BLOOD PRESSURE CONTROL AND ITS ASSOCIATED RISK FACTORS IN PRIMARY CARE OUTPATIENTS USING THE HEARTS IN THE AMERICAS HYPERTENSION TREATMENT PROTOCOL IN TRINIDAD : A CROSS-SECTIONAL STUDY

A Clinical Research Project

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ABSTRACT

Thesis title: Blood Pressure Control and Associated Risk Factors in Primary Care Outpatients Using the HEARTS in the Americas Hypertension Protocol in Trinidad: A Cross-Sectional Study

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Background: A comprehensive cardiovascular disease risk reduction program, HEARTS (Healthy-lifestyle counselling, Evidence-based treatment protocols, Access to essential medicines and technology, Risk based charts, Team-based care, Systems for monitoring) in the Americas was established by WHO (World Health Organization) and PAHO (Pan American Health Organization) in response to the growing burden of cardiovascular disease (CVD) and uncontrolled hypertension in the Americas. The aim of the study was to determine the impact of the HEARTS hypertension treatment protocol on blood pressure control among adult hypertensive patients attending a primary care clinic in Trinidad.

Method: A cross sectional survey was conducted over a four-month period at a primary care, chronic disease outpatient clinic. Anthropometric and blood pressure measurements were taken for each participant and factors associated with blood pressure control were assessed using the AUDIT-C (Alcohol Use Disorder Identification Test- Consumption), Heaviness of Smoking Index, GPPAQ (General Practice Physical Activity Questionnaire), CUP FV (Cup of Fruits/ Vegetable Serving), HB-MAS (Hill Bone Medication Adherence Scale) and HBCHBPT (Hill Bone Compliance to Blood Pressure Therapy Scale) through interviewer administered questionnaires.

Results : A total of 287 patients participated in the study, creating an overall response rate of 89.7%. The overall proportion of patients with optimally controlled blood pressure was 52.3%

(95% CI: 46.5%-58.0%); with a mean systolic and diastolic blood pressure ±SD of 136.6 ±18.1 and 81.9 ±10.6 respectively. Most participants were on Step 1 of the HEARTS Hypertension treatment protocol (n=155, 54%). Blood pressure control was significantly and positively associated with higher monthly incomes of greater than $10,000 TT per month (AOR: 3.536, 95% CI: 1.255-9.957, p =0.017), while being overweight (AOR 0.459, 95% CI: 0.229-0.920, p=0.028) was significantly associated with lower odds of having optimally controlled blood pressure. Having an active lifestyle (AOR 2.240, 95% CI: 0.961-5.219) was positively associated with blood pressure control though not statistically significant. Patients over 60 years of age had higher adherence scores, representing higher medication (HB-MAS) (p= 0.003), and overall hypertensive therapy adherence (HBCHBPT) (p= 0.001), while 46.3% of all participants had high adherence to their antihypertensive treatment therapy (HBCHBPT).

Conclusion: The results reveal that while there is still room for improvement, the implementation of the HEARTS hypertension treatment protocol among attendees in a primary care outpatient clinic, has resulted in better blood pressure control rates among adult patients, which supersedes the expected national control rate for Trinidad and Tobago and is good at an international level. National, organizational and clinician-based interventions must be explored to achieve higher blood pressure control rates to combat the non-communicable disease burden.

Keywords: blood pressure control; hypertension; HEARTS in the Americas; primary care; Trinidad

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LIST OF ACRONYMS

ACE-I	Angiotensin Converting Enzyme Inhibitor
AOR	Adjusted Odds Ratio
ARB	Angiotensin Receptor Blocker
AUDIT-C	Alcohol Use Disorders Identification Test Consumption
BP	Blood Pressure
CARICOM	Caribbean Community
CARPHA	Caribbean Public Health Agency
CCB	Calcium Channel Blocker
CDAP	Chronic Disease Assistance Programme
CI	Confidence Interval
COVID-19	Coronavirus disease 2019
CUP-FV	Cup of Fruits/ Vegetable Serving
CVD	Cardiovascular Disease
DASH	Dietary Approaches to Stop Hypertension
DLW	Doubly Labelled Water
FDC	Fixed Dose Combination
GPPAQ	General Practice Physical Activity Questionnaire

HEARTS	Healthy-lifestyle counselling, Evidence-based treatment protocols, Access to essential medicines and technology, Risk based charts, Team-based care, Systems for monitoring
HBCHBPT	Hill Bone Compliance to Blood Pressure Therapy Scale
HB-MAS	Hill Bone Medication Adherence Scale
HYDRA	Hypertension and Diabetes Screening and Awareness
MMAS-4	Morisky Medication-taking Adherence Scale
NCD	Noncommunicable Disease
NHANES	National Health and Examination Survey
OR	Odds Ratio
PAHO	Pan American Health Organization
RAS	Renin- Angiotensin System
SD	Standard Deviation
WHO	World Health Organization

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INTRODUCTION

BURDEN OF HYPERTENSION

According to the WHO, noncommunicable diseases (NCDs) account for 41 million deaths worldwide annually, of which 5.5 million are derived from the Region of the Americas[1], with cardiovascular diseases accounting for 42% of all NCD deaths annually. Of the 5.5 million deaths within the Region of the Americas, cardiovascular disease accounts for 1.8 million and is the number one cause of deaths within the region and globally.[2] The majority of cardiovascular disease conditions are caused by unaddressed modifiable risk factors which can be controlled or treated, such as elevated cholesterol levels, obesity, tobacco use, excessive alcohol consumption and elevated blood pressure. Significant and sustained interventions are needed to address these risk factors for the control of cardiovascular diseases. One of the ways in which we can successfully reduce all-cause mortality and morbidity rates of cardiovascular disease is by improving the health system's capacity to detect and control hypertension.

Hypertension, a notable risk factor for cardiovascular disease, is estimated to affect 1.28 billion adults aged 30 – 79 worldwide, most (two thirds) living in low to middle income countries.[3] Annually, hypertension is responsible for 7.6 million deaths worldwide (13.5% of all deaths), more than for any other individual risk factor.[4] In the Region of the Americas high systolic blood pressure was attributable to 1.2 million deaths in 2019.[5] While in Trinidad and Tobago, non-communicable diseases account for 62% of deaths annually, with over half the population having at least three risk factors for this, and hypertension being the single most modifiable biological risk both locally and globally.[6]

Globally the estimated age-standardized prevalence of hypertension changed little from 1990-2019, increasing from 32% to 33%.[5] Regionally, Latin America and the Caribbean comprises

of thirty-three countries, which can be further sub-divided by regions; South America, Central America and the Caribbean. Within each region the prevalence of hypertension as observed in 2015, ranges from 18.6 % to 25.8% , with the Caribbean region leading; Trinidad and Tobago (25.8%), Barbados (24.4%) and Jamaica (21.8%).[7] Correspondingly, of all the regions, the Caribbean had the lowest prevalence of hypertension control in 2019; Trinidad and Tobago (20.9%), Jamaica (19.1%) and Barbados (33.7%).[8] Despite extensive research over the past few decades into the aetiology and treatment of hypertension, control of blood pressure is suboptimal in the global population. Approximately only 1 in 7 hypertensive adults; a staggering 13.8%, can be classified as being controlled.[9] It is therefore of grave concern that the control of hypertension is so low in the Caribbean region. Although the cause of this gap is not completely clear, the significant socioeconomic inequalities coupled with failure to implement effective public health policies and primary care systems have contributed notably.[10]

Additionally, the coronavirus pandemic 2019 (COVID-19) is expected to have adverse effects on long term cardiovascular disease outcomes. Notably, a possible worsening of hypertension control rates during the pandemic is of great concern, due to the prolonged stress and unfavourable lifestyle habits, including increased alcohol and salt intake, weight gain and sedentarism.[11] This threatens to impede the efforts being taken to tackle this grave public health concern.

CARIBBEAN INTERVENTIONS

Several measures have been taken to address these concerns in Latin America and the Caribbean. The government of Trinidad and Tobago launched the Chronic Disease Assistance Programme (CDAP) in 2003. This was a free prescription drugs programme, eligible to all members of the public regardless of age, income, or other sociodemographic

factors.[12] In 2007, the Caribbean Health and Research Council produced a booklet entitled "Managing Hypertension in Primary Care in the Caribbean". This was distributed among all healthcare workers in the English-speaking Caribbean. This manual was "geared to the culture, economic situation and health care systems in the Caribbean and was designed to serve as key tools in improving patient care."[13] Additionally, CARPHA (Caribbean Public Health Agency), CARICOM (Caribbean Community) and HCC (Healthy Caribbean Coalition) have also worked to support the Caribbean region over the years, to meet and facilitate their goals towards noncommunicable disease reduction, inclusive of hypertension and blood pressure control.

Hypertension prevention and control can make a substantial contribution to achieving the United Nation's Sustainable Development Goals target 3.4.1 on noncommunicable diseases, which aims to reduce the risk of premature death among people aged 30-69 years of age by one third by 2030.[14] This follows in tandem with the World Health Organization's plan to achieve a 25% reduction in premature NCD-related deaths between 2010 and 2025.[15]

HEARTS INITIATIVE

In light of the increasing prevalence of cardiovascular disease throughout the Americas, a thorough program aimed at reducing the risk of cardiovascular disease, known as HEARTS in the Americas, was initiated towards the close of 2016.[10] One pillar of the HEARTS initiative is the implementation of a standardized treatment protocol, with specific medications and dosages. This falls under the Evidence-based treatment protocols and "is rooted in a seamless transition from existing treatment practices to best practice using pharmacologic protocol built around a core set of ideal antihypertensive medications."[10] The HEARTS in the Americas and more recently the 2021 WHO Hypertension Guidelines, suggest fixed dose combination therapy, preferably with a single pill combination as initial treatment. Fixed dose

combinations have the advantage of reducing pill burden and increasing treatment adherence, ultimately addressing one of the key challenges in blood pressure control.

The treatment protocol for hypertension outlined in the WHO HEARTS technical package, recommend the use of four drug classes (angiotensin-converting enzyme inhibitors [ACEI], angiotensin receptor blockers [ARB], calcium channel blockers [CCB], and diuretics) to be used in various combinations. At the core of the formulary and protocols, is an emphasis on the initial use of two antihypertensive medications in the individual with hypertension.[10] In keeping with the above, "HEARTS is moving toward a formulary that consists of 7-8 core, high-quality medications with 19-20 preparations for use in primary care."[10] HEARTS in the Americas was launched in 2016 and is currently being implemented and expanded in 21 countries of the Region which cover approximately 8.2 million adults in their respective catchment area.[16] Barbados, Chile, Colombia and Cuba were the pilot countries chosen to initiate the HEARTS in the Americas interventions in 2016, adapting these tools to their local context.[16] All countries saw success with the initiative which led to its expansion within the various countries in the region.

Trinidad and Tobago launched the HEARTS initiative program in 2019 with five pilot sites. This partnership between PAHO/WHO and the Ministry of Health, emphasized the country's commitment to tackling the epidemic of non-communicable diseases through the development of the National Strategic Plan for the prevention and control of NCDs in Trinidad and Tobago. This country has seen a high and increasing prevalence of risk factors for NCDs within its population. As such, controlling hypertension may be the single most effective and feasible mechanism to reduce noncommunicable disease death and disability, through the global public health approach of the HEARTS in the Americas initiative. Without concerted action, the increasing prevalence of NCDs threatens to further burden our health care system

which is already plagued with scarce resources, which can severely undermine our socioeconomic and health advancement. Thus, making the issue of hypertension control one of grave public health concern.

There is an abundance of international research exploring the prevalence of blood pressure control and its associated factors, from high income population-based studies to resource limited populations.[17,18,19] Similarly there are many regional studies within Latin America and the Caribbean that also explore this relationship.[20,21] (see Appendix 8) Previous research conducted in Trinidad and Tobago using cross-sectional survey design and validated interviewer-administered questionnaires and anthropometric measurements among public primary care attendees, has demonstrated inadequate levels of blood pressure control, ranging from 11% - 26.7%.[22,23,24] Factors associated with blood pressure control have also been explored, such as sociodemographic data, alcohol use, cigarette smoking and physical activity as seen in the study by Gulliford et al. [23] , while adherence to antihypertensive medication among primary care attendees was investigated in a study by Motilal et al.[24] Both studies were unable to find a significant positive association between these factors and blood pressure control rates.

However, to my knowledge, there is a paucity of studies in the Caribbean and Trinidad and Tobago that explore the prevalence of blood pressure control and its associated factors, with the use of specific treatment protocols, inclusive of the most recent WHO/ PAHO HEARTS in the Americas global initiative. Therefore, the goal of this study is to determine the impact of this simplified, standardized hypertension treatment protocol on blood pressure control and identify the associated factors, thus filling this gap in the literature. This research can aid

primary care physicians, health policy makers and key stakeholders in their consideration of targeted strategies to improve public awareness, treatment, and control of hypertension.

RESEARCH QUESTION

1.What is the prevalence of blood pressure control among adult hypertensive patients using the HEARTS in the Americas hypertension treatment protocol, attending a primary care clinic in Trinidad?

2.What are the associated factors for blood pressure control among adult hypertensive patients, using HEARTS in the Americas hypertension treatment protocol and attending a primary care clinic in Trinidad?

AIM

To determine the impact of the HEARTS in the Americas hypertension treatment protocol on blood pressure control among adult hypertensive patients attending a primary care outpatient clinic in Trinidad.

OBJECTIVES

Primary Objective:

To determine the prevalence of blood pressure control among adult hypertensive patients, using the HEARTS in the Americas hypertension treatment protocol, attending a primary care clinic in Trinidad.

Secondary Objectives:

To determine the relationship between blood pressure control and

1. Gender
2. Exercise
3. Fixed dose medication protocol
4. Comorbidities
5. Education
6. Taking antihypertensive medications at night
7. Compliance with antihypertensive medications
8. Income

METHODOLOGY

STUDY DESIGN AND SETTING

This research was a cross-sectional survey with quantitative results. The site of this public primary care, chronic disease outpatient clinic, henceforth referenced as Site A, is situated within a town in North-Central Trinidad. According to the 2011 Population and Housing Census, the population of this town stood at 33,606 persons, representing some 2.5% of the national population of 1,328,019 persons.[25] It is the second most densely populated area in Trinidad and Tobago. Its population is relatively young, with a working age population (persons between 15 and 64 years) of 69.9%.[25] Trinidad and Tobago as a country, is a plural society and as such its population is heterogeneous in terms of ethnic composition. The predominant ethnic group within this town is "mixed-other" accounting for 38.31%, followed closely by Africans who made up 31.57% and East Indian, who account for 15.5%.[25]

Site A is found within one of five major regional health authorities that serve the population of Trinidad and Tobago. Within this regional health authority, primary care is further divided into three clusters. Site A falls under one of these three clusters and serves the largest population within that cluster. It provides several services, including the Chronic Disease Clinic, that functions four days of the week, seeing an average of 250 patients weekly. Adult patients attending the Chronic Disease Clinic, come from a range of age group, sex and socioeconomic backgrounds, which make them an ideal group to assess the impact of the global HEARTS initiative, hypertensive treatment protocol on their blood pressure control and its associated factors.

