?

Yes ☐ No ☑

10. Can you leave the study early?

YES, if you wish you do not have to continue in this study.

11. What are some of the reasons for early discontinuation of the study?

Possible reasons for the early discontinuation of the study include personal commitments of participants which require them to leave the study location and sudden disinterest in participating in the study.

12. How will your privacy be protected?

a. ALL information about you will be protected.

b. The research team working on the study will collect information about you. This includes things learned from the procedures described in this consent form.

c. Only people on the research team will know your identity and that you are a participant in the research study.

d. You may cancel your permission to use your information at any time by notifying the Principal Investigator of this study in writing. The Principal Investigator's name, address, phone and fax information are on page one of this consent form. If you do cancel your permission to use and disclose your information, your part in this study will end and no further information about you will be collected. Your cancellation would not affect information already collected in the study.

13. Will the study require any of your other healthcare providers to share your health information with the researchers of this study?

Yes ☐ No ☑

14. What happens to Data, Tissue, Blood and Specimens that are collected in the study (and transported elsewhere-if applicable)?

Biological samples and tissues are used in this study

Yes ☐ No ☑

Biological samples and tissues are transported elsewhere for further analysis

Yes ☐ No ☑

This study cannot be undertaken without your permission to use the biological samples collected from you. The data, tissue, blood and specimens collected from you during this study are important to both this study and future research.

If you join this study:

- You will not own the data, or the tissue, blood, or other specimens given by you to the investigators for this research.
- The investigators of this research may study your data and the tissue, blood or other specimens collected from you.
- If data, tissue, blood or other specimens are in a form that does not identify you, they may be shared with other academic medical centres for further analysis
- You will not own any product or idea created by the researchers working on this study.
- You will not receive any financial benefit from the creation, use or sale of such a product or idea.

15. Assent Statement

We are doing this study to let people know about high blood pressure and high blood sugar levels, which can negatively affect your eyes in different ways. To do this, we will have you fill out some information about yourself, such as your gender, age and ethnicity, and then answer a few short questions. After this, we will take your blood pressure and blood sugar reading.

16. What other things should you know about this research study?

All procedures performed in this study are routine and common in regular medical examinations.

17. What do you do if you have questions about the study?

Call the principal investigator. The address and fax number are on page one of this consent form. If you cannot reach the principal investigator or wish to talk to someone else, call the University Ethics Committee at 662 2002.

Subject Signature: _____

Witness Signature: _____

Data Collection Sheet:

Gender: Age:

(Please tick one from the options below):

What is your ethnicity?

- ☐ East Indian
- ☐ African
- ☐ Asian
- ☐ Caucasian
- ☐ Mixed
- ☐ Other:

Please tick the most appropriate response where applicable.

To your knowledge, what do you think is a normal blood pressure level? …….. mmHg

To your knowledge, what do you think is a normal blood sugar level? …….. mg/dL

How often do you check your blood sugar levels?

Daily ☐ Weekly ☐ Monthly ☐ Every few months ☐ Yearly ☐ Never ☐

How often do you check your blood pressure levels?

Daily ☐ Weekly ☐ Monthly ☐ Every few months ☐ Yearly ☐ Never ☐

Are you currently on any medication?

Yes ☐ No ☐

If yes, please state the medications you are currently using:

……

……

Blood sugar reading: ……. mg/dL Blood pressure reading: ……. mmHg

THE UNIVERSITY OF THE WEST INDIES
ST. AUGUSTINE, TRINIDAD AND TOBAGO, WEST INDIES
CAMPUS RESEARCH ETHICS COMMITTEE
TELEPHONE: (1-868) 662-2002 ext. 82755 E-mail: campusethics@sta.uwi.edu

January, 11 2023

Dr. Niall Farnon
Omar Babb, Kyla Salvary
Department of Clinical Surgical Sciences
Faculty of Medical Sciences
Email: niall.farnon@sta.uwi.edu

Dear Dr. Niall Farnon,

Ref: CREC-SA.1858/11/2022

Title: The blood pressure and sugar level characteristics of patients visiting a university eye clinic.

I am pleased to advise that your application for research on the above captioned topic has been approved on behalf of Campus Research Ethics Committee, St. Augustine.

Approval is valid for one (1) year.

Sincerely,

Professor Jerome De Lisle
Chair
Campus Research Ethics Committee

19.0 References

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