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The Moderating Effect of Ethnicity on the Relationship Between Type of Healthcare Professional and Antihypertensive Medication Adherence

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has been found to be complete and satisfactory in all respects,
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the review committee have been made.

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Walden University
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Abstract

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MPharm, University of Portsmouth, 2012

Proposal Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Health Psychology

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Abstract

Hypertension is a modifiable risk factor for cardiovascular diseases and the main stay of treatment is antihypertensive medications. Individuals from minority ethnic groups such as the Black population have shown a lower adherence rate to antihypertensive medication compared to their White counterparts. Literature has also identified benefits of team-based care in the management of long-term conditions such as hypertension. The purpose of this cross-sectional correlational quantitative study was to examine the extent to which ethnicity moderated the relationship between type of healthcare professional (single healthcare professional vs. multiple healthcare professional) and antihypertensive medication adherence. This study was guided by the biopsychosocial model of health. Data were collected anonymously via surveys from adults with hypertension and participants were recruited through Prolific (an online recruitment service). Data were analyzed using multiple regression with moderation analysis. The results revealed that ethnicity was a significant predictor of medication adherence with Blacks reporting lower levels of antihypertensive medication adherence compared to Whites. Type of healthcare professional did not predict medication adherence. Ethnicity was not a moderator of the relationship between type of healthcare professional and medication adherence. Findings from this study may inform a positive social change through the incorporation of a patient-centered approach and multidisciplinary interventions in hypertension management especially among the Black population in primary and secondary care settings.

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Dedication

This dissertation is dedicated to the Almighty God who made it possible for me to start and complete this program successfully through his divine help. I am eternally grateful to my late father who set me on this journey through his encouragement and sponsorship; you provided a platform for me to obtain a PhD though you did not wait to see the fruit of your good deed. May your soul continue to rest in peace dad! A massive thank you to my mother and mother-in-law! The beginning was very tough, but you offered all the support I needed to meet deadlines for all my courses. Thanks, mum, for stepping into dad's shoes after his departure, your financial support was a great relief. To my husband, your kind is rare! Thank you for your financial, moral, and emotional support throughout the journey. And of course, to our lovely children, thank you for your patience and understanding.

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I would like to thank my family, friends, and all the people the Lord brought my way to provide support throughout this journey. Above all, glory to God for his marvellous help and timely intervention throughout the journey.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Introduction

Non-communicable diseases (NCDs) are chronic diseases requiring long term management and accounting for about 71% of deaths worldwide (World Health Organization [WHO], 2021). The World Health Organization (2021) identified four leading NCDs, which are cardiovascular diseases, cancer, respiratory diseases, and diabetes; the most prevalent being cardiovascular diseases which accounts for most NCDs' deaths with 17.9 million deaths annually. Reducing the risk factors associated with these diseases will contribute immensely to disease control and reduce the increasing rise in the burden of NCDs.

According to the American Heart Association (2022), hypertension is a significant risk factor for cardiovascular diseases and is the most prevalent co-morbidity for NCDs which is consistent with reports from a few studies in different parts of the world (Baldridge et al., 2022; Cissé et al., 2021; Gbadamosi & Tlou, 2020; Iqbal et al., 2021; Nyaaba et al., 2020; Ouyang et al., 2022; Wilkinson et al., 2022). Therefore, hypertension control through pharmacological and non-pharmacological treatments is paramount with evidence of effectiveness. Non-pharmacological treatment includes lifestyle modification such as dietary control with low sodium intake, physical activity, smoking cessation, and alcohol consumption reduction while pharmacological treatment includes the use of antihypertensive medications. Hypertension control remains a public health challenge globally with medication non-adherence contributing significantly to lack of blood pressure control among other factors (Wilkinson et al., 2022), which is a

major reason why this study was conducted to examine the impact of ethnicity and the type of healthcare professional on medication adherence, and to determine if ethnicity has a moderating effect on the relationship between the type of healthcare professional that manages (diagnosis and treatment) the patient's hypertension and medication adherence.

The perspectives of health care professionals on the causes of poor hypertension control were explored by Nyaaba et al. (2020), and the points raised included patient-related barriers, health systems barriers, and health professionals' barriers with strong emphasis on communication difficulties, sociocultural barriers, and structural barriers, which all influence medication adherence and impact on blood pressure control. Furthermore, studies by Wilkinson et al. (2022) examined antihypertensive medication non-adherence from the patients and healthcare provider's view taking cognizance of existing strategies while proposing potential strategies to support patients such as creating adherence club and taking a holistic approach to hypertension care which can lead to improved medication adherence and blood pressure control. Uncontrolled hypertension leads to comorbidity, increased mortality, and other cardiovascular disease complications with evidence of increasing mortality trend among hypertension patients (Ouyang et al., 2022). Therefore, findings from this quantitative study will contribute to the existing body of knowledge by providing information that can further address the issue of medication adherence among hypertension patients, consequently reducing mortality, comorbidity, and improving blood pressure control bringing about a positive social change within the society.

This chapter will provide information on the background of the research, a problem statement, the purpose for this study, the research questions, and hypotheses. Furthermore, this chapter will give brief information on the theoretical framework, nature of study, definitions, assumptions, scope and delimitations, limitations, significance, and the chapter will conclude with a summary of the study.

Background

Medication non-adherence is a psychosocial behavior that has gained a lot of attention by researchers and scholars. Barriers and facilitators of antihypertensive medication adherence have been examined by researchers as well as perspectives of patients and healthcare professionals explored to understand the impact of medication adherence on blood pressure control and discover an effective approach to hypertension management (Burnier & Egan, 2019; Easthall et al., 2019; Kang & Jeong, 2020; Satish et al., 2019; Tan et al., 2017; Tavakoly Sany et al., 2020; Zuo et al., 2019). Furthermore, strategies to overcome the barriers and interventions that offer life-long adherence support to hypertension patients have also been a subject of study for researchers in the last few years (Celio et al., 2018; Hwang et al., 2017; Sadeghi et al., 2020; Santschi et al., 2017; Wilkinson et al., 2022; Woodham et al., 2020).

Previous literature identified healthcare professional barriers to promoting adherence among physicians and pharmacists which was addressed through the provision of adequate training and developing an electronic tool (e-AdPharm) that can be used by both pharmacists and physicians for sharing adherence information to help overcome existing barriers and improve medication adherence among hypertension patients

(Fénélon-Dimanche et al., 2021; Tavakoly Sany et al., 2020). Patient-related barriers to antihypertensive medication adherence such as low health literacy, inadequate knowledge about the condition, and psychological resistance to treatment were identified in past studies and the reasons for nonadherence were found to be consistent across these studies (Kang & Jeong, 2020; Nyaaba et al., 2020; Satish et al., 2019). Furthermore, low medication adherence rates were found among the Blacks, Hispanics, and Asians compared to their White counterparts due to sociocultural factors such as diverse cultural beliefs (Rashid et al., 2017; Sripipatana et al., 2019). A patient-centered care was proposed by the authors to increase patients' knowledge of their condition, dietary control, improve medication adherence and reduce blood pressure among minority ethnic groups.

Collaborative management of hypertension has been proposed in previous studies as an effective way of supporting patients with medication adherence and achieving blood pressure control. Hwang et al. (2017) investigated the impact of a pharmacist-physician collaborative approach to hypertension management and the study revealed a reduction in blood pressure which is consistent with the findings from other studies where a collaborative approach between healthcare professionals (physicians, nurses, and pharmacists) resulted in improved medication adherence and improved blood pressure control (Celio et al., 2018; Woodham et al., 2020; Zuo et al., 2019). Furthermore, Pinho et al. (2021) conducted a review of medication adherence interventions in hypertension patients to develop an evidence-based categorization tool that can be used to inform clinicians about medication adherence to antihypertensive medications. The study

revealed that clinicians found the tool useful in making evidence-based decisions on adherence to antihypertensives. However, there is sparce research on the impact of the type of healthcare professional that manages the patient's condition on medication adherence. A majority of UK residents have an assigned general practitioner/family doctor (British Medical Association, 2020); therefore, the patient's condition is typically diagnosed by their doctor and treatment is started as deemed necessary with subsequent appointments scheduled for a review by their doctor or a nurse. The patient also has access to the pharmacist, giving the patient the opportunity to have his/her condition managed by more than one healthcare professional and to develop a relationship with each of them. The better the relationship the better the chance of fostering medication adherence and achieving the desired treatment outcome.

There is a gap in knowledge in determining whether the relationship between the type of healthcare professional that manages the patient's condition and medication adherence depends on the patient's ethnicity. Findings from this study will add to the existing body of knowledge by further addressing non-medication adherence among hypertension patients especially those from the minority ethnic group and the importance of patient-centered care in the management of hypertension.

Problem Statement

The research problem addressed through this study was the extent to which ethnicity moderates the relationship between the type of healthcare professional (single healthcare professional vs multiple healthcare professionals) and antihypertensive medication adherence among hypertension patients who are between 25 years and 60

years of age. The association between sociodemographic factors such as age, gender, race/ethnicity, living status and hypertension management has been studied in previous research work (Cissé et al., 2021; Gbadamosi et al., 2020; Nyaaba et al., 2020; Iqbal et al., 2021; Wilkinson et al., 2022), and it was found that low adherence to antihypertensive medication was prevalent among males, the Black minority ethnic group, younger patients, and patients from low socioeconomic status which contributes to poor treatment outcomes and increases cardiovascular disease risk among hypertension patients (Nyaaba et al., 2020). Medication adherence is an important factor which was addressed in this study alongside other variables (healthcare professional and ethnicity) as this is a current public health problem of national and global significance, impacting health service and the nation's economy at large.