PARTICIPANTS

The participants selected included adult hypertensive patients on the HEARTS Hypertension Protocol, attending a primary care, outpatient clinic.

The inclusion and exclusion criteria are as follows:

Inclusion criteria:

1. Adult patients aged 18 years and older
2. Confirmed diagnosis of hypertension of at least three (3) months.

   Hypertension defined as having a blood pressure of ≥140/90 mmHg or systolic blood pressure of ≥130 mmHg and diastolic blood pressure ≥80 mmHg, in high risk hypertensive patients (presence of cardiovascular disease ie composite outcome of cerebrovascular disease, coronary heart disease and peripheral artery disease; diabetes mellitus, chronic kidney disease)
3. Patient using the HEARTS in the Americas hypertension treatment protocol for at least three (3) months

   These would include:

   (i) patients who have been newly diagnosed hypertensives post implementation of HEARTS protocol in November 2019

   (ii) patients without a compelling indication for use of a specific drug other than an initial combination of a calcium channel blocker and an angiotensin - converting enzyme inhibitor or angiotensin II receptor blockers, such as in atrial fibrillation, or adverse side effect to medication

   (iii) hypertensive patients who were uncontrolled on a previous anti-hypertensive medication regime

Exclusion criteria :

1. Pregnant patients
2. Patients less than 18 years of age
3. Confirmed diagnosis of hypertension less than three (3) months
4. Patients using the HEARTS in the Americas hypertension treatment protocol for less than three (3) months

SAMPLE SIZE AND SAMPLING

To determine the sampling frame, a list of all patients registered to the global HEARTS in the Americas hypertension treatment protocol was obtained from the manual registry. This worked out to be approximately 1850 participants. Using the formula for sample size of a cross-sectional study :

$$\mathbf{n_o = (Z^2 / d^2) p (1-p)}$$

With a Confidence level of 95% (Z= 1.96)

Desired margin of error (d=0.05)

Estimated prevalence of blood pressure control in Trinidad and Tobago (p= 0.21)

The estimated sample size was :

$$\mathbf{n_o = 254.9 \sim 255 \text{ participants}}$$

This sample size represents more than 5% of the population size. As such the Finite Population Correction Factor should be applied.

$$n = n_o / [1 + n_o / N]$$

n= 224 participants

The expected non-response rate for this research is 20%. Using the formula for adjustment for nonresponse :

n / 1-k = 280

A non-probability convenience sampling method was used to select participants for inclusion in the study. The population for this study included all patients that have been registered to the HEARTS hypertension treatment protocol, since its implementation in November 2019. This can be located in a manual document found in the Chronic Disease outpatient clinic at Site A's Head Nurse's office.

The minimum sample size used for this study was 280 patients.

The sampling frame for this study would include 1850 patients.

PATIENT SELECTION AND RECRUITMENT

Site A has clinic four days of the week: Mondays, Tuesdays, Thursdays and Fridays. On the morning of each clinic visit a compiled list of potential participants was created. This was done using the HEARTS sheet identifier which could be found at the front of every patient's medical file enrolled in the HEARTS hypertension treatment protocol. This would yield on average 15 – 30 participants of which 5 -12 participants would be acquired for the study. The participants acquired resulted from persons who confirmed their presence in the clinic and were then approached as they waited in the lobby to see their doctor. These patients were consecutively selected in order of appearance according to their convenient accessibility. They were then subsequently informed of the rationale and objective of the research and invited to participate on that day.

INSTRUMENT DEVELOPMENT

A search of the existing research as described in the literature review was used to determine the best instruments and tools used to assess blood pressure and its associated factors. The questionnaire instrument was divided into 5 sections. It included multiple-choice, open-ended questions and Likert scales to quantify participants' responses. It also included the anthropometric and blood pressure measurements of each participant along with review of their clinical notes to document their antihypertensive medication. An informed consent page prefaced the questionnaire explaining the nature of this research project.

Section 1

The first section includes the sociodemographic information of participants. This would comprise of age, sex, ethnicity, marital status, education level and income. (Appendix 3)

Section 2

The second part of the questionnaire comprises of 12 questions that have been identified from the literature as risk factors for hypertension and possible associated factors for blood pressure control (Appendix 4). They include alcohol use, smoking status, physical activity and nutritional practices. Questions were adopted from the revised Trinidad and Tobago HEARTS Hypertension registry framework. [26] Alcohol use was assessed using the (AUDIT-C). This is scored on a scale of 0-12, in men a score of >/ 4 is positive and in women a score of >/3 is considered to be positive. Participants were classified into low risk(0-4), increasing risk (5-7), high risk(8-10) and dependence(11-12).[27] Smokers were assessed

using the Heaviness of Smoking Index, which is a validated self-report, two item measure, which was derived from the Fagerstrom Test for Nicotine Dependence. It is a six point scale that categorizes nicotine dependence into a three category variable: low (0-1), medium (2-4) and high (5-6) .[28,29,30] Physical activity was assessed using the General Practice Physical Activity Questionnaire (GPPAQ). This is a validated instrument used among adult patients and provides a simple 4-level Physical Activity Index (PAI) of: active, moderately active, moderately inactive or inactive.[31] Nutritional practices were categorized into adequate (4 or more servings of fruits and vegetables daily) and inadequate (< 4 servings of fruits and vegetables daily) consumption of fruits and vegetables. This was assessed using an amended version of the validated 2 item CUP FV (Fruits and Vegetables) Screener, which consists of two questions assessing daily fruit and vegetable consumption.[32] The presence of comorbidities was identified to include diabetes, dyslipidaemia, history of cerebrovascular accident, chronic kidney disease, heart failure and other.

Section 3

This section includes the adopted Global HEARTS in the Americas Hypertension protocol that has been chosen under careful consideration for Trinidad and Tobago and under the guidance of the HEARTS Technical package for the evidence-based treatment protocols [33] (Appendix 5). This is comprised of 2 treatment algorithms (i) A and (ii) B and a choice of 1 out of 4 steps that appropriately reflects the patient's current hypertensive treatment regime. It includes a choice of a select combination of a Calcium channel blocker (Amlodipine) and ACE-i (Lisinopril) or ARB (Irbesartan, Candesartan), which is titrated in a stepwise fashion

to maximum dosages, followed by the addition of thiazide/ thiazide like diuretic (Bendrofluazide, Hydrochlorothiazide, Chlorthalidone) .

This section would also include patient indication of routine night time taking of antihypertensive medications, assessed by indicating " yes" or "no".

Section 4

This section consists of the Hill- Bone Compliance to High Blood Pressure Therapy Scale (HBCHBPT) (Appendix 6). It is a 14-item scale that assesses patients' behaviours for three important behavioural domains of high blood pressure treatment.[34]

The three are 1) reduced sodium intake (2 items), 2) appointment keeping (3 items) and 3) medication taking (9 items). Each item is a four-point Likert type scale. [34] The sensitivity and specificity of the HBCHBPT scale, as a diagnostic tool has not yet been established because the scale does not yet have a definite cut off point to determine compliant vs non-compliant. [35] For this 14-item scale, all possible scores ranged from 14 (minimum) – 56 (maximum); higher scores signified better adherence.[36] The scores were treated as a continuous variable.[36] The groups were split based on the median obtained from the 'median split' method, into more adherent / less adherent categories. [36]

The advantage of this instrument is that it is validated for use among hypertensive patients in a community setting and also among urban African American adults.[37] The content validity of the scale was assessed and found to be culturally sensitive and appropriate for low literacy.[35] As such these characteristics make it a favourable instrument to be used in this study that focusses on blood pressure control within a population that may have varied levels of literacy. The instrument is also brief, averaged at 5 minutes and as such will not significantly add to the length of the interview process.

Section 5

This section includes the physical assessment of the anthropometric and blood pressure measurements of the participants (Appendix 7). The blood pressure measurement technique followed that outlined in the "HEARTS Technical package for cardiovascular disease management in primary health care, evidence-based treatment protocol." The OMRON automated electronic device is a validated blood pressure measurement device for clinical accuracy as determined by an independent review process.[38,39] Two blood pressure readings both systolic blood pressure and diastolic blood pressure, recorded in mm/Hg, taken 1 minute apart were recorded. The arithmetic average of both systolic blood pressure and diastolic blood pressure readings were used for the final analysis of results.

The patient's weight in kg and height in metres were also documented using a standard electronic scale and ruler. Using the Quetelet formula Body mass index was calculated BMI =kg/ m^2. A BMI of less than 18.5 falls within the underweight category, a BMI of 18.5 to <25, falls within the healthy weight category, a BMI of 25 to <30, falls within the overweight category and a BMI of 30.0 or higher, falls within the obesity category.[40] Obesity is frequently subdivided into categories, class 1: BMI of 30 to <35, class 2: BMI of 35 to <40, class 3: BMI of 40 or higher, this class is also sometimes referred to as "severe" obesity.[41]

Waist Circumference was measured with a flexible tape measure and recorded in centimetres. With the patient standing, the tape is placed, in a horizontal position, midway between the top of your hip bone and your lowest rib, at the level of your belly button. The tape is kept snug around the waist and the waist circumference is measured just after the patient exhales.[40] For men, a waist circumference below 94 cm is classified as low risk, 94 cm – 102 cm is high risk and more than 102 cm is very high risk for developing chronic conditions. For women, below

80 cm is classified as low risk, 80 – 88 cm is high risk and more than 88 cm is very high risk.[41]

ETHICAL APPROVAL AND CONSIDERATION

Ethical approval was sought from the Ethics Committee at the University of the West Indies, St Augustine Campus and obtained on 24th July 2022 (Appendix 9). Approval was then sought from the ethics committee of North Central Regional Health Authority (N.C.R.H.A.) on July 27th 2022 and granted on November 16th 2022 (Appendix 9).

An informed consent page was included in the questionnaire. This explained the purpose and nature of the study, as well as ensured the confidentiality of all participants involved. Participants were also reminded that this is a voluntary study, and that they could withdraw their participation at point in the study. No incentives of any kind were involved in this study. No declarations or conflicts of interest exist within this study. The consent was then signed by both the participant and researcher.

The AUDIT-C (Alcohol Use Disorders Identification Test-Concise) questionnaire identifies participants who are hazardous drinkers or have active alcohol use disorder, based on their score of > or = to 4 in men and > or = to 3 in women. These participants were offered further treatment for their substance abuse disorder by being referred to the Caura Substance abuse and treatment centre. All smokers were offered a referral to the Smoking Cessation clinic.

All patients were asked to follow up with their treating physician after the questionnaire was administered and anthropometric measurements taken.

To ensure confidentiality was maintained, the names of participants registered to this study were coded. This sensitive information was stored on a password protected laptop that was

only accessible to the researcher. All data collected was secured in a locked cabinet found in the Primary Care Physician II (administration) office, only accessible to the researcher. The data is intended to be stored for at least five (5) years in the Department of Family Medicine.

PERMISSION FOR USE OF SCALES

Permission was obtained from the Hill-Bone Scales Team on October 18th 2022, to utilize the Hill-Bone Compliance to High Blood Pressure Therapy Scale (Appendix 9).

PRETESTING

Pretesting commenced on the 2nd December 2022 after ethical approval was granted from both The University of the West Indies, St Augustine and the North Central Regional Health Authority. This was performed at the Maloney Local Health Centre Chronic Disease Outpatient Clinic. Ten (10) participants were selected through convenience sampling. None of the participants were patients of Site A, where the research was carded to be conducted. Participants meeting the inclusion criteria were approached on their clinic day and informed about the objective, rationale and its purpose as a pretest. Participation was voluntary. Those who agreed gave consent and then had an interviewer- administration of the questionnaire, as well as blood pressure and anthropometric measurements taken.

The objectives of the pretest were to :

(i) Identify the time taken to complete the questionnaire

(ii) Receive feedback on words or phrases that were poorly understood, inappropriately worded, or should be excluded

(iii) To allow proper assessment of technique and interval timing done between blood pressure measurements

(iv) To allow proper assessment of technique for waist circumference, weight and height measurements.

From the pretest study it was determined that the questionnaire and anthropometric measurements took an average of 10 – 15 minutes to complete. This was a favourable outcome which supported its utility in administering the questionnaire in the outpatient clinic setting at the health centre.

The feedback given was used to adjust the questionnaire. Most participants did not understand the term "unit of alcohol". This was changed to "standard drink of alcohol" and each interviewer had a graphical depiction of what a standard alcoholic drink looked like for participants' understanding. Grammatical errors and measurement units for height and weight were also standardized. It was noted after taking the measurements that height was easier to measure in centimetres, as opposed to the initial metres cited and weight was easier to measure in kilograms, as all weight scales had been programmed to the kilogram setting for clinic.

9 of 10 participants agreed that interviewer administration format for the questionnaire was preferable to self-administration. 1 person stated that one question on monthly income was "uncomfortable" to answer in an interviewer administered setting. Other persons expressed no feelings of discomfort with the questions asked. Most patients preferred the interviewer-administered questionnaires because clarification could be given in real time, which allowed them to give an answer, rather than opting to skip the question. This was particularly helpful in keeping participants' focus during administration, allowed for a lower item nonresponse bias and overall higher response rate.

TRAINING

Research assistants were obtained and first given the HEARTS in the Americas Technical Package to review the accurate technique for taking blood pressure measurements. A two (2) hour training session was conducted on measurement taking including blood pressure, height, weight and waist circumference and on the administration of the questionnaire. The questionnaire was thoroughly examined with the assistants so that they were familiarized with its content and could adequately answer any questions that participants may have, that require clarification during the face-to-face interview. It additionally ensured that they had the same understanding and interpretation of the questionnaire as the primary investigator.

The assistants were also coached on how to answer any difficult questions or issues that may arise and possible solutions that could be implemented. The assistants were all junior medical doctors.

DATA COLLECTION

Data collection was carried out over a 4 month period from December 6th 2022 to April 02nd 2023. The ethical approvals obtained from the ethical committees of The University of the West Indies, St Augustine and The North Central Regional Health Authority were submitted along with the research proposal to the Primary Care General Manager and the County Medical Officer of Health, to gain permission for the researcher and assistants to conduct the research. Once granted, the Primary Care Physician II (Administration), the direct supervisor for clinical duties was approached with approvals received for the research. Management for clerical and nursing staff, as well as the Chronic Disease clinic doctors were also sensitized of the proposed research to be conducted, the time frame allocated to conduct the study and the names of the research assistants.

The research assistants were volunteer medical doctors who were trained prior to the study. They introduced themselves as research assistants to all potential participants in the study and were not identifiable as medical doctors. Once they consented, participants partook in interviewer- administered questionnaires, face-to-face, in an enclosed doctor's room within the clinic setting and had their anthropometric measurements taken. Participants were given a copy of the consent form and participant information sheet to keep. The second copy of the consent form and the completed questionnaire were placed in separate envelopes, collected at the end of the clinic day and stored in a locked cabinet in the Primary Care Physician II's office.