The Sustainable Development Goals were developed by the United Nations in 2015 with the aim to establish a poverty-free and disease-free environment globally by year 2030. This proposal included 17 goals (169 targets), one of which is to reduce premature death from NCD by one-third by year 2030 (World Health Organization (WHO), 2022). This target can only be achieved through disease prevention, screening, early detection, and treatment with an emphasis on adherence to treatment. A key aspect of disease prevention involves educating the populace on smoking cessation, reduction in alcohol consumption, physical activity and healthy eating with low sodium intake which is closely related to hypertension. A literature review by Singh Thakur et al. (2021) identified that half of the 176 countries who adopted the goals were able to meet two out of 10 progress indicators for NCDs, which suggested that little progress is being made in

reducing NCDs-related mortality. The consequences of not making adequate progress include reduced work ability especially for the working population, increased cost of healthcare, and financial instability. Therefore, this research problem is relevant and of high significance to health psychology.

The association between type of healthcare professionals and antihypertensive medication adherence has been previously studied with a significant relationship between both variables. Woodham et al. (2020) examined the influence of a multidisciplinary intervention on adherence and blood pressure management. Repeated-measures analysis of variance (ANOVA) was used to compare changes in blood pressure and medication adherence between the intervention group (patients seen by a multidisciplinary team) and the control group (patients seen by a physician or clinic nurse). It was found that the intervention group showed greater adherence to antihypertensive medications compared to the control group (72.40% vs 65.38%) and a small effect size was reported (effect size = 0.10). Patients in the intervention group with access to multiple health professionals had improved antihypertensive medication adherence and blood pressure control compared to those in the control group. Similarly, Celio et al. (2018) conducted a systematic review of medication adherence intervention provided through a pharmacist-nurse collaboration. Logistic regression was used to analyze the relationship between medication adherence, blood pressure control and economic outcomes. It was found that, holding all other predictor variables constant, the odds of blood pressure control occurring increased by 55% (OR = 1.559, 95%CI [1.082–2.245]) for a one-unit increase in medication adherence, therefore medication adherence and health outcomes

were significantly improved. Furthermore, studies by Dougherty et al. (2021) and McQuaid and LaNier (2018) examined medication adherence among different racial/ethnic groups and found an association between ethnicity and medication adherence with Blacks having the highest prevalence of hypertension and lowest adherence rate to antihypertensive medications. However, the extent to which ethnicity moderates the relationship between the type of healthcare professional (i.e., a single healthcare professional or multiple healthcare professionals) and antihypertensive medication adherence has not been studied. This current study filled the gap in the literature.

Purpose of Study

The purpose of this quantitative study was to examine the extent to which ethnicity moderates the relationship between type of healthcare professional (single healthcare professional vs. multiple healthcare professionals) and antihypertensive medication adherence. The dependent variable was medication adherence while the independent variable was type of healthcare professional (single healthcare professional vs. multiple healthcare professionals). Ethnicity served as a moderating variable.

Research Questions and Hypothesis

The research questions and hypotheses that was used to address the research problem for this quantitative study are stated below:

Research Question 1: To what extent does the type of healthcare professional (single healthcare professional vs. multiple healthcare professionals) relate to antihypertensive medication adherence among hypertension patients?

$H_0$1: Type of healthcare professional does not predict antihypertensive medication adherence.

$H_1$1: Type of healthcare professional does predict antihypertensive medication adherence.

Research Question 2: To what extent does ethnicity relate to antihypertensive medication adherence among hypertension patients?

$H_0$2: Ethnicity does not predict antihypertensive medication adherence.

$H_1$2: Ethnicity does predict antihypertensive medication adherence.

Research Question 3: To what extent does ethnicity moderate the relationship between the type of healthcare professional (single healthcare professional vs multiple healthcare professionals) and antihypertensive medication adherence among hypertension patients?

$H_0$3: Ethnicity does not moderate the relationship between the type of healthcare professional (single healthcare professional vs multiple healthcare professionals) and antihypertensive medication adherence.

$H_1$3: Ethnicity moderates the relationship between the type of healthcare professional (single healthcare professional vs multiple healthcare professionals) and antihypertensive medication adherence.

The level of measurement for the dependent variable (medication adherence) was interval measurement using the Hill-Bone Compliance to High Blood Pressure Therapy Scale. The level of measurement for the independent variable (type of healthcare professional) and moderating variable (ethnicity) were nominal (dichotomous)

measurement. The moderating role of ethnicity on the relationship between type of healthcare professional and medication adherence was determined using multiple regression with moderation analysis.

Theoretical Foundation

This study used the theoretical domains framework (Michie et al., 2005) and the biopsychosocial model of health (Engel, 1977) as its theoretical foundation to guide the research study. The theoretical domains framework was developed by three groups of experts (18 psychological theorists, 30 health psychologists, and 16 health service researchers) and was originally comprised of 12 domains designed to address challenging health behaviors therefore providing guidance to health professionals in providing intervention/support that brings about behavioral change (Cane et al., 2012; Easthall et al., 2019; Michie et al., 2005). The 12 domains include knowledge, skills, social/professional role and identity, beliefs about capabilities, beliefs about consequences, motivation and goals, memory, attention and decision processes, environmental context and resources, social influences, emotions, nature of behavior, and behavioral regulation (Michie et al., 2005). However, Cane et al. (2012) conducted another validation test building on the validation process by Michie et al. (2005), which resulted in a 14-domain version of the theoretical domain framework with an additional two domains to the original version. The 14- domain version includes knowledge, skills, social/professional role and identity, beliefs about capabilities, optimism, beliefs about consequences, reinforcement, intentions, goals, memory, attention and decision processes, environmental context and resources, social influences, emotions, and

behavioral regulation. The optimism and intentions domains are missing from the 12-domain version therefore this study used the 14-domain version of the framework focusing on knowledge, memory, attention and decision processes, skills, social influences, and intentions domains.

The biopsychosocial model was developed by Engel (1977) to meet patients' physical, psychological, and social needs by providing a patient-centered care through the assessment and treatment of patients in a holistic manner. The biopsychosocial model is a way to understand how health and disease are influenced by biological, psychological, and social factors. These three factors are reflected in the 14 domains of the theoretical domains framework and allow healthcare professionals to strategically provide medication adherence intervention to hypertension patients from different ethnic groups. Chapter 2 provides detailed explanation of both frameworks and the rationale for choosing them for this study.

Nature of Study

The research problem was addressed using a quantitative approach. A cross-sectional correlational design was used to examine the extent to which ethnicity (IV) moderates (interaction term) the relationship between type of healthcare professional (IV) and antihypertensive medication adherence (DV). According to Burkholder et al. (2020), correlational design helps the researcher understand the relationship between variables in a study. Correlational design does not allow a causal inference to be made therefore a moderating variable was used in this quantitative study to determine the extent of relationship between the dependent and independent variables. Data were collected via

online survey; research participants were between 25 years and 60 years of age, diagnosed with hypertension more than three months ago, and took at least one antihypertensive medication. Participants were recruited through Prolific (an online recruitment service). Survey and demographic information were used to address the research questions using the Hill-Bone Compliance to High Blood Pressure Therapy Scale. Multiple regression with moderation analysis was used to analyze the data.

Definitions

Antihypertensive medication: Antihypertensive medications are used in the pharmacological treatment of high blood pressure.

Ethnicity: Ethnicity is defined as a social classification according to a person's identity, culture, or ethnic group (American Psychological Association, 2022).

General practice: This is also known as a surgery and is a place where a range of health services are offered to people with medical needs (National Health Service, n.d.).

Healthcare professional: The term healthcare professional refers to doctors, nurses, and pharmacists who manage the patient's hypertension in terms of diagnosis and treatment.

Hypertension: Hypertension is also known as high blood pressure and is when the pressure in the blood vessels is too high (World Health Organization, 2021).

Medication adherence: The World Health Organization (2003) defines adherence as the extent to which a person's behavior corresponds with agreed recommendations from a healthcare provider. Therefore, medication adherence implies the extent to which individuals take their medications as prescribed by their health practitioner.

Multiple healthcare professionals: This refers to two or more healthcare professionals who manage the patient's hypertension in terms of diagnosis and treatment.

Single healthcare professional: This refers to one healthcare professional, either a doctor, a nurse, or a pharmacist who manages the patient's hypertension in terms of diagnosis and treatment.

Assumptions

It was assumed that participants followed the instructions for completing the surveys accurately and that they were truthful and accurate in their responses. However, participants might have been reluctant to describe their health-related behaviors (or lack thereof). Participants were given the requirements of the study that detailed the need for their honest responses to the survey questions. Furthermore, participants were reminded that the online survey is anonymous and that there was no identifying information requested, with the hope that this would ensure participants were comfortable answering questions honestly. There was also a general assumption that the responsibility of medication adherence lies mainly with the patient while the healthcare providers in charge of the patient's care make minimal input to provide adherence support.

Scope and Delimitations

The focus of this study was to examine the moderating effect of ethnicity on the relationship between medication adherence and the type of healthcare professional (single healthcare professional vs multiple healthcare professionals). The sample was limited to men and women who have been diagnosed with hypertension more than 3 months ago and prescribed at least one antihypertensive medication, between 25 years and 60 years of

age, belonging to a Black or White ethnic group, and residing in the United Kingdom. The issue of medication adherence has been widely studied mostly using a qualitative approach, therefore this study used quantitative analysis to examine the relationship among the variables of interest. Demographic information was collected and limited to age, gender, comorbidity, and type of healthcare professional managing hypertension. Finally, this study was conducted in the United Kingdom, and findings from this study may not be generalizable to other countries or racial groups.

Limitations

This quantitative study relied on the data provided by research participants through an online survey. There is a potential for response bias when using a self-report survey such as one used for this study and social desirability is a type of response bias where participants respond to questions in a way that do not portray honesty to earn favor (Burkholder et al., 2020). Participants may also provide extreme answers such as "strongly agree" on every question which equally portrays dishonesty and can affect the results. Another limitation of this study was researcher bias; I work in the health system and understand that conducting the study from my perspective can influence the results. To avoid researcher bias, data were analyzed objectively using statistical tools and interpretation of data was done using the same approach (objectively) to prevent any threat to the validity of the study. There was also a limitation with the research design for this study. Correlational designs can be used to determine the relationship between the variables however, it is unable to infer causation from the data (Burkholder et al., 2020).

Significance

This study addressed a gap in the literature by determining whether ethnicity moderates the relationship between type of healthcare professional and medication adherence. The results from this study may be used for positive social change to address the issue of non-adherence to medication among hypertension patients especially those of the minority ethnic group by identifying and addressing some of the factors that predispose this group to health disparities. Findings from this study will determine whether management of hypertension by a multiple healthcare professional improves medication adherence compared to management by a single healthcare professional thereby adding to existing body of knowledge. Literature has identified that Blacks have low adherence rate compared to Whites; therefore, if greater adherence is reported among Black participants managed by a multiple health professional, findings from this study may be used to promote the implementation of a multidisciplinary intervention into routine hypertension services in primary and secondary care setting for Black patients, which will contribute to disease control and reduce the increasing rise in the burden of NCDs. Finally, the findings from the study may lead to positive social change by building a healthy community through positive health outcomes among hypertension patients with improved medication adherence, blood pressure control, reduced risk of morbidity/mortality, and improved quality of life.

Summary

Chapter 1 introduced the study describing the research problem and gap in knowledge supported by research literature. Medication adherence is important in the

management of hypertension; however, non-adherence to antihypertensive medication is common and is a leading cause of poor treatment outcome (Easthall et al., 2019). Non-adherence to antihypertensive medication can result in uncontrolled hypertension leading to other cardiovascular disease complications such as stroke and heart failure (American Heart Association, 2022). The Black ethnic group are more likely to have a low medication adherence rate compared to their White counterpart therefore healthcare providers are in a strategic position to identify non-adherence to treatment among this group and support hypertension patients from this ethnic group with adherence through a tailored, patient-centered intervention (Dong et al., 2021). The purpose of this quantitative study was stated, variables were defined, methodology was briefly described, and research questions highlighted. Theoretical domains framework and biopsychosocial model of health were identified as the theoretical frameworks. Key variables and terminology with multiple meanings were defined. Chapter 2 will provide synthesized information regarding the literature search and the theoretical frameworks followed by an exhaustive review of the literature related to key variables (i.e., the health system and management of hypertension, barriers to medication adherence, collaborative approach to enhance medication adherence, ethnicity and medication adherence). The chapter will end with a summary and conclusions.

Chapter 2: Literature Review

Introduction

Hypertension is a modifiable risk factor for cardiovascular diseases and the main stay of treatment is antihypertensive medications. Individuals from the minority ethnic groups such as the Black population have shown a lower adherence rate to antihypertensive medication compared to their White counterparts. The purpose of this cross-sectional correlational quantitative study was to examine the extent to which ethnicity moderates the relationship between type of healthcare professional (single healthcare professional vs. multiple healthcare professional) and antihypertensive medication adherence.

Cardiovascular disease is the leading cause of death worldwide affecting about 17.9 million people annually and comprising of different heart conditions such as coronary heart disease, cerebrovascular disease, peripheral arterial disease, heart failure, rheumatic heart disease, and congenital heart disease (WHO, 2022). Hypertension is a modifiable risk factor and a major determinant for developing cardiovascular disease with a higher prevalence of cardiovascular disease present in low-income countries, low-middle income countries, and upper-middle income countries (Chow et al., 2013) which is consistent with the health report by the world health organization (WHO, 2020). The study by Chow et al. (2013) revealed a higher rate of awareness, treatment, and blood pressure control in the urban communities compared to the rural communities among the low-income and low-middle income countries. Awareness, treatment, and blood pressure control were the same in the urban and rural communities among the upper-middle and

high-income countries which reflects the impact of socio-economic status on the prevalence and incidence of hypertension. Sub-Saharan Africa is noted to have the highest prevalence of hypertension with the lowest rate of awareness, treatment, and control (Ataklte et al., 2015). Research has shown that keeping hypertension under control reduces the risks of developing cardiovascular disease (Pinho et al., 2021); however, achieving blood pressure control remains a challenge mainly because of non-adherence to antihypertensive medication which establishes the relevance of this study's research problem. The Million Hearts (2020) study revealed that only about 50% of patients diagnosed with hypertension who are on antihypertensive treatment take their prescribed medication leading to co-morbidity and increased mortality. This chapter provides synthesized information regarding the literature search and the theoretical frameworks followed by an exhaustive review of the literature related to key variables (i.e., the health system and management of hypertension, medication adherence, barriers to medication adherence, collaborative approaches to medication adherence, ethnicity and medication adherence). This chapter ends with a summary and conclusions.

Literature Search Strategy

The keywords included *medication adherence support, hypertension, healthcare professionals, physicians, pharmacists, nurse practitioners, medication adherence, cardiovascular disease, multidisciplinary team, ethnicity or race or culture or minority or minorities, and hypertension management, ethnicity or race or culture or minority or minorities,* and *socioeconomic status.* I conducted this search using the Thoreau

multidatabase search. The focus of the literature search was on peer-reviewed journal articles published in the last 5 to 10 years.

Theoretical Framework

The frameworks that guided this study are the theoretical domains framework (Michie et al., 2005) and the biopsychosocial model of health (Engel, 1977). The use of theory in research provides a deeper understanding into the research problem and helps to navigate through other components of the study which impacts on the study's findings (Stewart & Klein, 2016).

Theoretical Domains Framework

The theoretical domains framework is a framework of theories developed by a group of experts in the field of psychology to help address the issue of selecting the most appropriate theory for use in research (Michie et al., 2005; Stewart & Klein, 2016). This framework is a summation of 33 behavior change theories and was originally comprised of 12 domains which includes knowledge, skills, social/professional role and identity, beliefs about capabilities, beliefs about consequences, motivation and goals, memory, attention and decision processes, environmental context and resources, social influences, emotions, nature of behavior, and behavioral regulation (Michie et al., 2005). Further validation of the framework by Cane et al. (2012) resulted in a 14-domain version of the theoretical domain framework with an additional two domains to the original version. The 14-domain version includes knowledge, skills, social/professional role and identity, beliefs about capabilities, optimism, beliefs about consequences, reinforcement, intentions, goals, memory, attention and decision processes, environmental context and

resources, social influences, emotions, and behavioral regulation. The optimism and intentions domains are missing from the 12-domain version therefore this study used the 14-domain version of the framework.

A systematic review of the literature conducted by Morrissey et al. (2017) applied the theoretical domains framework in examining barriers and facilitators of medication adherence. They also addressed the impact of each targeted domain on blood pressure control and medication adherence in hypertension patients who were prescribed antihypertensive medications. The domains mostly targeted for adherence intervention were memory, attention and decision processes, environmental context and resources, social influences, knowledge, behavioural regulation and beliefs about consequences. Improved medication adherence and blood pressure outcomes were associated with the memory, attention and decision processes domain. Presseau et al. (2017) conducted a qualitative study using the theoretical domains framework to understand medication adherence in patients who suffered a myocardial infarction. Higher adherence rates were reported, and the domains found useful in understanding medication adherence were memory, attention, and decision process, social role and identity, beliefs about consequences, social influence, and behavioral regulation.

The studies conducted by Morrissey et al. (2017) and Presseau et al. (2017) addressed patient-related factors that influenced medication adherence among patients with long-term conditions using the theoretical domains framework. However, Patton et al. (2021) addressed factors related to the healthcare system using the theoretical domains framework to provide guidance to community pharmacists in providing medication

adherence support to patients with long-term conditions. Patton et al. examined the barriers community pharmacists faced that hindered adherence support to older patients on complex dosage regimens. Medication adherence support is regarded as a complex clinical behavior requiring the skill of being able to identify non-adherent patients and to tailor intervention that is specific to each individual. The theoretical domains framework was used to identify domains to be targeted by the community pharmacists that could enhance medication adherence support. A mixed method approach was used to understand the behavior of medication adherence. The quantitative phase used a self-administered in-person survey which was preferred over an online survey to avoid low response rate from the latter. Findings revealed that only a third of the surveyed pharmacists frequently asked patients about missed doses of their medication and barriers to adherence support reported by all the surveyed pharmacists were inadequate knowledge about adherence, lack of time, lack of professional confidence, difficulty with decision making, and inadequate training. The key domains identified as targets for improving pharmacist adherence support included knowledge, skills, motivation and goals, memory, attention, and decision processes, environmental context and resources, social influences, and behavioral regulations (Patton et al., 2021).