STATISTICAL ANALYSIS

Analysis of the data collected was performed using SPSS 29 for Windows. Continuous data was presented as means and standard deviations (SD), while categorical data was presented as frequencies and percentages. Differences in HB-MAS and HBCHBPT were compared using independent samples t-tests and one-way analysis of variance (ANOVA), while differences between proportions of blood pressure (BP) control groups were compared using Pearson's $\chi 2$ tests. Tukey's HSD test was used in ANOVA post-hoc analysis for multiple comparisons. Bivariate analyses including odds ratios (OR) with 95% confidence intervals (CIs) were used to estimate the strength of association between independent factors and BP control. All variables with p-values < 0.20 in the bivariate analyses were fitted in to multivariable logistic regression with adjusted odds ratios (AOR) and 95% CIs to control for the possible effects of confounding. Statistical significance was set at $p < 0.05$.

RESULTS

RESPONSE RATE & NON-RESPONDERS

A total of 320 patients registered to the HEARTS Hypertension treatment registry, in the Chronic Disease and Lifestyle outpatient clinic were approached to participate in the research. Of the 320 patients approached, 287 were enrolled into the study, creating an overall response rate of 89.7%. Of the non-responders, 48.6% were female and 56.4% were male. Some of the reasons cited for their non-participation were, a lack of time to complete the questionnaire, a need to consult with their relative (usually spouse or church elder) first before consenting to the study and a lack of interest in the research topic.

SOCIODEMOGRAPHIC CHARACTERISTICS OF PATIENTS

Among the n = 287 patients enrolled in the study, 169 (58.9%) were over the age of 60 years. Other sociodemographic characteristics are summarized in Table 1. The majority were female (n = 180, 62.7%) and earned less than $5,000 TT each month (n = 186, 64.8%). The most common ethnicity in the study was Afro-Trinidadian (n = 138, 48.1%), married persons (n = 118, 41.1%), and schooling to at least secondary level (n = 186, 64.8%). Fig.1 shows age distribution of men and women.

Table 1. Sociodemographic characteristics of participants

Sociodemographic characteristic	**n**	**%**
	287	
Age		
≤60 years	118	41.1
>60 years	169	58.9
Gender		
Male	107	37.3
Female	180	62.7
Ethnicity		

Afro-Trinidadian	138	48.1
Indo-Trinidadian	44	15.3
Mixed	105	36.6
Marital status		
Single	67	23.3
Married	118	41.1
Divorced/Separated	25	8.7
Widowed	55	19.2
Common-law	22	7.7
Education		
Up to primary education	100	34.8
Secondary education	86	30.0
Technical/Vocational	59	20.6
University education	42	14.6
Income per month		
<$5,000 TT	186	64.8
$5,000-$9,999 TT	76	26.5
≥$10,000 TT	25	8.7

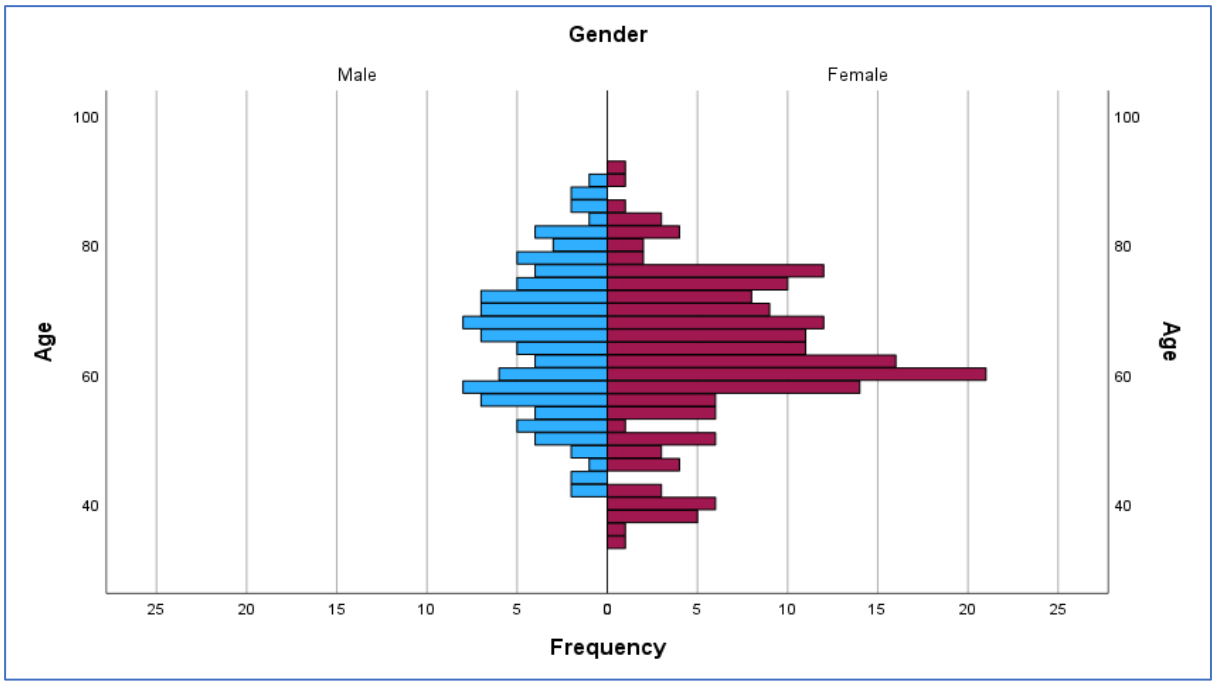

Fig.1 Age distribution of men and women

RISK FACTORS FOR HYPERTENSION AND COMORBIDITIES

Most patients either did not consume alcohol or had their alcohol use assessed as low risk (n = 258, 89.9%) based on the Alcohol Use Disorders Identification Test Consumption (AUDIT-C). Using the Heaviness of Smoking Index, 274 (95.5%) patients either did not smoke or were assessed as having low nicotine dependence, while according to the Physical Activity Index (PAI) based on the General Practice Physical Activity Questionnaire (GPPAQ), 176 (61.3%) were classified as being inactive, and the 2-item CUP FV (Fruits and Vegetables) presented most patients (n = 282, 98.3%) having inadequate nutritional practices, i.e., consuming less than four servings of fruits and vegetables daily (Table 2). Twenty-three patients in this study had cardiovascular diseases (8.0%). Diabetes (n = 128, 44.6%) and elevated cholesterol (n = 117, 40.8%) were the most common comorbidities of patients in this study (Figure 1).

Table 2. Risk factors for hypertension and possible factors associated with blood pressure control

Factors	n=287	%
Alcohol consumption		
Does not drink alcohol	116	40.4
Low risk	142	49.5
Increasing risk	22	7.7
High risk/Dependence	7	2.4
Nicotine dependence		
Does not smoke	260	90.6
Low	14	4.9
Medium/High	13	4.5
Physical activity		
Inactive	176	61.3
Moderately inactive	44	15.3
Moderately active	34	11.8
Active	33	11.5

Nutritional practices		
Inadequate	282	98.3
Adequate	5	1.7
Cardiovascular disease		
No	264	92.0
Yes	23	8.0

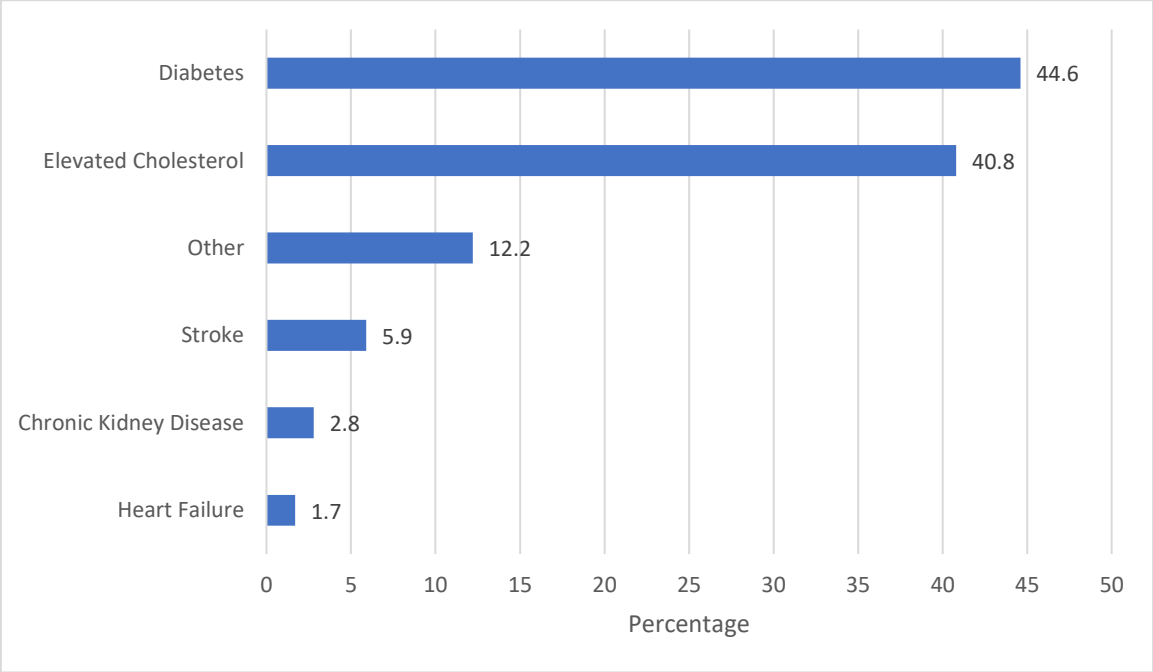

Figure 2. Presence of comorbidities in patients

ANTIHYPERTENSIVE THERAPY

The distribution of patients on the HEARTS protocol followed: unspecified HEARTS schedule (11.1%), Step 1 (54%), Step 2 (27.2%), Step 3 (4.5%), and Step 4 (3.1%). Approximately half of the participants in this study (n = 144, 50.2%) took night-time antihypertensive medication (Table 3).

Table 3. Hypertensive treatment regime

Medications	n=287	%
HEARTS protocol		
Unspecified HEARTS Step	32	11.1
Step 1	155	54.0
Step 2	78	27.2
Step 3	13	4.5
Step 4	9	3.1
Night-time antihypertensive medication		
No	143	49.8
Yes	144	50.2

CLINICAL CHARACTERISTICS

Patients presented an average weight of 82.5 ± 18.9 kg, an average height of 164.3 ± 9.70 cm, a mean systolic BP of 139.6 ± 18.1 mmHg, and a mean diastolic BP of 81.9 ± 10.6 mmHg. Ninety patients (31.4%) had an overweight BMI classification, while 138 (48.1%) were suffering from obesity. Most patients had waist circumference readings putting them at very high risk (n = 186, 64.8%) (Table 4). The overall proportion of patients with optimally controlled BP was 52.3% (95% CI: 46.5%-58.0%)

Table 4. Anthropometric and blood pressure measurements of participants (n = 287)

Measurements	Mean ± SD	
Weight (kg)	82.5 ± 18.9	
Height (cm)	164.3 ± 9.70	
Systolic BP (mmHG)	139.6 ± 18.1	
Diastolic BP (mmHG)	81.9 ± 10.6	
	N	**%**
BMI		
Underweight/Healthy Weight	59	20.6
Overweight	90	31.4
Obesity	138	48.1
Waist circumference		
Low risk	39	13.6
High risk	62	21.6
Very high risk	186	64.8
BP control		
Uncontrolled	137	47.7
Controlled	150	52.3

HILL-BONE MEDICATION ADHERENCE SCALE (HB-MAS) and HILL-BONE COMPLIANCE TO HIGH BLOOD PRESSURE THERAPY SCALE (HBCHBPT)

The overall proportion of patients with higher adherence to high blood pressure therapy using the HBCHBPT was 46.3% (95 % CI: 40.6-52.1%),with the median split method and a mean score of 50.7 ±3.52 , while the proportion of patients with higher adherence to medication using the HB-MAS was 41.5% (95% CI:35.9- 47.2%),with the median split method and a mean score of 32.5 ±2.95 , (Table 5).

Table 5 presents the differences in HB-MAS and HBCHBPT according to the sociodemographic characteristics of patients in the study. An independent samples t-test revealed significant differences were observed in HB-MAS (p = 0.003) and HBCHBPT (p = 0.001) when participants' ages were considered. Higher scores were observed for HB-MAS and HBCHBPT in patients over age 60 as compared with persons up to 60 years old, therefore, representing higher medication and overall hypertensive therapy adherence, respectively.

Table 5. Differences in HB-MAS and HBCHBPT for sociodemographic characteristics of participants

Sociodemographic characteristic	**HB-MAS**		**HBCHBPT**	
	Mean ± SD	**p-value**	**Mean ± SD**	**p-value**
Total	32.5 ± 2.95		50.7 ± 3.52	
Age		0.003[b]		0.001[b]
≤60 years	31.9 ± 2.97		49.9 ± 3.57	
>60 years	32.9 ± 2.86		51.3 ± 3.37	
Gender		0.263[b]		0.099[b]
Male	32.2 ± 3.29		50.3 ± 3.92	
Female	32.6 ± 2.72		51.0 ± 3.24	
Ethnicity		0.226 [a]		0.296 [a]
Afro-Trinidadian	32.2 ± 3.25		50.4 ± 3.82	
Indo-Trinidadian	32.9 ± 2.61		51.1 ± 3.28	
Mixed	32.7 ± 2.62		51.0 ± 3.17	
Marital status		0.136 [a]		0.050 [a]
Single	32.4 ± 3.08		50.6 ± 3.53	
Married	32.2 ± 3.13		50.4 ± 3.77	
Divorced/Separated	33.4 ± 1.71		51.8 ± 2.29	
Widowed	33.0 ± 2.44		51.5 ± 2.96	
Common-law	31.7 ± 3.51		49.4 ± 3.95	
Education		0.983 [a]		0.989 [a]

Up to primary education	32.5 ± 3.40		50.7 ± 4.10	
Secondary education	32.4 ± 2.85		50.7 ± 3.35	
Technical/ Vocational	32.6 ± 2.66		50.8 ± 3.15	
University Education	32.4 ± 2.41		50.6 ± 2.86	
Income		0.861 [a]		0.880 [a]
<$5,000 TT	32.5 ± 3.06		50.8 ± 3.68	
$5,000-$9,999 TT	32.3 ± 2.87		50.5 ± 3.40	
≥$10,000 TT	32.6 ± 2.38		50.7 ± 2.53	

[a]One-way ANOVA [b]Independent-samples t-test

FACTORS ASSOCIATED WITH BLOOD PRESSURE CONTROL

Table 6 presents the bivariate analysis of sociodemographic factors affecting BP control. Income was found to be significantly associated with BP control (p = 0.033). Patients with monthly incomes of at least $10,000 TT (OR: 3.378, 95% CI: 1.291-8.838) had over three times the odds of having optimally controlled BP compared with persons earning less than $5,000 TT per month. Age, gender, ethnicity, marital status, and education were not found to be significantly associated with BP control in this study (p > 0.05).