Biopsychosocial Model of Health

The biopsychosocial model of health was developed by Engel (1977) following a criticism of the existing model of care, the biomedical model. The biomedical model assesses and treats patients' medical condition based on biological factors excluding other crucial factors such as psychological and social factors. While biological factors are

important and considered the major criteria for confirming a disease (i.e., pointers to disease onset in the presence of abnormalities), it does not provide a full understanding of how the disease is experienced and reported subjectively by everyone. Engel critiqued the inability of the biomedical model to assess and treat a patient in a holistic manner which led to the introduction of the biopsychosocial model which stemmed from behavioral science where behavior (psychosocial) and disease (biological) has been reconciled.

The biopsychosocial model takes into account the patient, the patient's environment, culture and beliefs, the healthcare provider, and the healthcare system to provide a better understanding of the determinants of the disease and tailor intervention that is patient-centered. The biopsychosocial model of health is relevant to this study as it reflected the relationship between the type of healthcare professional as a social factor, medication adherence as a psychological factor, and ethnicity as a social factor. Psychological factors such as health behaviors are contributing factors to health and illness. For example, non-adherence to antihypertensive medication leads to complications which includes development of co-morbidities and increased mortality. Healthcare professionals are in a better position to explore the patient's fears, concerns, beliefs, ideas, expectations, and support adherence to produce the desired outcome all of which are embedded in the biopsychosocial model (Engel, 1977).

Kretchy et al. (2020) used the biopsychosocial model to understand the psychosocial predictors of medication adherence among male hypertension out-patients. The results revealed that medication adherence was influenced by patients' socio-demographic factors and psycho-behavioral factors which included age, education,

income, marital status, number of medications taken, duration of diagnosis, psychological distress, sleep problem, and sexual dysfunction (Kretchy et al., 2020). Higher adherence rates were found among the younger participants, those with fewer years of diagnosis, those taking less medications, those who earn higher income, the highly educated, and the unmarried. Adherence rates were lower among participants with sleep problems, psychological distress, and sexual dysfunction. The authors concluded that intervention that targets these factors can help support medication adherence among this group of patients which will consequently improve their quality of life.

Nadir et al. (2018) acknowledged the relevance of the biopsychosocial model to medication adherence and the patient's health journey generally. The qualitative study assessed the extent the biopsychosocial model was used by doctors in consulting with their patients. The findings revealed that the biopsychosocial model was seldom used during consultations leaving patients dissatisfied. The authors gave a few reasons why the biopsychosocial model is mostly ignored by doctors such as anticipated increase in workload and lack of conviction about the model's importance. Health is defined as a "state of complete physical, mental, and social well-being" (World Health Organization, 1946); therefore, in restoring a patient from the state of illness/disease to health, all three factors that make up the biopsychosocial model should be put into consideration as part of a physician's consultation.

Literature Review Related to Key Variables

The Healthcare System and Management of Hypertension

The healthcare system in Europe and the United States are quite different; the health system in England for instance is run by the national health service, while healthcare in the United States is mostly funded by private companies (Marshall et al., 2016). The national health service is made up of four sectors namely the primary care sector, secondary care sector, tertiary care sector and community health. Primary care comprises of general practice, community pharmacy, dentistry, and optometry, with healthcare mostly provided by health professionals such as general practitioners, practice nurses, dentists, opticians, and pharmacists (NHS Digital, 2022). The NHS provides and funds a wide range of health services with most of these services freely provided to the public including hypertension diagnosis and management. According to the National Institute of Health and Care Excellence (NICE, 2019) guidelines, 25% of adults living in England are affected by high blood pressure, accounting for 12% of appointments in primary care.

Hypertension is mostly managed in the general practice by general practitioners (also known as family doctors); however, other primary care providers involved in hypertension management in terms of diagnosis and treatment include nurses and pharmacists, reinforcing medication adherence and improving blood pressure control. The study by Celio et al. (2018) confirmed the unique skills of pharmacists and nurses in managing hypertension patients, early identification of non-adherence and supporting medication adherence using a collaborative approach. The authors went a little further to

explain the terminologies used to describe collaborative working among healthcare professionals such as "multidisciplinary" and "interdisciplinary." A multidisciplinary team comprise of different healthcare professionals working on the same task independently towards achieving a common goal while interdisciplinary team involves different healthcare professionals working closely together, exchanging ideas and knowledge in a given task/project (Celio et al., 2018). This study used the terminology "multiple healthcare professionals" instead of multidisciplinary team for clarity comprising of physicians, nurses, and pharmacists working independently to manage hypertension patients and support their journey from diagnosis to treatment control using different care models. Fletcher et al. (2019) discussed four care models in their study and the authors explored patients' choice of care model in managing their condition (hypertension). The care models discussed are GP led, pharmacist led, telehealth, and self-management. Following exposure to all four care models, participants chose hypertension management by their GP, pharmacist, and through telehealth over self-management (Fletcher et al., 2019). Patients' preference determines the effectiveness of treatment therefore it is recommended that preferences should be explored before and during treatment to establish concordance and create a platform for productive adherence support. Patients whose preference is to have their condition managed by a practice pharmacist, a practice nurse, and/or a community pharmacist will most likely engage in the shared decision making and adhere to recommendations that promote medication adherence and improve treatment outcomes. Patients are assigned to a general practitioner (family doctor) when they register with the general practice which helps to

co-ordinate the running of the general practice and reassures patients someone is accountable for their care (British Medical Association, 2020). The patient's condition will be managed primarily by their assigned doctor or other doctors within the general practice unless a plan is put in place that allows the practice nurse or pharmacist to manage the condition, acting within their area of competence. Patients also have the flexibility of choosing any doctor or nurse within the general practice for their appointments. Having this support role in place is of utmost importance and beneficial for both healthcare providers and patients considering that general practitioners have a lot of workloads with limited consultation time (Burnier et al., 2021). The consultation will require assessing the patient in a holistic manner, make a diagnosis, offer the most suitable treatment and counsel patients about the prescribed medicine which drives concordance as well as builds a foundation for adherence to therapy. The time required to provide all necessary information which includes making future plans is not realistic in some instances therefore having other health professionals such as nurses and pharmacist support in the management plan can influence the achievement of adherence to medication. Whatever is missed during the doctor's consultation can be made up for during appointments with other health professionals who have lesser workload.

Burnier et al. (2021) conducted a survey to examine healthcare professionals' perspectives about medication adherence and hypertension management. Healthcare professionals who took part in the survey were doctors, nurses, and a few laboratory biologists and some of the findings revealed that about half of the healthcare professionals designated 1 to 5 minutes to discuss medication with patients. The

timeframe is neither realistic nor sufficient to drive adherence if the consultation were to be patient-centred using a two-way communication method and conducted in a holistic manner using the biopsychosocial model. Furthermore, findings from the study revealed that 38% of healthcare professionals will always schedule more frequent appointments and 13% will recommend the support of a nurse as a strategy to improve adherence among hypertension patients (Burnier et al. (2021) which supports the notion that patients are sometimes seen by more than one health professional such that after the initial diagnosis and treatment initiation by their doctor, subsequent appointments are overseen by the nurse or pharmacist where blood pressure measurements are taken, treatment is optimized, lifestyle measures are reinforced, adherence to medication is reviewed, and referral to the patient's doctor is made where necessary.

Barriers to Medication Adherence

Adherence to medication has been studied by several researchers from different perspectives ranging from factors that hinder adherence to strategies that can be used to address each of these factors. The World Health Organization (2003) summarized the various factors that influence medication adherence into five groups, and these have formed the basis for the barriers/hinderances to adherence. The five groups are patient-related factors, socio-economic factors, condition-related factors, therapy-related factors, and health systems factors. It has been established that non-adherence to medication could be intentional and non-intentional (Pinho et al., 2021) and the ability to identify the difference among patients guides the healthcare professional in tailoring suitable adherence support. Barriers to adherence identified from previous qualitative and

quantitative studies include stress, lack of knowledge about the condition or treatment, side effects of medication, cultural beliefs, psychological resistance, poor physician-patient communication, financial constraint, unhealthy lifestyle, polypharmacy, and complex dosage regimens (Kang & Jeong, 2020; Roohafza et al., 2016; Satish et al., 2019; Tavakoly Sany et al., 2020). Each of these barriers fit into one or more of the five factors summarized by WHO (2003) as shown in Table 1.

Table 1: *Barriers to Medication Adherence in Relations to the Five Factors that Influence Adherence*

Patient-related Factors	Socioeconomic-related Factors	Condition-related Factors	Therapy-related Factors	Health systems-related Factors
Poor health literacy, Cultural beliefs, Psychological resistance	Financial constraint, Unhealthy lifestyle, Lack of transportation	Polypharmacy, Complex dosage regimen	Side effects of medication, Polypharmacy, Complex dosage regimen	Poor physician-patient communication

Antihypertensive medication non-adherence could start from the point of therapy initiation where patients refuse to start therapy or after treatment has been initiated where patients stop taking their prescribed medication. Kang and Jeong (2020) were the first to study treatment resistance at the initiation stage among hypertension patients. Patients revealed the reason for refusing to start treatment as being psychological where they

assume the disease would go away with time. However, they acknowledged the awareness of the consequences of resisting treatment and concluded that they would take their prescribed medication with time. This is an example of intentional non-adherence to treatment which should be identified during consultation through effective physician-patient communication. However, it is important to note that non-adherence could start at any stage of treatment and patients should be closely monitored throughout the different stages of treatment by encouraging follow-up clinic visits.

Research has shown that routine follow up positively influences medication adherence and blood pressure control among hypertension patients. Zuo et al. (2019) examined the association between blood pressure control and frequency of hypertension clinic visit and they argued that the most common cause of poor blood pressure control was poor adherence to medication and unhealthy lifestyle. They also identified from their study that barriers to blood pressure control were found at the patient-level, physician-level, and the healthcare system-level (Zuo et al., 2019). Logistic regression analysis was used to evaluate the relationships between frequency of clinic visits and BP control, medication adherence, and behavioral change among patients with hypertension. It was found that holding all other predictor variables constant, the odds of adherence to antihypertensive medication occurring increased by 82% (OR = 1.747, 95% CI [1.484–2.056]) for a one-unit increase in clinic visit. Findings revealed that follow-up clinic visits improved adherence to medication and subsequently improved blood pressure control among this group of patients. Therefore, to maintain a prolonged positive health

outcome, healthcare systems should incorporate routine follow-up clinic visits into the management of hypertension both in primary care and secondary care.

Effective physician-patient communication should be encouraged as one of the barriers to blood pressure control identified by Zuo et al. (2019) was found at the physician level and one of the barriers to medication adherence identified earlier is poor physician-patient communication. Physicians will benefit from communication skills training which will positively impact on blood pressure control and medication adherence. Tavakoly Sany et al. (2020) assessed the effectiveness of communication skills training for physicians and its impact on self-efficacy, health literacy skills, blood pressure control, and medication adherence among hypertension patients. Findings from the study revealed an improvement in patient-physician communication following the training and an overall improvement was seen among the patients in self-efficacy, medication adherence and blood pressure control. One of the strategies identified to address some of the barriers to adherence include theory-based interventions such as the theory of reasoned action, theoretical domains framework, biopsychosocial model, and plan-do-study-act model of healthcare (Kretchy et al., 2020; Morrissey et al., 2017; Sadeghi et al., 2020; Satish et al., 2019). Strategies to address barriers to medication adherence suggested by Burnier and Egan (2019) were patient education, encouraging self-management and self-monitoring, simplifying drug regimen, a multidisciplinary approach (collaborating with physicians, nurses, and pharmacists), and providing financial support to help facilitate collaboration between healthcare professionals.

Collaborative Approaches to Medication Adherence

Few studies have suggested the utilization of a collaborative approach involving physicians, nurses, and pharmacists in the successful management of long-term conditions such as hypertension. Hwang et al. (2017) examined the benefits of having a physician-pharmacist collaboration in the management of hypertension. In their study, the role of the pharmacist in disease management and the influence on disease control was identified. The collaborative approach resulted in improved blood pressure control and a better quality of life among hypertension patients. However, the authors highlighted the challenges of bringing pharmacists into the healthcare system to collaborate with physicians despite the benefits to patients and the health system. Some of the challenges include inadequate knowledge about pharmacists' training and lack of funding for the collaborative service. Similarly, Celio et al. (2018) investigated the impact of pharmacist-nurse collaboration on medication adherence among patients with long term conditions. In their systematic review, the role of each health professional reflects the extent to which medication adherence support could be provided to patients which suggest that the type of healthcare professional that manages the patient's long term condition determines how much influence they have on the patient to improve medication adherence however, management of long term condition with the input of different health professionals allows the combination of different skills to provide support to patients. One of the unique skills of pharmacists is in conducting structured medication review while nurses have the unique skills of disease management and health assessment which helps to identify adherence issues and provides the avenue for adherence support according to each

patient's need. There are skills peculiar to both health professional which has been used successfully to provide medication adherence support to patients with long term condition and these include motivational interview skills, patient education, and self-management advise. The literature review by Celio et al. (2018) focused on only two health professionals: pharmacists and nurses. However, all healthcare providers including physicians, psychologists, social workers are in a good position to influence and support medication adherence in patients.

Sadeghi et al. (2020) argued that a multidisciplinary team of health professionals can offer strategic interventions to improve blood pressure control among hypertension patients through the utilization of various skills such as medicines optimization, medicines use review, knowledge of the hypertension guidelines, and patient education in supporting patients with medication adherence. Similarly, team-based care was acknowledged as the recommended model of care in the management of long-term conditions such as hypertension (Carter et al., 2012; Santschi et al., 2017; Santschi et al., 2021). Santschi et al. (2021) evaluated the effectiveness of team-based care offered by physicians, nurses, and pharmacists to improve blood pressure control. There was improvement in systolic blood pressure from the treatment group who were exposed to intervention by all three health professionals compared to the control group who only received an intervention from the physician. Similarly, Woodham et al. (2020) evaluated a multidisciplinary intervention in the management of hypertension among elderly patients. The study revealed that patients improved blood pressure control when they were provided with comprehensive information, patient-centered care, and medication

adherence support. The above evidence points to the importance of incorporating a collaborative approach into the routine management of hypertension for improving patients' quality of life, providing patient satisfaction, reducing co-morbidity/mortality, and reducing the growing healthcare cost on the national health service.

Ethnicity and Medication Adherence

Hypertension is a modifiable risk factor for cardiovascular disease with a higher prevalence in middle- and low-income countries compared to high-income countries. It has been established that pharmacological treatment such as antihypertensive medications and non-pharmacological treatment such as lifestyle modification are key aspects of hypertension management (Burnier & Egan, 2019). Medication adherence plays a vital role in blood pressure control, however achieving blood pressure control remains a major challenge in the health sector as literature has revealed that less than half of patients diagnosed with hypertension who are on antihypertensive medication have their blood pressure controlled (Sadeghi et al., 2020). The inability to attain blood pressure control predisposes the patient to other cardiovascular disease risks, decrease in quality of life, mortality, and consequently, increasing the economic burden on the national health service. The prevalence of hypertension is highest among the minority ethnic groups and individuals who have low socioeconomic status within their community. Similarly, uncontrolled hypertension is more prevalent among these groups which is closely linked to non-adherence to antihypertensive medications (Dougherty et al., 2021; Marseille et al., 2021; Rashid et al., 2017; Sripipatana et al., 2019).

An explorative study of medication adherence among different ethnic groups was carried out by Dong et al. (2021), comparing the level of adherence to hypertension, diabetes, and hyperlipidemia medications among Whites, Hispanics, Blacks, and Asians. Logistic regression was used to analyze the relationship between racial/ethnic disparity and nonadherence to hypertension, diabetes, and hyperlipidemia medications. It was found that holding all other predictor variables constant, the odds of nonadherence to antihypertensive medication occurring increased by 27% (OR = 1.27, 95% CI [1.22–1.32]) for Black participants. Findings revealed a statistically significant difference in medication adherence across the ethnic groups. Blacks reported the highest level of non-adherence to medication in the three disease areas while Asians had the lowest level of non-adherence (Dong et al., 2021).The authors also examined how predisposing factors such as age, gender, marital status, level of education, geographical region, and income contribute to adherence rate among the different ethnic groups and it was found that non-adherence was lower among the males married couples, and high income earners. Those who lived in counties with a high proportion of married couple families reported low non-adherence rate which is a significant finding because such counties had an advantage of social support and community affluence which plays a vital role in the management of chronic diseases such as hypertension. Patients who lived in counties with a high proportion of married couple families and consequently had social support from family and friends were able to better manage their condition compared to those who did not have such an advantage. Blacks and Hispanics lived in counties with a low proportion of married couple families compared to their White counterpart and consequently, did not

have much access to social support which negatively impacted on their health and contributed to a higher level of medication non-adherence.

Non-adherence to antihypertensive medications leads to poor blood pressure control which can result in uncontrolled hypertension hence, the vicious circle continues without an appropriate intervention and management plan. Furthermore, it is paramount to have adequate knowledge and gain understanding about the association between ethnicity and medication adherence to skillfully manage each individual's condition and optimize treatment among hypertension patients.

In the United States and the United Kingdom, the ethnic group that has the highest incidence of hypertension is the Black population (Aggarwal et al., 2021; British Heart Foundation, 2021). However, research has shown that only about half of the diagnosed population are adherent to antihypertensive treatment which is consistent with the report by Million Hearts (2020). Furthermore, poor adherence to medication is identified as a contributing factor to disparity in health outcome. One of the reasons for disparity in health outcome among the minority ethnic group compared to the Whites is identified as suboptimal level of disease and treatment awareness however, strategies are in place to address this health disparity which includes patient education, early screening and monitoring, medication adherence support, and other self-management support (Sripipatana et al., 2019).