Table 6. Bivariate associations between BP control and sociodemographic characteristics of patients

Sociodemographic characteristic	**BP Control**		**p-value**	**OR[b] (95% CI)**
	Uncontrolled n=137(%)	**Controlled n=150(%)**		
Age			0.750	
≤60 years[a]	55 (40.1)	63 (42.0)		1
>60 years	82 (59.9)	87 (58.0)		0.926 (0.578- 1.483)

Gender			0.475	
Male[a]	54 (39.4)	53 (35.3)		1
Female	83 (60.6)	97 (64.7)		1.191 (0.737-1.923)
Ethnicity			0.551	
Afro-Trinidadian[a]	66 (48.2)	72 (48.0)		1
Indo-Trinidadian	24 (17.5)	20 (13.3)		0.764 (0.387-1.509)
Mixed	47 (34.3)	58 (38.7)		1.131 (0.680-1.883)
Marital status			0.972	
Single[a]	33 (24.1)	34 (22.7)		1
Married	54 (39.4)	64 (42.7)		1.150 (0.631-2.097)
Divorced/Separated	13 (9.5)	12 (8.0)		0.896 (0.357-2.246)
Widowed	27 (19.7)	28 (18.7)		1.007 (0.493-2.054)
Common-law	10 (7.3)	12 (8.0)		1.165 (0.443-3.061)
Education			0.292	
Up to primary education[a]	49 (35.8)	51 (34.0)		1
Secondary education	46 (33.6)	40 (26.7)		0.835 (0.469-1.488)
Technical/Vocational	27 (19.7)	32 (21.3)		1.139 (0.597-2.170)
University education	15 (10.9)	27 (18.0)		1.729 (0.823-3.636)
Income			0.033	
<$5,000 TT[a]	96 (70.1)	90 (60.0)		1
$5,000-$9,999 TT	35 (25.5)	41 (27.3)		1.250 (0.732-2.133)
≥$10,000 TT	6 (4.4)	19 (12.7)		3.378 (1.291-8.838)

[a]Reference Category
[b] The Odds Ratio (OR) assessed is for Blood Pressure Controlled

Table 7 presents the bivariate analysis of potential risk factors affecting BP control. Having an active lifestyle was observed to be positively associated with BP control with these patients displaying almost three times the odds of having optimally controlled BP compared with persons who were inactive (OR: 2.728, 95% CI: 1.200-6.201). Other risk factors including

cardiovascular disease, alcohol consumption, nicotine dependence, and nutritional practices were not found to be significantly associated with BP control in this study ($p > 0.05$).

Table 7. Bivariate associations between BP control and risk factors

Risk factors	BP Control		p-value	OR[b] (95% CI)
	Uncontrolled n=137 (%)	Controlled n=150 (%)		
Alcohol consumption			0.416	
Does not drink alcohol[a]	54 (39.4)	62 (41.3)		1
Low risk	70 (51.1)	72 (48.0)		0.896 (0.548-1.464)
Increasing risk	8 (5.8)	14 (9.3)		1.524 (0.594-3.910)
High risk/Dependence	5 (3.6)	2 (1.3)		0.348 (0.065-1.869)
Nicotine dependence			0.684	
Does not smoke[a]	122 (89.1)	138 (92.0)		1
Low	8 (5.8)	6 (4.0)		0.663 (0.224-1.965)
Medium/High	7 (5.1)	6 (4.0)		0.758 (0.248-2.316).
Physical activity			0.069	
Inactive[a]	89 (65.0)	87 (58.0)		1
Moderately inactive	24 (17.5)	20 (13.3)		0.852 (0.439-1.654)
Moderately active	15 (10.9)	19 (12.7)		1.296 (0.619-2.712)
Active	9 (6.6)	24 (16.0)		2.728 (1.200-6.201)
Nutritional practices			0.999	
Inadequate[a]	135 (98.5)	147 (98.0)		1
Adequate	2 (1.5)	3 (2.0)		1.378 (0.227-8.370)
Cardiovascular disease			0.379	
No[a]	124 (90.5)	88 (93.3)		1
Yes	13 (9.5)	10 (6.7)		0.681(0.289-1.609)

[a]Reference Category
[b]The Odds Ratio (OR) assessed is for Blood Pressure Controlled

Table 8 presents the bivariate analysis of hypertensive treatment regime, HB-MAS and HBCHBPT affecting BP control. HEARTS protocol step, taking night-time antihypertensive medication, medication adherence, and hypertensive therapy adherence were not found to be significantly associated with BP control in this study ($p > 0.05$).

Table 8. Bivariate associations between hypertensive treatment regime, HB-MAS and HBCHBPT with BP control

Variable	BP Control			
	Uncontrolled n=137 (%)	**Controlled n=150 (%)**	**p-value**	**OR[b] (95% CI)**
HEARTS protocol			0.316	
Unspecified HEARTS Step[a]	14 (10.2)	18 (12.0)		1
Step 1	73 (53.3)	82 (54.7)		0.874 (0.406-1.880)
Step 2	35 (25.5)	43 (28.7)		0.956 (0.417-2.189)
Step 3	8 (5.8)	5 (3.3)		0.486 (0.130-1.816)
Step 4	7 (5.1)	2 (1.3)		0.222 (0.040-1.241)
Night-time antihypertensive medication			0.139	
No[a]	62 (45.3)	81 (54.0)		1
Yes	75 (54.7)	69 (46.0)		0.704 (0.442-1.121)
HB-MAS	32.4 ± 3.13	32.6 ± 2.78	0.565	1.024 (0.946-1.108)
HBCHBPT	50.6 ± 3.82	50.8 ± 3.22	0.676	1.014 (0.949-1.084)

[a]Reference Category
[b]The Odds Ratio (OR) assessed is for Blood Pressure Controlled

Table 9 presents the bivariate analysis of anthropometric measurements affecting BP control. BMI and waist circumference were not found to be significantly associated with BP control in this study ($p > 0.05$).

Table 9. Bivariate associations between anthropometric measurements and BP control

Anthropometric measurements	**BP Control**		**p-value**	**OR[b] (95% CI)**
	Uncontrolled n=137 (%)	**Controlled n=150 (%)**		
BMI			0.122	
Underweight/Healthy weight[a]	22 (16.1)	37 (24.7)		1
Overweight	49 (35.8)	41 (27.3)		0.498 (0.254 –0.973)
Obesity	66 (48.2)	72 (48.0)		0.649 (0.347- 1.211)
Waist circumference			0.914	
Low risk[a]	18 (13.1)	21 (14.0)		1
High risk	31 (22.6)	31 (20.7)		0.857 (0.384- 1.913)
Very high risk	88 (64.2)	98 (65.3)		0.955 (0.478- 1.907)

[a] Reference Category
[b]The Odds Ratio (OR) assessed is for Blood Pressure Controlled

BLOOD PRESSURE CONTROL AND PREDICTORS

All variables with p < 0.20 in the bivariate analyses were fitted in to multivariable logistic regression to control for the possible effects of confounding. Controlling for physical activity level and use of antihypertensive medications at night, patients earning at least $10,000 TT per month (AOR: 3.536, 95% CI: 1.255-9.957) had over three times the odds of BP control compared with persons with monthly incomes less than $5,000 TT. Overweight patients (AOR: 0.459, 95% CI: 0.229-0.920) had lower odds of having optimally controlled BP compared with persons of a healthy weight (Table 10).

Table 10. Multivariable associations with BP control

Variable	p-value	AOR[b,c] (95% CI)
Income		
<$5,000 TT[a]	-	1
$5,000-$9,999 TT	0.273	1.368 (0.781-2.397)
≥$10,000 TT	0.017	3.536 (1.255- 9.957)
Physical activity		
Inactive[a]	-	1
Moderately inactive	0.469	0.776 (0.391-1.540)
Moderately active	0.811	0.907 (0.406-2.017)
Active	0.062	2.240 (0.961-5.219)
Night-time antihypertensive medication		
No[a]	-	1
Yes	0.145	0.699 (0.432-1.132)
BMI		
Underweight/Healthy weight[a]	-	1
Overweight	0.028	0.459 (0.229-0.920)
Obesity	0.172	0.639 (0.337-1.214)

[a] Reference Category
[b]The Adjusted Odds Ratio (AOR) assessed is for Blood Pressure Controlled
[c]Factors adjusted for: waist circumference, adherence, HEARTS step, presence of cardiovascular disease, nutritional practices, smoking practices, alcohol consumption, education, marital status, ethnicity, gender and age.

In summary, the response rate was 89.7% with a sample of 287 participants. The overall proportion of patients with optimally controlled blood pressure was 52.3% (95% CI: 46.5%-58.0%); with a mean systolic and diastolic blood pressure ±SD of 136.6 ±18.1 and 81.9 ±10.6 respectively. Most participants were on Step 1 of the HEARTS Hypertension treatment protocol (n=155, 54%). Blood pressure control was significantly and positively associated with higher monthly incomes of greater than $10,000 TT per month (AOR: 3.536, 95% CI: 1.255-9.957, p =0.017), while being overweight (AOR 0.459, 95% CI: 0.229-0.920, p=0.028) was significantly associated with lower odds of having optimally controlled blood pressure. Having an active lifestyle (AOR 2.240, 95% CI: 0.961-5.219) was positively associated with blood pressure control though not statistically significant. Patients over 60 years of age had higher adherence scores, representing higher medication (HB-MAS) and overall hypertensive therapy adherence (HBCHBPT); (p= 0.003), (p= 0.001) respectively, while 46.3% of all participants had high adherence to their antihypertensive treatment therapy (HBCHBPT). There was no association found between hypertension control and sociodemographic factors such as age, gender, ethnicity, marital status and education. There was also no association found between blood pressure control and presence of cardiovascular disease, adherence scores, HEARTS Step categories and

risk factors such as cholesterol, alcohol consumption, nicotine dependence, nutritional practices, waist circumference.

DISCUSSION

PREVALENCE OF BLOOD PRESSURE CONTROL

The overall prevalence of blood pressure control in this study was found to be 52.3%. This figure supersedes the expected national blood pressure control rate for Trinidad and Tobago as stated by the WHO Global Health Observatory report 2019 of 20.9%. [8] This figure is also higher than the target set in priority area #2, to increase the proportion of persons with hypertension for whom the condition is controlled by 50 %, as outlined in the National Strategic Plan for the Prevention and Control of Non-communicable diseases Trinidad and Tobago 2017-2021.[43] These results were also found to be higher than those observed in two Trinidadian studies by MC Gulliford et al [23,44] and another by D Mahabir and MC Gulliford [22], which revealed blood pressure control rates of 11%, 23% and 13% respectively. The similarities observed in these studies were that they all included participants who attended primary care clinics in the public healthcare facilities with the exception of one which included both private and public primary care facilities from Barbados, Tortula and Trinidad and Tobago.[44] The low blood pressure control rates identified in the aforementioned studies may have been influenced by the changes in drug utilization which were a direct result of changes in drug procurement at a national level, as well as differences in the expertise of health professionals involved in the management of hypertension. This common thread could explain the similar blood pressure control rates found in other regional countries such as Barbados [8,45] and Jamaica.[8,46] The difference in the level of blood pressure control in this study (52.3%) might be due to a more aggressive strategy in the treatment of hypertension, with the use of standardized free equivalent dose combination medication, an available substitute for the fixed dose combination medication as outlined in the HEARTS hypertension treatment protocol.

The hypertension control rate for this study was comparable to those seen in high income countries such as South Korea, Iceland and Canada.[47,48] An Australian and USA based study by Ernst et al, also found comparable control rates in older adults using combination therapy; 50.2 % vs 65.6% respectively.[49] The difference in control rates between these two cohorts can be explained by "American physicians' liberal use of combination treatment for initial therapy in accordance with USA guidelines for hypertensive therapy."[49] This is in keeping with the principles of the HEARTS hypertension treatment protocol. These figures were also higher than the groups treated with monotherapy. This similarity in the level of blood pressure control can also be explained in the similarity of the age of participants, as nearly three fifths of the participants were above the age of 60, in our study. However, one notable difference in this study was that data collection came from participants involved in a randomized control trial.

A cross sectional Swedish study among 4594 primary care patients revealed a blood pressure control rate of 54%.[50] This study was also comparable to our study in the similarities seen in their target for blood pressure control (<140/90 and <130/80 in those at high risk i.e. diabetes and renal impairment) and primary care patient setting. It once again revealed that those receiving combination therapy for hypertension saw lower blood pressure readings. This furthermore attests to the benefits of combination therapy for blood pressure control.

Several studies done in Latin American countries have revealed control rates that are akin to those seen in upper to middle class or high-income countries; >50%.[20,21,51] One common thread linked to the high levels of blood pressure control in these studies, was the organization of their health system which aided in offering patients comprehensive multidisciplinary, team based care. Likewise, this is also promoted in the WHO/PAHO HEARTS initiative and may have contributed to the blood pressure control rate we found in our study. Additionally, all of the doctors at the chronic disease clinics have received postgraduate training in family

medicine, as well as PAHO training on the HEARTS initiative. Our results have followed the likes of Cuba, Colombia and Chili who launched the WHO/ PAHO HEARTS initiative in 2017 and have "already seen favourable results, with control rates among patients varying from 55-83%." [51]

Another explanation for the results of this study, which found the prevalence of blood pressure control to be 52.3% , may be physicians' reluctance to up titrate patients' medication regime due to uncertainty over patient's accurate blood pressures. This is especially seen when there is a discrepancy between office blood pressure recordings and verbal or written reports of home blood pressure readings. Additionally, limitations in healthcare delivery, insufficient understanding of comfort levels regarding dose escalation, and potential medication side effects may have contributed to these outcomes.

In the current study, more than half of participants (54 %) were only on the first step of the HEARTS hypertension treatment protocol. The phenomenon of therapeutic inertia in hypertension management is widely acknowledged as a clinical challenge.[52] Research indicates that reducing therapeutic inertia by 50% could potentially result in a 20% improvement in hypertension control within a one-year timeframe.[53] Studies have also shown that sustained systolic blood pressure control is associated with a lower rate of multimorbidity progression as well as a lower risk of progressing to six or more chronic conditions.[54]

SIGNIFICANT ASSOCIATIONS

The majority of participants in this study earned less than 5000 TT per month (64.8%). The result of the bivariate analysis of sociodemographic factors affecting blood pressure control revealed that income was found to be significantly associated with blood pressure control (p = 0.033). Patients with monthly incomes of at least $10,000 TT (OR: 3.378, 95% CI: 1.291-

8.838, p=0.033; AOR: 3.536, 95% CI: 1.255-9.957) had over three times the odds of having optimally controlled blood pressures compared with persons earning less than $5,000 TT per month. Similar findings were found in studies by Qin et al (OR = 0.73) and Shahu et al (OR =0.48), which showed that lower income groups were less likely to have controlled hypertension [55,56]

More than half of the participants in this study were over the age of 60 years, which in the context of this population aligns with retirement for most individuals in this category. Additionally, almost a third of the study population achieved primary school education as their highest level of scholastic success and 51.2 % of participants were single, divorced or separated or widowed. These factors can explain why most participants received an income of <5000 TT monthly and it can be inferred that the majority within this group may not have a partner or other support to supplement their total monthly intake.