Cultural factors (patient-related factors) and socioeconomic factors were among the five factors highlighted by the World Health Organization which impact medication adherence. Thus, factors such as patient, attitudes, beliefs, socioeconomic status, and

varying levels of concerns about taking medications should be considered when dealing with medication adherence among different ethnic groups (McQuaid & Landier, 2018). Low socioeconomic status predisposes patients to poor medication adherence due to factors such as under-employment, financial constraint, lack of access to health facilities, and unaffordability of health insurance. Xie et al. (2019) examined the impact of socioeconomic status on racial and ethnic disparities in medication adherence and it was found that patients with minimum income, low educational level and from the minority ethnic group had the lowest rate of medication adherence across the three chronic conditions (hypertension, type 2 diabetes, hyperlipidaemia) that were examined. Blacks and Hispanics were found to have about 4.8% to 6.5% lower adherence rates because they take their medications inconsistently compared to their White counterpart. Similarly, Gerber et al. (2010) in their study, had comparable findings from examining racial differences in medication adherence. It was found that African Americans had a lower adherence rate compared to Whites and the reason for non-adherence was mostly cost-related. It was also found that White patients refilled their prescription before running out of medication and to a large extent take their medications as prescribed while the African Americans seldom take their medication as prescribed and do not refill their prescription until they have run out of medication (Gerber et al., 2010). Patients from the minority ethnic group who do not have access or have limited access to medications may consider complementary and alternative medicine a cheaper alternative to their prescribed medication therefore refusing to attend medical appointments, no longer refilling their prescriptions, and discontinuing their antihypertensive medication (Kohl et al., 2020).

Complementary and alternative medicine is widely used as a monotherapy or in combination with conventional medications both in the developed and developing countries to treat chronic diseases and it is used by about 30% Of adults in the United States. Complementary and alternative medicine use varies across different ethnic groups, and it is commonly used among cardiovascular disease patients as it is considered to be safe, effective, and with few adverse effects in comparison to conventional medicines. However, there is no evidence yet to determine the influence of complementary and alternative medicine use on medication adherence among patients with cardiovascular disease risk in different ethnic groups. Research has shown that patients from the minority ethnic groups less frequently disclose the use of complementary and alternative medicine to their healthcare provider during their medical appointments (McQuaid & Landier, 2018), therefore, it should be a point of duty for health professionals to ask patients during consultations on the use of these medicines as they can help in identifying non-adherence and the reason why patients are not taking their medication as prescribed.

Language barriers and communication patterns are additional factors to consider in relation to ethnicity and medication adherence. Patients whose first language is not English and who have poor English literacy require a family member with high proficiency in English language or an interpreter for each appointment to get the best out of their treatment however, this may not always be the case leading to communication barrier between the patient and the healthcare professional (McQuaid & Landier, 2018). Consequently, poor communication and misinterpretation from both sides predisposes the patient to a higher rate of non-adherence due to the negative influence such consultation

would have on patients' understanding of their condition and medications (McQuaid & Landier, 2018). Furthermore, non-White patients with equally high English proficiency as their White counterpart face discrimination from health professionals during their medical appointments through the clinician's mode of communication such as verbal dominance which contradicts patient-centered care and impacts on medication adherence (Johnson et al., 2013). Patients from minority ethnic groups, especially Blacks, report being dissatisfied with their consultation with health professionals and the level of care they receive leading to a higher rate of distrust in the health system. Johnson et al. (2013) in their book, identified racial differences in the management of cardiovascular disease with the most favorable treatment offered to White patients compared to African American patients which explains the distrust and dissatisfaction Black patients have in their healthcare provider and the health system at large.

One of the strategies that has shown effectiveness in enhancing adherence to pharmacological and non-pharmacological treatment is the use of digital or technology-based intervention where text messaging can be used to send reminder messages to patients regarding diet control, recommended exercise, smoking cessation, reduction in alcohol consumption, and their daily medication. Dougherty et al. (2021) confirmed that more than half of Blacks and Latinx have access to internet through a smart phone or some other form of digital devices which suggests that they could potentially access health information if enrolled unto a health program where medication adherence can be promoted which may lead to improved health outcome and a better quality of life. However, the remaining population without access to a digital device will be deprived of

the benefits from the technology-based intervention. Therefore, alternative strategies such as free health fairs and free seminars/workshops should be made available to help bridge the gap. Anti-hypertensive medication adherence will be reinforced through a positive patient-healthcare professional relationship. Thus, the issue of adherence should be seen as the responsibility of both the patient and the healthcare professional.

Summary and Conclusions

Non-adherence to antihypertensive medications remains a global challenge and literature reveals that only half of patients diagnosed with hypertension take their medication as prescribed. Adherence rate is lower among the Blacks compared to their white counterparts due to financial constraints, lack of social support, under-employment, low income, limited access to health resources, and poor physician-patient relationship. Medication adherence can be improved through patient education, encouraging self-management and self-monitoring, simplifying drug regimen, effective patient-physician communication, collaboration among health professionals, and employing theory-based interventions based on the biopsychosocial model of health. It is clear from the literature review that collaboration among physicians, nurses, and pharmacists improves adherence to antihypertensive medication and ethnicity influences the level of medication adherence. However, the extent to which ethnicity moderates the relationship between medication adherence and type of healthcare professional is not yet known. This gap in the literature was addressed in this study. The frameworks that formed the basis of this study are the biopsychosocial model of health and theoretical domains framework. Chapter 3 includes a discussion of the research design and rationale, methodology

(population, and sampling and sampling procedures), procedures for recruitment, participation, and data collection, instrumentation and operationalization of constructs, data analysis plan, threats to validity, and ethical procedures.

Chapter 3: Research Method

Introduction

The purpose of this quantitative study was to examine the extent to which ethnicity moderates the relationship between type of healthcare professional (single healthcare professional vs. multiple healthcare professionals) and antihypertensive medication adherence. Chapter 3 includes a description of the research design and rationale, methodology, sampling procedures, recruitment, and data collection procedures. Instrumentation and operationalization of constructs will be discussed, including reliability and validity of each instrument and justification for use. Finally, the data analysis plan will be discussed along with the research questions and hypotheses, ending with a discussion of threats to validity and ethical procedures.

Research Design and Rationale

The variables include type of healthcare professional (independent variable), ethnicity (moderating variable), and medication adherence (dependent variable). A cross-sectional quantitative survey design was used to examine the extent to which ethnicity (IV) moderates (interaction term) the relationship between type of healthcare professional (IV) and antihypertensive medication adherence (DV). Data were collected, justifying the use of a cross-sectional design. A quantitative method uses a deductive approach to inquiry whereby the theoretical framework can be used to explain the findings from the hypotheses (Burkholder et al., 2020). A correlational design is a non-experimental research design used in quantitative studies and has been chosen for this study. There were no time or resource constraints using this design, as it does not involve experimental

procedures and relationship between variables were measured without controlling any of the variables; data collection was through online survey and questionnaire. The design choice was consistent with research designs needed to answer the research questions, as it allowed the use of numerical data and statistical analysis to understand factors related to antihypertensive medication adherence.

Methodology

Population

Hypertension affects about 1.2 billion adults worldwide and 13.5 million adults in England (NICE, 2019; WHO, 2021). The target population for this study includes men and women who were between 25 years and 60 years of age, diagnosed with hypertension more than 3 months ago, and took one or more antihypertensive medications. Participants were from Black or White ethnic group and were registered with a general practice in the United Kingdom.

Sampling and Sampling Procedures

Convenience sampling, which is a type of nonprobability sampling, was used to select participants through Prolific (online recruitment service). Participants were selected in a non-random manner and based on availability, which allowed easy accessibility of participants. The inclusion criteria for participant selection includes males and females who have been diagnosed with hypertension more than three months ago and prescribed at least one antihypertensive medication, between 25 years and 60 years of age, belong to a Black or White ethnic group, and who reside in the United Kingdom. The exclusion criteria include those who have been diagnosed with hypertension but not

on any antihypertension medication, non-English speaking patients, and patients who are not registered with a general practice.

Sample size was determined using G*Power (Faul et al., 2007). Effect size, alpha level, and power level are three terms that are closely related to determining the sample size for a research study however, they are not the only parameters for choosing an appropriate size (Burkholder et al., 2020). Effect size measures the strength of the relationship between the variables while alpha (α) is the probability of having a false positive conclusion (i.e., a type 1 error), which is usually set at .05; levels lower than .05 will require larger sample sizes. Power is the probability of having a true positive conclusion. The higher the power level the larger the sample size; however, a high-power level reduces the chances of making a type II error. The general effect size is 0.10 based on a previous study (Woodham et al., 2020); however, moderation studies use smaller effect sizes. A previous moderation study on medication adherence have reported a small effect size ($\Delta R2 = 0.03$) and an alpha value of 0.05 therefore, the effect size will be 0.04 for the moderator and the alpha value for this study will be 0.05 (Greer, 2016). According to Aguinis et al. (2005), the mean power to detect effect size of .04 is 0.8 therefore alpha and power levels are set at 0.05 and 0.8, respectively. The minimum recommended sample size using these parameters with one tested predictor (interaction variable/moderator) and three total predictors (i.e., type of healthcare professional, ethnicity, interaction variable) was 199.

Procedures for Recruitment, Participation, and Data Collection

The recruitment strategy bore in mind the best sources for finding participants who fit the inclusion criteria; therefore, data were collected through Prolific (an online recruitment service). Initial email contact was made with Prolific with briefings about my study and positive feedback received regarding recruiting eligible participants in a timely manner. The link to the survey was published on the company's website and eligible participants were notified through email and on their prolific studies page. Participants were expected to respond to the following statement before completing the survey questions: "if you consent and agree to participate, please click Continue." Participants were told they could exit the study at any time without any negative consequences. Approval from the Walden University's Institutional Review Board (IRB) preceded data collection, and data were collected anonymously.

Demographic information was collected on age, gender, ethnicity, co-morbidity (presence of other cardiovascular related disease), type of healthcare professional – whether a doctor, nurse, or/and a pharmacist manages the patient's hypertension in terms of diagnoses and treatment (participants will be asked to check all that applies). The Hill-Bone Compliance to High Blood Pressure Therapy Scale was used to measure antihypertensive medication adherence level (Kim et al., 2000). Data collected were stored securely on a password protected laptop for 5 years following dissertation approval.

Instrumentation and Operationalization of Constructs

Hill-Bone Compliance to High Blood Pressure Therapy Scale

The Hill-Bone Compliance to High Blood Pressure Therapy Scale (Hill-Bone Comp Scale) was developed by the National Institutes of Health (NIH) following an extensive revision and validation by a group of experts that comprised of five nurses and three doctors, and it is available to use without any financial cost (Johns Hopkins School of Nursing, 2022; Kim et al., 2000). The Hill-Bone Comp Scale is a 14-item scale with three subscales namely appointment keeping, diet (reducing sodium intake), and medication adherence subscale which measures both intentional and unintentional adherence to antihypertensive medication. The Hill-Bone Comp Scale is a disease-specific scale for assessing adherence in hypertension management therefore, it is considered appropriate for this study. The diet subscale assesses the extent of salty food intake and comprises two items. The appointment keeping subscale comprises three items and assesses prescription refills and medical appointments. The medication adherence subscale comprises nine items and assesses the extent of adherence to antihypertensive medication, which is relevant to this study. Therefore, only the medication adherence subscale scores was used; the diet and appointment keeping subscale scores will not be used in this study. The medication adherence subscale is also known as the Hill-Bone Medication Adherence Scale. Participants were to respond to each item using a 4-point Likert-type scale ranging from 1 (all of the time) to 4 (none of the time) (Kim et al., 2000). The total subscale scores range from 9 to 36, with higher scores indicating greater medication adherence.

The Hill-Bone Comp Scale was evaluated with two heterogenous samples: Sample 1 included African American hypertensive male adults between 18 and 55 years of age; Sample 2 included male and female African American adults with no age restrictions (Kim et al., 2000). Reliability of the Hill-Bone Comp Scale was assessed using Cronbach's alpha (internal consistency) and construct validity was evaluated through hypothesis testing to demonstrate a relationship between the key variables. Kim et al. (2000) found that the Hill-Bone Comp Scale had a high internal consistency reliability with a Cronbach's alpha of .74 (Sample 1) and .84 (Sample 2). Similarly, there were positive correlations between the variables as expected where increases in antihypertensive medication adherence subscale scores were linked to blood pressure control which established construct validity of the scale. While the results of the study supported the reliability and validity of the scale, one of the limitations of the study was possible cultural bias due to the samples used for the study being only African Americans therefore, questioning the generalizability of the instrument. However, this limitation has been addressed in some cross-cultural studies where the original study translated into other languages gave similar results (Chatziefstratiou et al., 2019, Lambert et al., 2006). I requested permission to use the scale from the Hill-Bone Comp Scale team at John Hopkins School of Nursing, and permission was granted.

Demographic Questionnaire

Demographic information, which includes age, gender, co-morbidity (presence of more than one medical condition in an individual coexisting at the same time), ethnicity, type of healthcare professional managing hypertension in terms of diagnoses and

treatment, diagnosed with hypertension more than 3 months ago, and taking at least one antihypertensive medication, was collected through demographic questionnaire. Type of healthcare professionals refers to the health professionals involved in the management of the participant's hypertension in terms of diagnoses and treatment which includes doctors, nurses, and pharmacists. Participant were asked to indicate who manages their condition and to choose one of two options (yes or no); managed by a single healthcare professional (a doctor or nurse practitioner, or pharmacist) or managed by multiple health professionals (two or more health professionals mentioned above). The type of healthcare professional was an independent variable, and the level of measurement was nominal (dichotomous). Ethnicity was an independent variable and a moderator therefore, the level of measurement was nominal (dichotomous). Participants identified as either Black or White. Co-morbidity refers to the presence of more than one medical condition in an individual coexisting at the same time. Participants indicated the presence or absence of other medical conditions. Participants identified as either male or female and were between 25 years and 60 years of age.

Data Analysis Plan

The Statistical Package for the Social Sciences (SPSS) version 28 software was used for statistical analysis of the quantitative data using multiple regression. SPSS was also used for descriptive statistics of the participants' demographic information (age, gender, ethnicity, co-morbidity). Data were screened and cleaned to identify outliers using the SPSS software. Surveys were completed online therefore eradicating the

possibility of having missing data as participants could not skip questions. The research questions and hypotheses are restated below:

Research Question 1: To what extent does the type of healthcare professional (single healthcare professional vs. multiple healthcare professionals) relate to antihypertensive medication adherence among hypertension patients?

$H_0$1: Type of healthcare professional does not predict antihypertensive medication adherence.

$H_1$1: Type of healthcare professional does predict antihypertensive medication adherence.

Multiple regression will be used to examine the linear relationship between the type of healthcare professional and medication adherence.

Research Question 2: To what extent does ethnicity relate to antihypertensive medication adherence among hypertension patients?

$H_0$2: Ethnicity does not predict antihypertensive medication adherence.

$H_1$2: Ethnicity does predict antihypertensive medication adherence.

Multiple regression will be used to examine the linear relationship between ethnicity and medication adherence.

Research Question 3: To what extent does ethnicity moderate the relationship between the type of healthcare professional (single healthcare professional vs multiple healthcare professionals) and antihypertensive medication adherence among hypertension patients?

$H_0$3: Ethnicity does not moderate the relationship between the type of healthcare professional (single healthcare professional vs multiple healthcare professionals) and antihypertensive medication adherence.

$H_1$3: Ethnicity moderates the relationship between the type of healthcare professional (single healthcare professional vs multiple healthcare professionals) and antihypertensive medication adherence.

Multiple regression was used to test the moderating role of ethnicity on the relationship between the independent variable (type of healthcare professional) and the dependent variable (medication adherence). A common assumption for this statistical analysis was that the data would assume a normal distribution (Maroof, 2013) i.e., residuals are normally distributed. Another assumption was that there will be a linear relationship between the dependent and independent variables. It was also assumed that a collinear relationship exists between predictor variables in a multiple regression analysis. Violation of any of these assumptions were to be addressed by using alternative statistical tests to determine the significance of the results.

Threats to Validity

Validity is a quantitative terminology used to ascertain that the findings from a research study are true and defensible putting into consideration the quality of the data collection methods and data source (Burkholder et al., 2020). According to Cook and Campbell (1976), as cited in Mitchell (1985), the following four validity concepts are relevant to correlational research: internal validity, external validity, construct validity, and statistical conclusion validity.

External validity refers to the extent to which the findings of a study are true and can be applied universally irrespective of population, culture, location, or settings (Burkholder et al., 2020). This study used convenience sampling, a non-probability sampling which implied that participants were not selected randomly which may affect the generalizability of results therefore increasing the chances of threats to external validity. This type of threat can be mitigated through extensive literature review and comparing research findings with existing literature (Burkholder et al., 2020).

Internal validity refers to the extent to which the relationship between two variables is true without an interference by a third variable (independent variable) and threats to this type of validity can be mitigated by adding a treatment/controlled group to the study which is only applicable to experimental research designs (Burkholder et al., 2020). This study was a non-experimental correlational research study which had a third variable, ethnicity, serving as both an independent variable and a moderator in determining the relationship between the independent variable (type of healthcare professional) and the dependent variable (medication adherence). Threats to internal validity was addressed by assessing demographic variables in the study which includes age, gender, and co-morbidity. The association between demographic variables and the dependent variable was assessed and compared with findings from the relationship between the independent and dependent variables.

Construct validity refers to the extent to which the constructs being studied are accurately represented and operationalized in a study (Burkholder et al., 2020). A potential threat to construct validity in this study was a lack of random sampling which

could impact on the generalizability of the findings however, threats to this type of validity was mitigated by using a validated scale such as the Hill-Bone Comp Scale and comparing measurements from this study with measurements from existing literature (Mitchell, 1985).

Statistical-conclusion validity refers to the extent to which the relationship between the variables is accurate. Mitchell (1985) identified four threats to this type of validity namely reliability of measures, variable values, nature of regression analyses, and number of statistical tests therefore threats to this validity can be mitigated by using appropriate instruments and statistical tests that will answer the research question(s). One of the ways to validate the reliability of measures is through construct validity.

Ethical Procedures

Walden IRB forms were completed to gain approval for access to research participants and data collection procedures. Relevant research ethics courses were completed on the Collaborative Institutional Training Initiative website where detailed information about consent, privacy, confidentiality, assessing risks, and general ethical principles were provided. The rights of research participants were protected by ensuring that adequate information regarding the study was provided to guide their decision to participate. A consent form which briefly describes the study and clearly states that participation in the study is voluntary was used to obtain consent from participants before the survey questionnaires were completed. Participants were notified they could withdraw from the study at any time and were not pressured to complete the study. The consent form had the following statement to provide guidance for participants: “if you

consent and agree to participate, please click Continue". Participants were informed to contact a licensed professional if they suffer an adverse effect from taking the survey and details of organizations such as Mental Health America (2023; http://www.mentalhealthamerica.net/search/node) and National Institutes of Health (2022) were provided in the consent form and the debrief page.