Economically poorer individuals may be burdened with proportionally higher out of pocket costs when it comes to healthcare, compared to economically richer individuals. These costs can include transportation to clinic or purchase of medication if there is no availability at the public healthcare pharmacies. This can also affect patient compliance with medication and thus blood pressure control. Additionally, stress levels which were not explored in this study, may be higher among individuals from lower income households because of unemployment, community safety, financial burdens, and violence and other social challenges.[56,57] These stress factors may exert an effect on blood pressure response to antihypertensive medication treatment, thus possibly explaining why blood pressure control amongst these individuals was difficult to achieve. Conversely, people with higher household incomes are more likely to live or work in a healthier environment, therefore increasing their chance of having their blood pressure adequately controlled.[55]

Approximately 80% of participants in our current study were classified as overweight or obese. While the bivariate analysis of anthropometric measurements affecting blood pressure control, revealed that BMI was not found to be statistically associated with blood pressure control in this study (p >0.05), the multivariate analysis found that overweight patients; higher BMI (AOR : 0.459, 95% CI :0.229-0.920, p=0.028) had lower odds of having optimally controlled BP compared with persons of a healthy weight. A finding which was statistically significant. A US population-based survey, NHANES conducted by the National Centre for Health Statistics of the Centres for Disease Control and Prevention found similar rates among BMI classes which were compatible with the observations of our current study, normal BMI 15.6% vs 20.6%, overweight 31% vs 31.4% and obese 53% vs 48.1%.[58] However, unlike our current study, this study found that the control of hypertension was surprisingly better among those with a higher BMI. Conversely, increased BMI was found to be a substantial risk factor for poor blood pressure control in the German population-based HYDRA study, [59] a finding that is well in line with previous observations.[60] Similar results were found in Latin American and Caribbean studies.[21,61]

In Trinidad and Tobago overweight and obesity continue to be a burden to the health and wellbeing of residents at a prevalence of 46 % in 2016.87 Globally it is projected that “by 2030, 1 in 5 women and 1 in 7 men will be living with obesity (BMI ≥30 kg/m2), which is approximated to be more than one billion people worldwide.”[62] This is further compounded by the alarming rates of childhood obesity; reflected in recent data from developing countries, including the Caribbean, which is a known predictor for the development of overweight and obesity in adulthood.

One explanation for the high proportions of overweight and obese individuals in this current study may be due to the high levels of physical inactivity (n=176, 61.3%) and inadequate nutritional practices (n=282, 98.3%) found. Physical activity and nutritional practices are two

lifestyle modifications that are integral components in the management of obesity for an individual. Additionally, with the majority of participants being over the age of 60 (n=169, 58.9%), there is likely to be an increased prevalence of joint and mobility disorders limiting physical activity among this group, which was not explored in this study, if the condition was not clinically diagnosed.

ASSOCIATION BETWEEN BLOOD PRESSURE AND ACTIVITY

Having an active lifestyle was observed to be positively associated with blood pressure control, with these patients displaying more than twice the odds of having optimally controlled blood pressures compared to persons who are inactive (OR: 2.728, 95% CI: 1.200-6.201, AOR: 2.240, 95% CI: 0.961- 5.219, p=0.062). Though not statistically significant, there was a trend towards an association as the p value was close to 0.05. Several studies have reported a positive association between blood pressure control and physical activity.[63,64,65] One difference noted in these studies were the physical activity assessment tools used. DLW (doubly labelled water) is suggested as the gold standard for energy expenditure, however it is not a practical tool for use in our population due to its high cost and participant invasiveness. Physical activity is usually categorized based on level of intensity and minutes spent per week, whereas in our current study the GPPAQ tool also focused on occupational physical activity with no physical limitations.[66] With more than half of participants in our current study meeting age criteria for retirement >60 years (n= 169, 58.9%), a large proportion of participants may not be in paid employment or may suffer from mobility difficulties which can further explain the findings of our research.

Despite its importance, regular activity is still not customary in the population especially among the elderly group. In Trinidad and Tobago, physical inactivity levels are quite high in

those above 70 years of age, 41% among males and 65% among females.[67] Similarly in our current research we found high levels of overall inactivity, 61.3%(n = 176).

ASSOCIATION BETWEEN BLOOD PRESSURE AND ADHERENCE

Treatment adherence is a pervasive patient-level factor that is related to blood pressure target achievement. The Hill-Bone Compliance to High Bood Pressure Therapy Scale and the Hill-Bone Medication Adherence Scale, are both widely used as indirect measurements of adherence to hypertension therapy. Overall adherence to hypertension management and medication treatment were found to be 46.3% (95% CI: 40.6-52.1%) and 41.5% (95% CI: 35.9-47.2%) respectively, using the median split method which recommends using artificial categorization to interpret continuous variables. This prevalence is relatively low compared to the global average of 50%.[68] However, the results were similar to two low-middle income country studies in Egypt and Palestine, which produced antihypertensive medication adherence rates of 46.12% and 45.8% respectively.[69,70] These studies were similar to our study in their patient selection of outpatient clinic participants, as well as it was observed that in the Palestinian study, like ours, there was a preponderance of females, two or more chronic conditions and government assistance with health treatment. Two Trinidadian cardiovascular outpatient clinic studies also concluded very low rates of good medication adherence of 25% and 21.7% respectively.[71,72] While another local study done in a primary care outpatient setting, similarly concluded that two fifths of patients (42%) had high adherence to their antihypertensive treatments.[24]

In contrast, the good medication adherence rate of a predominantly Caucasian population was significantly higher at 70 %, in a study done by Krousel-Wood et al.[73] This was consistent

with other studies which reported higher adherence rates among white participants.[73] The differences in study population, lack of standard measurements for adherence and sampling strategies may have contributed to the differences in the reported adherence rates among these studies. Our study did not find a correlation between adherence scores and blood pressure control, which was also found to be an insignificant correlating factor in other studies.[74,75] This might be due to the multifactorial determinants of blood pressure control, of which medication adherence is one of several contributing factors. However, many studies have shown a positive association between medication adherence and blood pressure control.[76,77]

While medication adherence and hypertension therapy adherence were not found to be significantly associated with blood pressure control, an independent samples t-test revealed significant differences in HB-MAS ($p = 0.003$) and HBCHBPT ($p = 0.001$) when participants' ages were considered. Higher scores were observed for HB-MAS and HBCHBPT in patients over the age of 60 as compared with persons less than 60 years of age. This therefore represents higher medication adherence and overall hypertensive therapy adherence, respectively. These findings are comparable to other studies.[77,78] This may be explained in the realization that comes with age seen in older persons. Those classified as middle aged – elderly are more accepting and better familiar with their higher risk of age-related health complications and morbidity and thus are more adherent to treatment given by their primary care provider. Additionally, physicians in our setting, may take more time to educate older patients, who have multiple symptomatic comorbidities, about their conditions in comparison to younger patients who have lower cardiovascular disease risks.

A recent study found also concluded that less medication discussion between providers and patients was associated with a six (6) fold increased odds of poor adherence to medication.[79] This discovery suggests that the decreasing motivation to consistently follow medication regimens over time in younger individuals with hypertension, may be influenced by the

asymptomatic nature of hypertension and the delayed onset of chronic cardiovascular disease coupled with lack of medication discussion from providers.

ASSOCIATION BETWEEN BLOOD PRESSURE CONTROL AND ALCOHOL AND SMOKING

Our current study revealed that almost three fifths of participants consumed alcohol, with less than 3 % of participants being classified as high risk. Among those classified as low risk for alcohol consumption 48% had controlled blood pressures, compared to 51.1%, who were uncontrolled, while amongst those who did not consume alcohol 41.3% were controlled while 39.4% were uncontrolled. This however, was not found to be significantly associated with blood pressure control in this study ($p > 0.05$). In Trinidad and Tobago, alcohol use is recognised as a major modifiable contributor to non-communicable diseases including hypertension, with approximately two thirds of households in Trinidad and Tobago reporting alcohol use.[43,80] Several global studies have also consistently demonstrated that alcohol is an important modifiable risk factor for hypertension among populations from a range of geographic territories including North America, Asia and Europe.[81] Alcohol represents the most important pressor agents in our diet and may influence the metabolism of antihypertensive drugs, through decreased absorption and increased metabolic clearance, thus reducing their effect.[82] Many studies reflect this association of poor control of hypertension with alcohol consumption[64,83,84,85] The validity of the interviewer based administration of this questionnaire can be questioned, as this may have led to interviewer bias, with participants underestimating their alcohol intake across the entire cohort in our current study. This could have led to the non-association of the level of alcohol consumption and blood pressure control found in our current study.

In our study, 91% of participants were non-smokers, while among the participants who smoked, approximately 5% were classified as low or medium/ high risk respectively. A bivariate analysis evaluated the association between blood pressure control and nicotine dependence. It revealed that among participants with uncontrolled blood pressures approximately 90 % were non-smokers and less than 10 % were smokers, while among those with controlled blood pressures, similarly 92% (p =0.684) were nonsmokers and the remainder were current smokers. This risk factor was not found to be significantly associated with blood pressure control in this study. Similar results were observed in studies done in Kenya and China, which "failed to reveal any significant dose dependent effect of current smoking on blood pressure indices."[85,86] One explanation for the results in our current study may have been because of the low number of participants that identified a current smoker (n=27). The result of this smaller sample was not sufficiently powered to detect a difference between the groups. This may be due to the researcher administered nature of the questionnaire which lends itself to interviewer bias, therefore leading to an underestimation of smokers in this study. Another contributing factor for this underestimation may be because the questionnaire failed to quantify the duration that a participant identified as being an ex-smoker. The blood pressure of participants who had their last cigarette within the previous six months may still be influenced by changes to the small and large arteries and damage to the endothelium that is thought to be important to the pathophysiology of hypertension.[86]

Globally, 22.3% of persons are tobacco users; 36.7% of men and 7.8% of women.[87] In Trinidad and Tobago, approximately 30 % of men and 5% of women are current tobacco users, which is also similar to the global rate. In our current study the distribution of current tobacco users between the sexes were 33% female and 67% male. The reason for this disparity from what is found both globally and nationally may be explained by this study's small sample size of current smokers. Smoking is thought to be related to the development of

hypertension because of its association with nicotine, which plays an active role as an adrenergic agonist, mediating local and systematic catecholamine release, which results in arterial stiffness leading to the development of cardiovascular diseases and their sequalae.[85,88] Despite these findings, the association between smoking and blood pressure remains paradoxical, with some studies revealing lower blood pressure values among smokers than non-smokers, while others have shown higher ambulatory values among smokers than non-smokers.[88]

ASSOCIATION BETWEEN BLOOD PRESSURE CONTROL AND NUTRITION

In our current study most patients were assessed as having inadequate nutritional practices (n=282, 98.3%) i.e. consuming less than four servings of fruits and vegetables daily. The bivariate analysis concluded that nutrition was not found to be significantly associated with

blood pressure control in this study ($p > 0.05$). Ecological and epidemiological evidence suggest that high consumption of fruits and vegetables is a recommended dietary strategy for hypertension management. Several studies have demonstrated the relationship between diet and hypertension, emphasizing that the DASH (Dietary Approaches to Stop Hypertension) diet and modifications to the DASH diet which is rich in fruits and vegetable consumption, show dose dependent decreases in blood pressure values.[63,85,89,90,91] While others, like our current study, have shown no clear association between vegetable consumption and blood pressure control[92] especially among older adults.[93]

Trinidad and Tobago, much like many other Caribbean regions, has been experiencing a nutrition transition reflected in a shift in diets away from indigenous staples, locally grown vegetables, fruits and legumes, to diets that contain more processed foods.[94] According to the Global Nutrition Report, Trinidad and Tobago has shown limited advancement towards achieving the diet related non-communicable disease targets at 34% of the recommended fruit

intake and 29% of recommended vegetable intake.[95] One explanation for this can be taken from a study by Gulliford et al, which concluded that food insecurity was associated with decreased consumption of vegetables and fruits.[96] Additionally, a local study by Bahall explored how our social environment can contribute to our obesogenic eating practices, with our vast and easily accessible fast food outlets estimated to exceed 3000.[97] It found that approximately 60.9% and 45.5% of participants had low fruit and vegetable preference respectively.[97] Similarly, our study also found that the majority of participants had low fruit intake, however unlike the study by Bahall et al., it showed that the majority had low vegetable intake. By exploring the connection between dietary habits and the factors that contribute to non-communicable diseases, we can gather insights to assess and enhanced community- focused initiatives targeting the reduction of chronic diseases and associated risk factors in Trinidad and Tobago, thus aiding in blood pressure control among hypertensive patients.

ASSOCIATION BETWEEN BLOOD PRESSURE CONTROL AND WAIST CIRCUMFERENCE

Most participants had a waist circumference reading, placing them at very high risk of developing chronic conditions (n = 186, 64.8%). The bivariate analysis of anthropometric measurements affecting blood pressure control, revealed that waist circumference was not found to be statistically associated with blood pressure control in this study ($p > 0.05$). Other studies have shown that higher waist circumference was positively associated with odds of having uncontrolled hypertension. [98,99] With 64.8% of participants in the very high waist circumference category in our current study, it is important to address individuals who present

with increased waist circumference as this can have deleterious consequences on their cardiovascular health.

Furthermore, though not reflected in our current study, waist circumference may have a stronger correlation with hypertension compared to BMI.[100] A Chinese study revealed that "for each 10 cm annual waist circumference gain in men and women was associated with a 0.98-mm Hg (95% CI: 0.61-1.35) and a 0.97-mm Hg (95% CI: 0.62-1.32) annual increase in systolic blood pressure and a 1.13-mm Hg (95% CI: 0.87-1.38) and a 0.74-mm Hg (95% CI: 0.51-0.97) annual increase in diastolic blood pressure, respectively, independent of annual BMI change."[101]

ASSOCIATION BETWEEN BLOOD PRESSURE CONTROL AND CARDIOVASCULAR DISEASE

Hypertension is recognized as a prominent risk factor within the population, especially among persons with established cardiovascular disease. Effective management of hypertension results in notable decreases in both the occurrence and impact of damage to vital organs, as well as a reduction in cardiovascular disease-related mortality rates. Our current study revealed that there was no significant difference in blood pressure control present in patients with or without established cardiovascular disease (p= 0.681). Similar results were also observed in a Spanish population registry, cross-sectional, epidemiological study by Cordero et al.[103] Patients enrolled in our study showed characteristics akin to the Spanish registry such as being recruited from primary care clinics, as well as the prevalence of obesity, diabetes and dyslipidemia. One explanation for the results seen, may be due to the improvements in patient treatment as governed by the HEARTS hypertension treatment protocol, whose

evolution in treatment was influenced by marketing of fixed dose combination drug treatment with selected antihypertensive agents of specific classes.

ASSOCIATION BETWEEN BLOOD PRESSURE CONTROL AND NIGHT TIME TAKING OF MEDICATIONS

Our current study found that approximately half of the participants took night-time antihypertensive medication (n= 144, 50.2%). However, the bivariate analysis revealed that this was not found to be significantly associated with blood pressure control in this study ($p > 0.05$). Antihypertensive drug administration at bedtime has been suggested as a potentially more efficacious therapeutic approach compared to morning administration. Endogenous circadian rhythms and exogenous phenomena and behaviour significantly affect the pharmacodynamics and pharmacokinetics of hypertension medication which contribute to the 24-hour blood pressure pattern.[104] Studies have attested to the blood pressure lowering effects of six common classes of antihypertensive medications when taken at night.[104] Furthermore, additionally research have shown that combination therapy taken at bed time positively augments blood pressure lowering effects, as well as aids in achieving blood pressure control among hypertensive patients.[105,106] A few notably large clinical trials such as the HYGIA, MAPEC and CONVINCE trials have sought to demonstrate that nighttime dosing of antihypertensive medication is beneficial. However, the Position Paper conducted by the International Society of Hypertension discovered that these published studies had major methodological and/or other flaws and a high risk of bias in testing the impact of bedtime compared to morning treatment.[107] As such, it concluded that bedtime taking of medications should not be routinely recommended until more robust clinical trials are done.

One explanation for the findings in our current study, where approximately half of participants take antihypertensive medications at nighttime, may be that many of the physicians are aware and updated with this consensus and as such have not been advising patients to take antihypertensive medication at a specific time of the day. Additionally, these figures may not represent chronotherapy because currently the antihypertensive medications for Trinidad and Tobago's HEARTS hypertension protocol includes free equivalent combination therapy and not fixed dose combination. This means that there is a possibility that patients may take one antihypertensive medication in the morning and another at bedtime, thus negating the true effects of bedtime dosing on blood pressures.

STRENGTHS AND LIMITATIONS

One strength of this study was that it is the first of its kind to be done in Trinidad and Tobago, as no prior studies, to my knowledge, have evaluated the prevalence of blood pressure control and looked at its associated factors among hypertensive patients who are enrolled in the WHO / PAHO HEARTS in the Americas Hypertension treatment protocol. Additionally, this study had a good response rate of 89.7% which may have resulted because of the interviewer administered, face-to-face nature of the questionnaire, which reduced the incidence of nonresponse bias in this study, thus contributing to smaller standard errors.

The two blood pressure measurements and anthropometric measurements were performed by trained medical professionals, which aided in limiting the impact of measurement bias on the results of the study. The selected instruments used were validated instruments, which were appropriate for the measurements of outcomes and the recommended cut-off points were utilized.

This study, however, had some limitations. The cross-sectional study design prevented any inferences about causality. The self-reported health behaviours, patterns and practices of alcohol use, smoking status, dietary and physical activity, captured at one point in time, may not fully capture the participants' lifestyle as patterns vary over time, thus lending to recall bias. This is a limitation of the cross-sectional designs, however, because the findings are temporally related, associations can be established at most, to the clinical and anthropometric measures reported in the study, which adds to the confidence in the results.

Another limitation was that the small sample size may not have the power to detect statistical differences between some variables where we showed clinically relevant associations. Other

parameters such as duration of hypertension and lipid profiles were not assessed. Besides being etiologically related to the hypertension, these factors could also be associated with its control. Additionally, some confounding variables such as biopsychosocial factors including emotional, cognitive and behavioural domains were not assessed in this study. As such, the analysis could be affected by uncontrolled differences between patients. However, to compensate for this, confounding was controlled by the use of regression methods.

The use of a convenience sampling technique had the disadvantage of being highly vulnerable to selection bias and higher levels of sampling error but had to be incorporated in this study due to time limitations. Additionally, the outpatient setting in a public health centre may not have been representative of the rest of Trinidad and Tobago, due to differences in the population of other areas. As such, it would be imprudent to generalize these findings to the wider population of Trinidad and Tobago.

However, we may be able to generalize these findings with other public primary care chronic disease outpatient clinics found in the other regional health authorities throughout Trinidad and Tobago. The sociodemographics of the clinic may vary slightly from the general population. It must also be noted that the socio-economic distribution may not be representative of the population due to many hypertensive patients seeking healthcare within private institutions and also benefitting from health insurance. Additionally, the adoption of the WHO/ PAHO HEARTS Hypertension protocol within private primary care institutions, as a first line treatment protocol for hypertension is also unknown.

Although the study staff were well trained in the measurement of blood pressure, they may have underestimated the control of hypertension since blood pressure levels presented were based on the average of two (2) measurements performed by a health worker at a single office clinic visit. Moreso, some participants may have white coat hypertension which would also

lead to this underestimation of blood pressure control, as office blood pressures were used solely in the analysis.

Lastly, because many of the questions in this research assessed sensitive questions in relation to behavioural attitudes and practices of the participants during a face- to- face, interviewer administered questionnaire, participants may not have answered truthfully. This could have led to social desirability bias, whereby participants had the tendency to underreport socially undesirable attitudes and behaviours and to over report more desirable attributes. This may have resulted in an underestimation of alcohol use, smoking habits, physical activity levels, nutrition levels and adherence scores.

RECOMMENDATIONS

While hypertension can be successfully diagnosed and treated, one of the major barriers to hypertension management, lies in the blood pressure control rates among this group. To successfully achieve better blood pressure control rates among hypertensive patients, this problem needs to be urgently addressed on several domains, from three levels; a national level, an organizational level and a clinician-based level. If focus is placed on addressing the key elements of health care delivery systems, it can potentially lead to improved blood pressure control rates among hypertensive patients globally.

On a national level, focus should be placed on removing barriers to the availability and affordability of antihypertensive medications. This would include re-evaluating policy, legal, institutional, behavioural and financial factors. We should also aim to utilize the strategic approaches as outlined in the Chronic Care Model for the Caribbean Community (CARICOM) to reduce the burden of chronic disease by strengthening health systems through the use of evidence-based guidelines and comprehensive health care management.[108] This can be applied in conjunction with the latest HEARTS in the Americas initiative which is governed by similar tenets for reducing risk of cardiovascular disease.

Additionally, partnerships with scientific and professional societies, help to promote widespread acceptance of the HEARTS hypertension treatment protocol from practicing clinicians involved at different implementation levels.[109] One such professional society is the Caribbean College of Family Physicians | Trinidad Chapter, whose members range from practicing family physicians and general practitioners, who work in both public and private entities in primary care. Patients seen by these clinicians may utilize both public and private sectors for medical intervention, thus streamlining management for hypertension control with the HEARTS hypertension initiative, which at present is heavily encouraged in the public

primary care domains, will surely be beneficial for achieving better hypertension control rates, based on the favourable control rates seen in this current study.

Single pill, fixed dose combination therapy of antihypertensive medications has the advantage of decreasing daily pill burden, improving medication adherence, achieving faster blood pressure control and decreasing time to exposure to cardiovascular risk.[110,111,112,113] As such it is strongly recommended that on a national level, that single pill combination therapy can be made more cost effective by controlling the drug price through collaborative efforts. An Indian study by A Salam et al showed that the cost of single pill, fixed dose combination was similar to or lower than the cost of monotherapy with constituent pills.[114] Thus showcasing that this is achievable. This was also supported by a meta-analysis by Beth Sherrill et al, which compiled the evidence showing improved medication adherence and lower all cause health care costs for patients taking single pill combination therapy for hypertension compared to free equivalent combination regime.[115]

Additionally, at an organizational level, links between the healthcare system and the community can strengthen programs to prevent, treat and control hypertension. This can involve primary care providers partnering with traditional organizations or businesses, to help promote blood pressure monitoring and control through offering guidance on self-management , adherence to hypertensive medication and lifestyle changes such as cessation of tobacco use, consumption of fruits and vegetables, reduction of salt in the diet, regular physical activity, and avoidance of harmful alcohol use . Health promotion and intervention programmes targeting different hypertension risk factors resulted in varying levels of decrease in systolic blood pressure, ranging from 0.32 to 5.6 mmHg and is effective in controlling high blood pressure in a wider population.[116,117] To amplify these ongoing community involvement initiatives, announcements, heavy advertising through print media ; posters and

fliers and social media, as well as reminders by nurses and physicians on upcoming events can be done at each clinic visit.

Another aspect of recommendations to aid in the improvement of better blood pressure control rates, lies at the level of the clinician. There is a growing interest in understanding how therapeutic inertia may impact the equation. One method to address clinician inertia would be to play closer attention to the return intervals after visits where an elevated blood pressure was identified. This had been recognised as a significant driver for blood pressure control. Shorter intervals were associated with a faster time to control, with most significant benefit at intervals less than two (2) weeks.[118] The WHO/PAHO HEARTS Hypertension treatment protocol currently recommend one month follow up after uncontrolled blood pressure. Implementing a shorter interval period may aid in achieving higher blood pressure control rate among patients.

Another strategy that can be utilized to combat this, is to shift the burden of blood pressure control from physicians to other clinical professionals, including nurses, nurse practitioners and pharmacists, thus incorporating systems of care that transcend this paradigm, offers promise. It is also acknowledged that this recommendation may require revision of national law policies, surrounding healthcare workers and their organizational roles, before it can be implemented. [119]

FUTURE RESEARCH

Further research is needed to closely examine the associations that were found in this study. This can firstly be done by conducting a randomized controlled trial (RCT) which compares blood pressure control among patients using the HEARTS hypertension treatment protocol vs those using alternative hypertensive medication treatment regimes. Furthermore, RCTs should

be conducted to establish the efficacy of fixed dose combination therapy vs free equivalent combinations on blood pressure control, using the HEARTS hypertension treatment protocol medications.

Additionally, prospective cohort studies should be done to elucidate the temporal relationship between variables and the development of blood pressure control to determine which ones are predictors and thus can be addressed through preventative measures. Variables such as income and activity levels can be addressed first as these factors were found to be predictors of blood pressure control in our current study. Other variables such as awareness and knowledge of hypertension, biopsychosocial factors, physical, environmental, emotional, cognitive and behavioural factors, as well as duration of hypertension and lipid profiles can be additional variables explored in future research, as they may also be associated with blood pressure control.

Furthermore, qualitative studies can be conducted to provide insight into the thinking underlying patient or provider behaviours which contribute to blood pressure control. This may aid in identifying patient related barriers that contribute to poor hypertension control rates. It also allows us to determine and address the differences in health care seeking behaviours among patients, to improve health outcomes. Research should extend its focus beyond patients to encompass the involvement of healthcare providers, healthcare facilities, and healthcare systems in promoting greater blood pressure control rates.

CONCLUSION

While there is still room for improvement, the prevalence of blood pressure control found in the study population has exceeded the national strategic targets set for Trinidad and Tobago 2017-2021 and illustrates that hypertension control is achievable among Caribbean nations.

There was better blood pressure control rates in the population studied when compared to previous local studies done more than twenty (20) years prior, in which blood pressure control rates were much less than half of that found in the current study. We were able to identify several predictive factors for blood pressure control in this survey. These factors can be addressed at a national, organizational, community and physician level of engagement, where single pill, fixed dose combination medication, health promotion and intervention programmes and clinical inertia should be explored. This study has brought much needed attention to the benefits of using the WHO/ PAHO HEARTS hypertension treatment protocol as the latest global effort to target blood pressure control rates and combat the NCD burden. Future research should examine the efficacy of free dose equivalent combination vs single pill fixed dose combination therapy for the HEARTS hypertension treatment protocol and explore other possible factors that can be associated with blood pressure control that were not explored in this study.

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Appendix 1

#001

PARTICIPANT INFORMATION SHEET

You are being invited to take part in a research project. Before you decided it is important for you to understand why the research is being done and what participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask the researcher if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

What is the purpose of the study?

The purpose of this research is to determine the percentage of patients that have controlled blood pressure, among hypertensive patients, using the HEARTS in the Americas hypertension treatment protocol and attending a Chronic Disease Clinic in Trinidad. The research also seeks to investigate the various factors that are associated with uncontrolled blood pressure. The researcher hopes that through this research emphasis can be placed on addressing these factors, to ultimately increase blood pressure control rates and reduce the negative effects it can have on a person's health.

Who is conducting the study?

The study will be conducted by Dr. Zahra Mendoza, a primary care physician assigned to the North Central Reginal Health Authority. She is currently enrolled in the Doctor of Medicine, Family Medicine program at the University of the West Indies, St Augustine Campus.

Why have I been chosen?

This research seeks for participants who are known to have elevated blood pressure and currently taking antihypertensive medications in accordance to the HEARTS in the Americas Hypertension treatment protocol. Additionally, these participants must be adults, 18 years and old, diagnosed as hypertensive and on treatment for same, for at least 3 months prior to this study.

Do I have to take part ?

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep and asked to sign a consent form. You can withdraw at any time without giving a reason and without it affecting your future chronic disease and lifestyle clinic consultations.

What will happen if I take part ?

Once you agree to participate in this research you will be asked to complete a questionnaire which may take 15-20 minutes.

What are the benefits of participating in this study?

There are no benefits in participating in this study

Will my participation in this research be kept confidential ?

All the information that we collect about you during the course of the research will be kept strictly confidential. You will not be able to be identified in any ensuing reports or publications.

What will happen to the results of the research project ?

The data collected will be used to determine the percentage of patients with uncontrolled blood pressures and also the associated factors that may contribute to this.

Who is organizing and funding the research?

This research is being organized and funded by the researcher, Dr Zahra Mendoza.

Has this research been approved ?

This research has been given ethical approval by the Ethics Committee of the University of the West Indies, North Central Regional Health Authority.

Contact for further information

If you require any further information about this research, you can contact the researcher directly at 466-1122.

If you require assistance filling out the form, contact the researcher directly at the above number and an aid will be provided to assist you in completing the questionnaire.

Appendix 2

CONSENT FORM

I have read the information provided on the participant sheet, or it has been read to me. I have had the opportunity to ask questions about this research and any questions asked have been answered to my satisfaction. I understand that I will be given a copy of this form and the researcher will keep another copy on file. I consent voluntarily to be a participant in this study. I give the researcher permission to use my answers in this questionnaire for the sole purpose of the research outlined and permission to contact me if there are any follow up questions.

Print Name of Participant

Signature of Participant

Date (**Day/month/year)**

Print Name of Researcher **Dr Zahra Mendoza**

Signature of Researcher

Date (Day/month/yea)

[If the participant is illiterate 1]

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness

Signature of witness

Date (Day/month/year)

Appendix 3

Section 1

Please answer all questions as truthfully as possible. All information contained on this questionnaire will remain strictly confidential.

1. Please specify your current age.

   _____

2. Please specify your gender.

   ☐ Male

   ☐ Female

3. Please specify your ethnicity.

   ☐ Afro-Trinidadian

   ☐ Indo-Trinidadian

   ☐ Syrian

   ☐ Chinese

   ☐ Mixed

   ☐ Other Please indicate _____

4. Please specify your marital status.

   ☐ Single

   ☐ Married

   ☐ Divorced

   ☐ Separated

   ☐ Widowed

   ☐ Common Law

5. Please indicate which option best describes your highest level of educational achievement.

- ☐ No formal schooling
- ☐ Primary Education
- ☐ Secondary Education
- ☐ Technical / Vocational
- ☐ University Education

6. Please indicate which option best describes your monthly income.

- ☐ < 5000.00 TT
- ☐ $5000 - $9,999 TT
- ☐ $10,000- 14,999 TT
- ☐ $15,000- 19,999 TT
- ☐ $20,000 – 24,999 TT
- ☐ > 25,000 TT

Appendix 4

Section 2

Please answer all questions as truthfully as possible. All information contained on this questionnaire will remain strictly confidential.

	Never	Monthly or less	2 to four times per month	2 to three times per week	4 or more times per week
1. How often do you have a drink containing alcohol?					

	0 to 2	3 to 4	5 to 6	7 to 9	10 or more
2. How many units of alcohol do you drink on a typical day when you are drinking?					

	Never	Less than	Monthly	Weekly	Daily or

		monthly			almost daily
3. How often have you had 6 or more units if female, or 8 or more units if male, on a single occasion in the last year ?					

4. Can you define your smoking status?

☐ Non-smoker

☐ Current Smoker

☐ Ex-Smoker

If the answer to the above is current smoker, can you answer the following?

	Within 5 minutes	6-30 minutes	31-60 minutes	Over 60 minutes
5. At present, how long after waking do you wait before having your first cigarette?				

	10 or less	11-20	21-30	30 or more

6. How many cigarettes per day do you smoke?				

7. Please tell us the type and amount of physical activity involved at work

	Please tick one box only
I am not in employment (e.g. retired, retired for health reasons, unemployed, fulltime carer etc.)	
I spend most of my time at work sitting (such as in an office)	
I spend most of my time at work standing or walking. However, my work does not require much intense physical effort (e.g. shop assistant, hairdresser, security guard, childminder, etc.)	
My work involves definite physical effort including handling of heavy objects and use of tools (e.g. plumber, electrician, carpenter, cleaner, hospital nurse, gardener, postal delivery workers etc.)	
My work involves vigorous physical activity including handling of very heavy objects (e.g. scaffolder, construction worker, refuse collector, etc.)	

8. During a typical week , how many hours do you spend on each of the following activities?

Please mark one box on each row only

	None	Some but less than 1 hour	1 hour but less than 3 hours	3 hours or more
Physical exercise such as swimming, jogging, aerobics, football, tennis, gym workout etc.				
Cycling, including cycling to work and during leisure time				
Walking, including walking to work, shopping, for pleasure etc.				
Housework/Childcare				
Gardening/DIY (do it yourself)				

9. How would you describe your usual walking pace?

Slow pace	
Steady Average pace	
Brisk Pace	
Fast pace	

Please select one answer for the following questions:

	None	½ cup or less	½ cup – 1 cup	1-2 cups	2-3 cups	3-4 cups	4 cups or more
10. In the last six (6) months, about how many cups of fruit (including 100% pure fruit juice) do you eat or drink each day							
11. In the last six (6) months about how many cups of vegetables (including 100% vegetable juice) do you eat or drink each day							

12. Are you known to have any other medical conditions other than hypertension?

If so please indicate which applies to you .

☐ Diabetes

☐ Elevated Cholesterol

☐ Stroke

☐ Chronic kidney disease

☐ Heart Failure

☐ Other _____

Appendix 5

Section 3

This section is to be filled out by the interviewer

Please answer all questions as truthfully as possible. All information contained on this questionnaire will remain strictly confidential.

1. Please indicate which step of the HEARTS Hypertension protocol is the patient currently on. (Only pick one)

Step		**A**		**B**
1		Lisinopril 10mg + Amlodipine 5 mg		Irbesartan 150 mg (or Candesartan 16mg) + Amlodipine 5mg
2		Lisinopril 20 mg + Amlodipine 10 mg		Irbesartan 300mg (or Candesartan 32mg) + Amlodipine 10mg
3		Lisinopril 40 mg + Amlodipine 10 mg		Add Chlorthalidone 12.5 mg (or Bendrofluazide 2.5mg)
4		Add Bendrofluazide 2.5 mg (or Hydrochlorothiazide 12.5mg)		Increase Chlorthalidone 25mg (or Bendrofluazide 5mg)

2. Do you routinely take any antihypertensive medications at night time ?

   ☐ YES

   ☐ NO

Appendix 6

Section 4

Please answer all questions as truthfully as possible. All information contained on this questionnaire will remain strictly confidential.

For each statement kindly pick which option best applies to you.

HBP* – high blood pressure

	Statement	All the time	Most of the time	Some of the time	None of the time
1.	How often do you forget to take your HBP* medication?				
2.	How often do you decide not to take your HBP* medicine?				
3.	How often do you eat salty food ?				
4.	How often do you shake salt on your food before you eat it ?				
5.	How often do you eat fast food ?				
6.	How often do you make the next appointment				

	before you leave the doctor's office?				
7.	How often do you miss scheduled appointments ?				
8.	How often do you forget to get prescriptions filled ?				
9.	How often do you run out of HBP* pills ?				
10.	How often do you skip your HBP* medicine before you go to the doctor ?				
11.	How often do you miss taking your HBP* pills when you feel better ?				
12.	How often do you miss taking your HBP* pills when you feel sick ?				
13.	How often do you take someone else's HBP* pills ?				
14.	How often do you miss taking your pills when				

	you are careless ?				

Appendix 7

Section 5

This section is to be filled out by the interviewer

Please fill out this section accurately.

(i)Blood Pressure Readings :

Blood Pressure Reading 1 (mm/Hg)	
Blood Pressure Reading 2 (mm/Hg)	
Average Blood Pressure Reading (mm/Hg)	

(ii)Body Mass Index

Weight (Kg)	
Height (m)	
BMI (kg/ m^2)	

(iii)Waist Circumference (cm)

_____

Appendix 8

Critical Appraisal of Literature

Article 1: Londoño Agudelo E, Rodríguez Salvá A, Díaz Piñera A, García Roche R, De Vos P, Battaglioli T, et al. Assessment of Hypertension Management and control: A registry-based observational study in two municipalities in Cuba. BMC Cardiovascular Disorders. 2019;19(1):29.doi: 10.1186/s12872-019-1006-6.[PubMed]

Purpose/ Problem statement : The goal was to determine the prevalence of hypertension treatment and control among hypertensive patients in the Cuban municipalities of Cardenas and Santiago and to explore the main associated predictors. The reason for conducting the study include that chronic diseases account for 86% of total deaths in the country and cardiovascular diseases are responsible for 39% of the overall mortality.

Study Type : Cross-sectional study

Findings : Among diagnosed hypertensive patients 58% (95% CI 55-61) had controlled hypertension. The majority of patients(91% , 95%CI 90-93) were on pharmacological treatment, 49% with a combination of 2 or more classes of drugs. Diuretics plus ACE/ ARB was the most frequently used combination (49, 95%CI 45-53), followed by diuretics plus beta blockers (13, 95%CI 11-16) and diuretics plus CCB (11, 95% CI 9-14). There was no association between hypertension control and gender, age and socio-economic condition. Levels of hypertension control depended on health area and control furthermore was positively associated with post-primary education, not being obese and white ethnicity: adjusted odds ratio (95% CI) 1.71 (1.26-2.34), 1.43 (1.09-1.88) amd 1.41 (1.09-1.81) respectively.

Overall Quality:

Strengths: This study had a large sample size of 1400 hypertensive patients and carried out over a one year period. The data collection was well described and the methodology was outlined in detail to allow a replication study. This study assessed a large number of associated factors for blood pressure control such as sociodemographic factors, comorbidities such as diabetes and heart disease, adherence to medication and anthropometric measurements.

Limitations: The use of self reported scales for measuring medication adherence has some potential limitations, especially regarding patients' ability to understand the items and willingness to disclose information which can affect questionnaire validity. Factors such as smoking status, duration of hypertension or lipid profile were also not assessed.

Discussion + Conclusions: The figures observed in the study are outstanding at an international level. It shows how the country's health care approach and social equity in access to care can be seen as key to overcome system barriers to blood pressure control. Interventions at health service and community level aimed at increasing the effectiveness of hypertension management programs should be designed, implemented and evaluated.

Article 2: Jardim TV, Sousa AL, W.Barroso, Jardim PC. Blood pressure control and associated factors in a real world multidisciplinary treatment center. Journal of Hypertension. 2018Aug28;36(Supplement 1):174–81.doi: 10.36660/abc.20180384. [PubMed]

Purpose / Problem Statement: The aim of this study was to report the results of a long-term multidisciplinary treatment intervention for patients with hypertension, specifically assessing blood pressure control rates and associated factors.

Study type: Retrospective single centre study

Findings : Blood pressure control rates in all the sample and in non-diabetic and diabetic patients were 68%, 79% and 37.8% respectively. Diabetes was inversely associated with

blood pressure control (OR 0.16; 95%CI 0.12-0.20; p<0.001) while age ≥60 years (OR 1.48;95% CI 1.15-1.91; p=0.003) and female sex (OR 1.38; 95%CI 1.05-1.82; p=0.020) were directly associated.

Overall Quality:

Strengths: This study had a large sample size, which included more than 90% of all patients attending the centre. The study also assessed several factors associated with blood pressure control, such as anthropometric measurements, smoking status, alcohol consumption, physical activity, presence of diabetes and pharmacologic treatment and number of antihypertensive medications.

Limitations : The study design was a limitation as this was conducted retrospectively with no control group. The tools used to assess physical activity did not include daily physical activity in its definition. As a result, sedentary lifestyle may be overestimated.

Discussion + Conclusion: The figures observed in this study are extremely positive and are in keeping with blood pressure control rates seen in high income countries. The economic assessment of this team -based care in high income countries showed that it is cost effective to improve blood pressure control rates. Focus should be placed on diabetics, patients younger than 60 years and males to further improve these results.

Article 3: Mahabir D, Gulliford MC. A 4-year evaluation of Blood Pressure Management in Trinidad and Tobago. Journal of Human Hypertension. 1999;13(7):455–9.[PubMed][BIREME]

Purpose / Problem Statement: The aim of this study was to evaluate the quality of blood pressure management in government primary care health centres in Trinidad and Tobago. It is recognized that hypertension is a serious health problem in the Caribbean region, whether

measured in high prevalence of the condition or the mortality and health service used, which result from its complications.

Study Type : Single group before and after study with cross-sectional sampling.

Findings: The proportion of patients with blood pressure adequately controlled (<160/95 mmHg) was 338 (51%0 in 1994 and (58%) in 1998 . According to the criterion of 140/90 mmHG, 110 (15%) of subjects had adequate blood pressure control in 1994 and 76 (13%) in 1998. Most attenders had blood pressure recorded (96% in 1994 and 98% in 1998). Among 1176 subjects with hypertension , the proportion of dietary advice ever recorded increased from 21% in 1994 to 36% in 1998, and recording exercise advice increased from 5% in 1994 to 19% in 1998. Among subjects treated with drugs, use of Brinerdin decreased from 31% in 1994 to 6% in 1998, while the use of diuretics, beta blockers, calcium antagonists and ACE-I increased.

Overall Quality:

Strengths: This study had a large sample size of 1759 adults from 16 government primary care health centres in Trinidad and Tobago. Several factors were also assessed such as anthropometric measurements, urine analysis, blood glucose, urea and creatinine as well as whether advise on diet and exercise had been given.

Limitations: Standard methods were used to collect data, however the researcher only collected data that were recorded in case notes which lends itself to measurement bias. In a single group before and after study, the effect of intervention will be confounded by the effect of history and the range of external influences may have contributed to the changes observed.

Discussion + Conclusions: The results of the study showed that an audit study used to inform health care policy, staff training and clinical practice may contribute to improving standards of hypertension management in a middle income country like Trinidad and Tobago.

Article 4: Menanga A, Edie S, Nkoke C, Boombhi J, Musa AJ, Mfeukeu LK, et al. Factors associated with blood pressure control amongst adults with hypertension in Yaounde, Cameroon: A cross-sectional study. Cardiovascular Diagnosis and Therapy. 2016;6(5):439–45.doi:10.21037/cdt.2016.04.03.[PubMed]

Purpose / Problem Statement : The main goal of this study was to determine the predictors of blood pressure control in patients with hypertension in an urban city in Cameroon. It is recognized that hypertension is associated with considerable morbidity and mortality. Improvement of it management to reduce adverse cardiovascular outcomes will require an understanding of the patient characteristics and treatment factors associated with uncontrolled blood pressure.

Study Type: Descriptive cross-sectional study.

Findings: Only 36.8% of patients had their blood pressure controlled (BP , 140/90 mmHg). Multivariable regression analysis revealed good adherence to anti-hypertensive medications (OR=3.99; 95% CI 2.20-7.23; P<0.000) and dietary lifestyle changes (OR= 1.5; 95% CI: 0.53-2.49;P=0.031) to be factors independently associated with controlled hypertension. More than half (56%) the patients were physically inactive. The most common class of antihypertensive medication was calcium channel blockers (CCB) (74.64%); followed by thiazide diuretics (71.98%) and angiotensin converting enzyme inhibitors (ACE-I) (62.76%). The most common combination therapy used was the association of a diuretic and ACE-I (32.5%). About 60% of patients had good adherence to antihypertensive medication. More than 60% were adherent to dietary lifestyle changes.

Overall Quality

Strengths: The data collection and methodology was well described and makes it easy for replication of the study to be conducted. This study assessed several factors that affect blood

pressure control such as sociodemographic data; including health insurance and antihypertensive medications, history of cardiovascular risk factors and co-morbidities, anthropometric measurements, medication adherence using the MMAS-4 and lifestyle modifications or changes such as diet rich in fruits and vegetables, low in fat and salt and physical activity.

Limitations : A degree of bias may exist in this study as factors assessed such as alcohol use and dietary/ lifestyle modifications are subject to recall bias among participant. This study also did not assess patient's knowledge of hypertension.

Discussion + Conclusions : The results of this study demonstrate that a high rate of blood pressure control is achievable in a resource limited setting if treatment adherence is improved. Identification of patients at risk of non-adherence to treatment and poor blood pressure control can lead to targeted interventions.

Appendix 9

Approvals and Permission for Study

Approval from the Campus Ethics Research Committee, University of the West Indies, St Augustine Campus.

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

July, 24 2022

Zahra Mendoza
Department of Para-Clinical Sciences
Faculty of Medical Sciences
Email: zahra.k.mendoza@gmail.com

Dear Zahra Mendoza,

Ref: CREC-SA.1705/08/2022

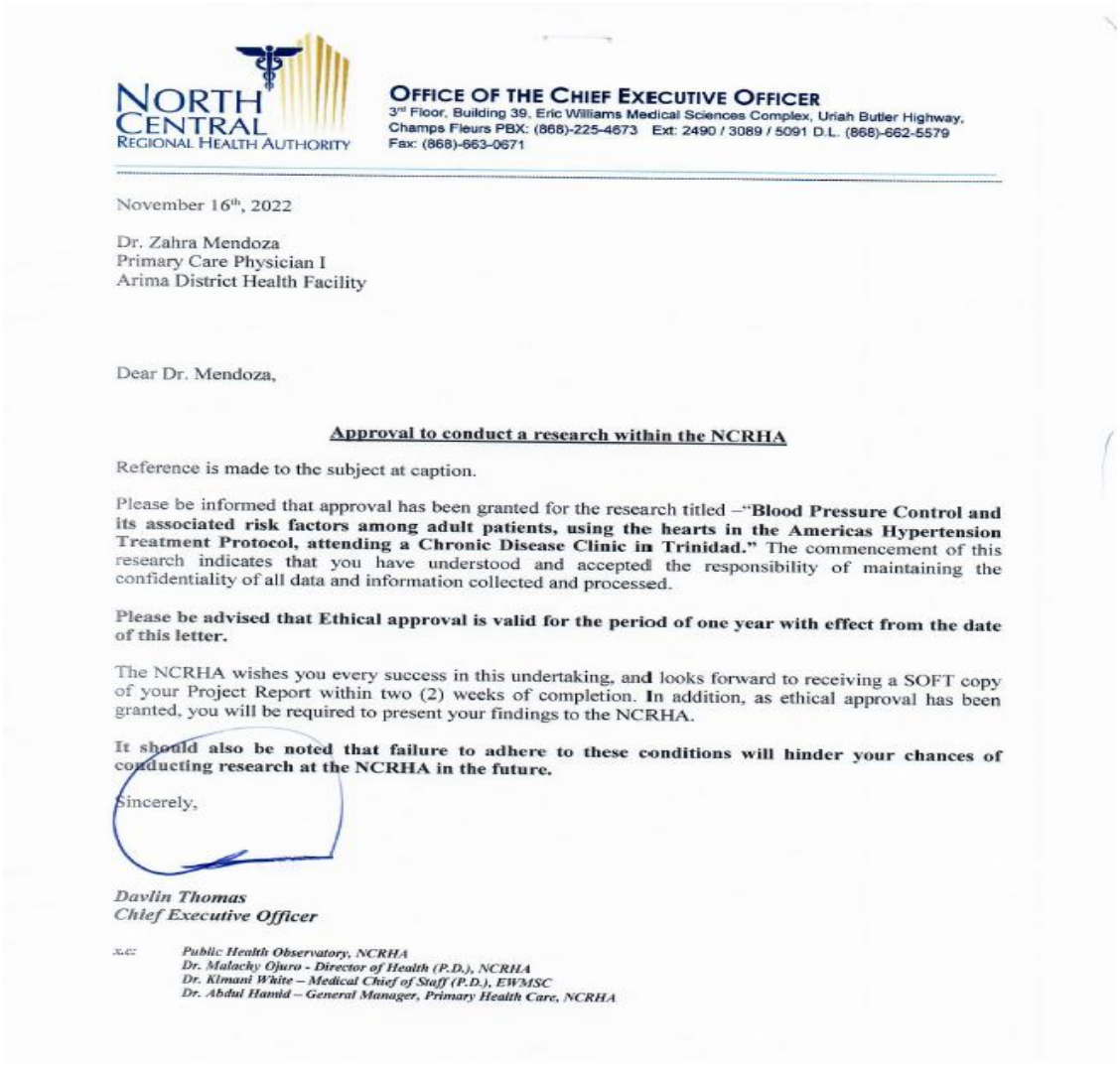
Title: Blood Pressure control and its associated factors among adult patients, using the HEARTS in the Americas hypertension treatment protocol, attending a Chronic Disease Clinic in Trinidad

I am pleased to advise that your application for research on the above captioned topic has met the criteria for Exemption from Review from the Campus Research Ethics Committee, St. Augustine. You may proceed with data collection/research activities.

Sincerely,

Professor Jerome De Lisle
Chair
Campus Research Ethics Committee

Approval from the office of CEO NCRHA



NORTH CENTRAL REGIONAL HEALTH AUTHORITY

OFFICE OF THE CHIEF EXECUTIVE OFFICER
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Champs Fleurs PBX: (868)-225-4673 Ext: 2490 / 3089 / 5091 D.L. (868)-662-5579
Fax: (868)-663-0671

November 16th, 2022

Dr. Zahra Mendoza
Primary Care Physician I
Arima District Health Facility

Dear Dr. Mendoza,

Approval to conduct a research within the NCRHA

Reference is made to the subject at caption.

Please be informed that approval has been granted for the research titled –"**Blood Pressure Control and its associated risk factors among adult patients, using the hearts in the Americas Hypertension Treatment Protocol, attending a Chronic Disease Clinic in Trinidad.**" The commencement of this research indicates that you have understood and accepted the responsibility of maintaining the confidentiality of all data and information collected and processed.

Please be advised that Ethical approval is valid for the period of one year with effect from the date of this letter.

The NCRHA wishes you every success in this undertaking, and looks forward to receiving a SOFT copy of your Project Report within two (2) weeks of completion. In addition, as ethical approval has been granted, you will be required to present your findings to the NCRHA.

It should also be noted that failure to adhere to these conditions will hinder your chances of conducting research at the NCRHA in the future.

Sincerely,

Davlin Thomas
Chief Executive Officer

x.c: *Public Health Observatory, NCRHA*
Dr. Malachy Ojuro - Director of Health (P.D.), NCRHA
Dr. Kimani White – Medical Chief of Staff (P.D.), EWMSC
Dr. Abdul Hamid – General Manager, Primary Health Care, NCRHA

Permission to use the Hill-Bone Scales and User Agreement

SON-HillBone <SON-HillBone@jhu.edu> Oct 18, 2022, 10:06 AM

to me

Hello,

Thank you for reaching out to us.
We have received confirmation that you completed the permission form requesting the use of the Hill-Bone scales.
Attached are the Hill-Bone Scales along with several relevant articles reporting on the validation and use of the scales. Please cite the scale using the references provided. **Please review and return the signed user agreement form at your earliest convenience**.

We would appreciate you sharing the findings of your research with us.
In the scoring guide, there is a note under the table that provides instructions on how to obtain a sum score for adherence. We do not recommend specific cut-offs but rather advise that adherence be examined on a continuous scale. For instance, for the 9-item HB-MAS, if a participant reports "None of the Time" for all the 9 questions, their total adherence score would be 36 points which indicates higher adherence.

We wish you the very best in your project and please do not hesitate to reach out to us if you have any follow-up questions.
Please do not share these scales with anyone who has not obtained permission for their use.

Kind Regards,
The Hill-Bone Scales Team

right, title or interest thereof for User, other than the right to use the Hill-Bone Scale(s) under this User Agreement.

Publications and Presentations

- Any publication or presentation created from research, clinical, educational, or other applicable use of any Hill-Bone Scale should include a statement that indicates which instruments were used and provide an appropriate citation.
- For precise citation, please see: *Kim MT, Hill MN, Bone LR, Levine DM. Development and testing of the Hill-Bone Compliance to High Blood Pressure Therapy Scale. Prog Cardiovasc Nurs. 2000 Summer;15(3):90-6. doi: 10.1111/j.1751-7117.2000.tb00211.x. PMID: 10951950.*

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- Use of the Hill-Bone Scale(s) in clinical research is encouraged, with the understanding that data collected from that use will contribute to knowledge about the validity of Hill-Bone Scale measures. USERS OF Hill-Bone Scale TOOLS ARE STRONGLY ENCOURAGED TO SUBMIT A BRIEF REPORT INCLUDING SAMPLE DEMOGRAPHIC INFORMATION, CLINICAL DATA SUFFICIENT TO characterize THE SAMPLE, AND SCORE DISTRIBUTIONS (E.G., BASELINE MEAN AND STANDARD DEVIATIONS OR CHANGE SCORES). This brief report should be submitted to son-hillbone@jhu.edu for internal review. None of this submitted information will be published without the written consent and participation of the submitter. In addition to the brief report, clinical researchers are encouraged to submit a final version of any translated scale, presentation or publication. Data ownership would remain with the submitter. Clinical researchers are strongly encouraged to collaborate with Hill-Bone Scale researchers when applying these items and banks to their research.

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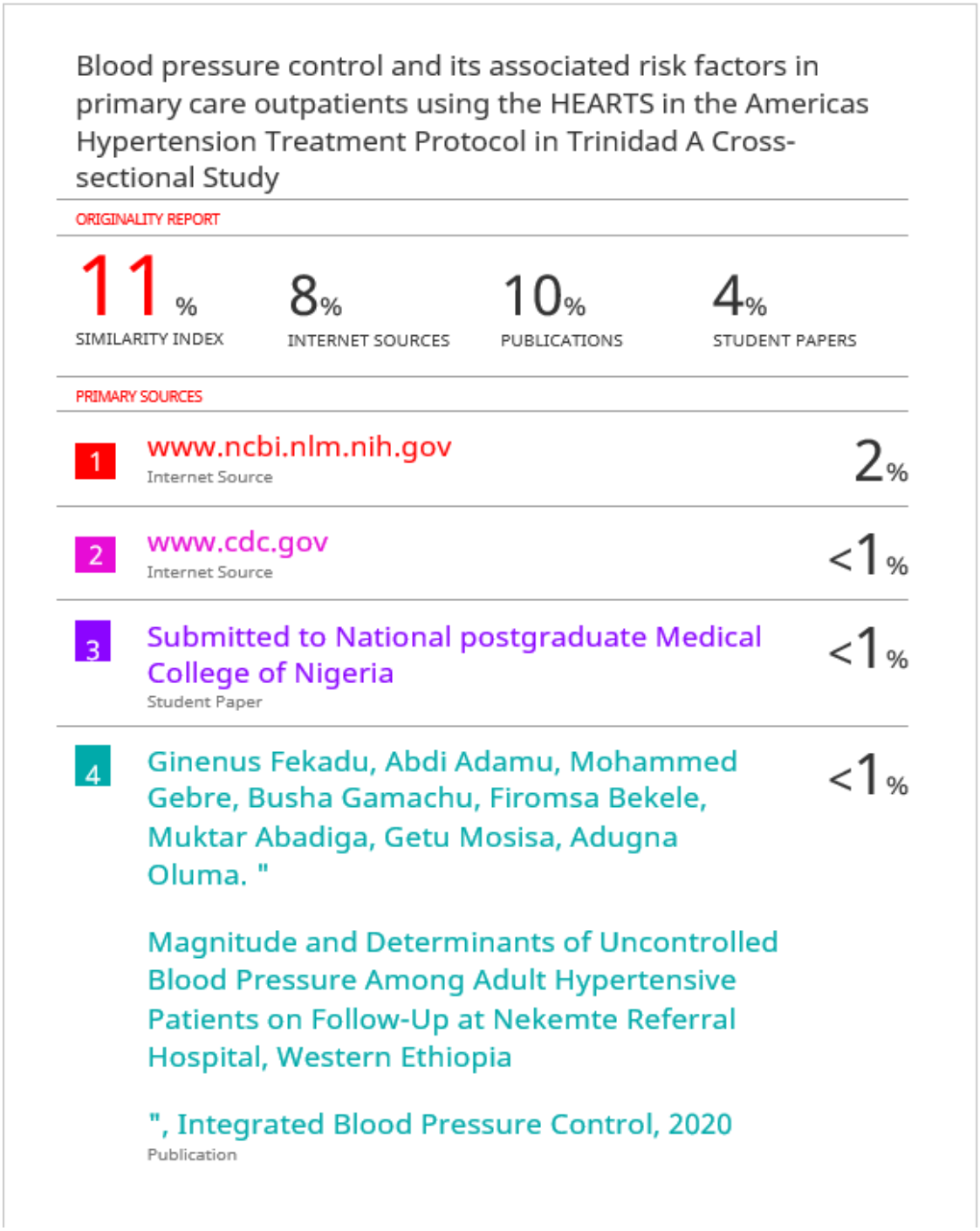
☑ Yes, I agree ☐ No, I do not agree

Signature: [signature] Date: 18. 10. 2022

Affiliation: UNIVERSITY OF THE WEST INDIES, ST AUGUSTINE

Appendix 10

Turnitin Report



Blood pressure control and its associated risk factors in primary care outpatients using the HEARTS in the Americas Hypertension Treatment Protocol in Trinidad A Cross-sectional Study

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Appendix 11

THE UNIVERSITY OF THE WEST INDIES

School for Graduate Studies and Research

CERTIFICATE OF COMPLETION OF THESIS/RESEARCH PAPER/PROJECT REPORT/CASEBOOK/CLINICAL RESEARCH PROJECT

Section A of this form is to be completed by the Student and Section B by both the Supervisor and Head of Department. It must accompany the thesis/research paper/project report/casebook/clinical research project when being submitted to the Campus Office of Graduate Studies and Research for examination.

Section A:

Name of Student: _____Dr Zahra Mendoza
_____

Faculty in which Student is registered: _____Medical Sciences
_____

Degree Programme: _____DM Family Medicine
_____

Title of Thesis/Research Paper/Project Report/Casebook/Clinical Research Project (the Submission):

Blood pressure control and its associated risk factors in primary care outpatients using the HEARTS in the Americas Hypertension Treatment Protocol in Trinidad: A Cross-sectional Study
_____
_____

_____
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_____

Declaration of Word Length and Ownership of Work

1. Word length of the Submission:
   _____13293_____

   A candidate will not normally exceed the word limit prescribed in the Thesis Guide. Any candidate wishing to exceed this limit must apply for permission to the Campus Committee for Graduate Studies and Research through his/her supervisor, and confirmation of suspension of Regulations must be attached.

2. Style Manual used:
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3. I confirm that the work presented in the Submission is my own and all references are cited according to accepted University of the West Indies' conventions. I have submitted my

Thesis/Research Paper/Project Report/Casebook/Clinical Research Project for checking by the following plagiarism detection software:

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4. Consistent with The University of the West Indies' policy on Plagiarism, I agree that the University has the right to use plagiarism detection software to check the electronic version of the Submission.

_____ _____ 18/ 03/2024_____
Signature of Student *Date*

Section B:

I hereby certify that:

a) Dr./Mr./Ms. _____Zahra Mendoza
_____,
(Name in Full)
is a registered Student of The University of the West Indies.

b) he/she has completed his/her Thesis/Research Paper/Project Report/Casebook[#]/Clinical Research Project[#].

c) five (5) identical copies of the Submission [†], or (4) identical copies of the Submission[†], as the requirement may be, have been produced in accordance with the Regulations of The University of the West Indies

d) the work has been checked for plagiarism and proper use of citation and referencing.

e) the work has been completed to my satisfaction and is acceptable for examination*.

[#] ***Format of the copies shall be as specified in the Regulations for Postgraduate Clinical Programmes.***
[†] ***Select as appropriate. One of these copies should be electronic, submitted on a CD/DVD (in edit-enabled format/Microsoft Word format), and certified by the Supervisor.***
***** ***If the Supervisor does not consider that the work has been completed to his/her satisfaction and is acceptable for examination, he/she should strike through the statement in part e) and write appropriate comments below.***

Supervisor's Comments (when declining to agree to part e):

_____
_____
_____
_____

_____

_____

_____ _____

_____

Name of Supervisor *Signature of Supervisor* *Date*

_____ _____

_____

Name of Co-Supervisor *Signature of Co-Supervisor* *Date*

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Name of Head of Department *Signature of Head of Department* *Date*