Ethical issues that may arise from the study involve concerns about anonymity, consent, privacy, and confidentiality therefore non-identifiable data were collected and stored securely on a password protected laptop. Data will be kept for five years following dissertation approval by the Chief Academic Officer and will be deleted from the secured electronic device afterwards.

Summary

Chapter 3 focused on the research methods that were followed in this quantitative study. A cross-sectional correlational research design was used for data collection and analysis. The minimum recommended sample size for this moderation study was 199 based on G*power analysis and convenience sampling strategy was used. Participants were males and females between 25 years and 60 years of age, diagnosed with hypertension more than three months ago, took one or more antihypertensive medications, and from Black or White ethnic group. The Hill-Bone Comp Scale was used to assess antihypertensive medication adherence and multiple regression analysis was used to examine the relationship between the study variables. Threats to validity, and ethical considerations were also discussed. Chapter 4 will provide information about data collection, statistical analysis, and results from the data obtained.

Chapter 4: Results

Introduction

The purpose of this quantitative study was to examine the extent to which ethnicity moderates the relationship between type of healthcare professional (single healthcare professional vs. multiple healthcare professionals) and antihypertensive medication adherence. The research questions and hypotheses are restated below:

Research Question 1: To what extent does the type of healthcare professional (single healthcare professional vs. multiple healthcare professionals) relate to antihypertensive medication adherence among hypertension patients?

$H_0$1: Type of healthcare professional does not predict antihypertensive medication adherence.

$H_1$1: Type of healthcare professional does predict antihypertensive medication adherence.

Research Question 2: To what extent does ethnicity relate to antihypertensive medication adherence among hypertension patients?

$H_0$2: Ethnicity does not predict antihypertensive medication adherence.

$H_1$2: Ethnicity does predict antihypertensive medication adherence.

Research Question 3: To what extent does ethnicity moderate the relationship between the type of healthcare professional (single healthcare professional vs multiple healthcare professionals) and antihypertensive medication adherence among hypertension patients?

$H_0$3: Ethnicity does not moderate the relationship between the type of healthcare professional (single healthcare professional vs multiple healthcare professionals) and antihypertensive medication adherence.

Chapter 4 discusses the data collection process and presents results of the data analysis including the descriptive and demographic characteristics of the sample. This chapter also reports findings from the multiple regression analysis with moderation.

Data Collection

Data were collected over a period of 8 weeks through an online recruitment service (Prolific) and convenience sampling was used for recruitment. The link to the survey was published on the company's website and eligible participants were notified through email and on their prolific studies page. Email invites were sent by Prolific to all eligible White and Black participants to partake in the study. A minimum of 199 participants was needed for the study and a total of 230 participants completed the survey.

Descriptive statistics were used to summarize demographic data. The mean age of participants was 46.72 (SD = 10.28) years, with a minimum of 25 years and maximum of 60 years. Frequency data for demographic characteristics of the sample including gender, ethnicity, co-morbidity, and type of healthcare professional are shown in Table 2. More than half of the participants were female (59.1%), and most of the participants were White (73.9%). Few (16.5%) of the participants had a co-morbidity, and most (80%) had their hypertension managed by a single healthcare professional. Regarding participants' hypertension status, 97.8% had high blood pressure that lasted more than 3 months and

all participants were prescribed blood pressure medication. There were 136 White and 48 Black participants whose condition was managed by a single healthcare professional, while there were 34 White and 12 Black participants whose condition was managed by multiple healthcare professionals. The number of Blacks in the study are small compared to their White counterparts. A convenience sample was used rather than a random sample therefore, the sample may not be representative of the Black population considering the small number of Black participants in the study.

Table 2

Demographic Characteristics of Participants

Characteristics	*n*	%
Gender		
Male	94	40.9
Female	136	59.1
Type of healthcare professional		
Single healthcare professional	184	80
Multiple healthcare professional	46	20
Ethnicity		
White	170	73.9
Black	60	26.1
Hypertension		
Yes	225	97.8
No	5	2.2
Antihypertensive medication		
Yes	228	99.1
No	2	0.9
Co-morbidity		
Yes	38	16.5
No	192	83.5

Results

Descriptive Statistics

The medication adherence subscale (9 items) of the Hill-Bone Comp Scale was used to assess the extent of adherence to antihypertensive medication(s). Participants responded to the 9 items using a 4-point Likert-type scale ranging from 1 (all of the time) to 4 (none of the time). The total subscale scores range from 9 to 36, with higher scores indicating greater medication adherence. The mean total subscale score was 32.2 (*SD* =

3.13) and participants' scores ranged from 19 to 36. More than half of the participants took their medication(s) as prescribed.

Evaluation of Statistical Assumptions

Assumptions for multiple regression were tested by determining normality, linearity, multicollinearity, independence of residuals, and homoscedasticity and it was found that all assumptions were met (Appendix E). For the test of normality, medication adherence, ethnicity, and type of healthcare professional were found to be significant ($p < 0.001$) which suggested a non-normal distribution. However, the histogram and normal Q-Q plots suggests the acceptability of data (Appendix E). For multicollinearity, VIF statistics (9.2, and 10) were within the acceptable range which suggested that the assumption of multicollinearity was met. Durbin-Watson test was used to assess the independence of residuals and it was found that Durbin-Watson statistic (1.9) was within the acceptable range which suggested that assumption was met. The assumption of homoscedasticity was met and there were no significant outliers.

Reliability of the Hill-Bone Compliance Scale

Internal consistency of the Hill-Bone Compliance Scale was assessed using Cronbach's alpha and acceptable internal consistency was found with an alpha of 0.76.

Multiple Regression Analysis

To answer the research questions, the two predictor variables (ethnicity and type of healthcare professional) were first mean centered, then the mean centered predictors variables were multiplied by each other to calculate the interaction variable (ethnicity X type of healthcare professional). Medication adherence was regression onto the two

predictor variables and the interaction (moderation) in a standard multiple regression analysis. Medication adherence was identified as a scale variable while type of healthcare professional was identified as nominal (dichotomous) variable. A new variable for type of healthcare professional was created categorizing type of health professional into either single or multiple healthcare professionals. Single healthcare professional was coded as 1 and two or more health professionals was categorized as multiple healthcare professionals and coded as 2. Ethnicity was a nominal (dichotomous) variable and coded as White = 1 and Black = 2.

Standard multiple linear regression analysis was conducted to evaluate the extent to which type of healthcare professional, ethnicity, and the interaction (type of healthcare professional X ethnicity) predict hypertensive medication adherence. The overall regression model was significant and explained approximately 12% of the variance in medication adherence ($F(3, 226) = 10.10$, $p < 0.05$, $R^2 = .12$). The ANOVA result showed that at least one predictor variable was significant in predicting medication adherence (Table 4). The results of the multiple linear regression analysis revealed type of healthcare was not a significant predictor of medication adherence ($B = -1.59$, $p = .28$), and thus I failed to reject the null hypothesis for Research Question 1. The moderation variable (type of healthcare professional X ethnicity) was not a significant predictor of medication adherence ($B = 1.45$, $p = .19$), and thus I failed to reject the null hypothesis for Research Question 3. However, the results of the multiple linear regression analysis showed that ethnicity was a significant predictor of medication adherence ($B = -4.11$, and $p < .05$), and so I rejected the null hypothesis and accepted the alternative hypothesis that

ethnicity does predict medication adherence. This suggested that with every one unit increase in ethnic group (i.e., from White to Black), there was 4.11 unit decrease in medication adherence. Thus, Black participants showed significantly lower adherence to their antihypertensive medication(s).

Table 3

Multiple Regression Model

Model	*R*	R^2	Adjusted R^2	*SE*
1	.34[a]	0.12	0.11	2.96

Table 4

Multiple Regression ANOVA

Model		SS	df	MS	*F*	*p*
	Regression	265.67	3	88.56	10.102	<.001
	Residual	1981.13	226	8.77		
1	Total	2246.80	229			

Table 5

Multiple Regression Coefficients for Predictor Variables

						95% *C*I for *B*	
Variables	*B*	*SE*	β	*t*	*p*	Lower	Upper
Type of Healthcare Professional	-1.59	1.48	-0.20	-1.07	0.28	-4.52	1.33
Ethnicity	-4.11	1.41	-0.58	-2.92	0.00	-6.88	-1.34
Interaction Variable	1.45	1.11	0.35	1.31	0.19	-0.74	3.64

Summary

Two hundred and thirty participants completed the online survey. The mean age of participants was 46.72 (*SD* = 10.28) years with a range from 25 to 60 years. Most participants were female, identified as White, had high blood pressure, were prescribed blood pressure medication(s), did not have a co-morbidity, and were managed by a single

healthcare professional. The results revealed that ethnicity was a significant predictor of medication adherence which showed a lower adherence among Black participants. Ethnicity did not moderate the relationship between type of healthcare professional and medication adherence. Chapter 5 provides interpretation of findings, limitations, recommendations, and implications for social change.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this cross-sectional correlational quantitative study is to examine the extent to which ethnicity moderates the relationship between type of healthcare professional (single healthcare professional vs. multiple healthcare professional) and antihypertensive medication adherence. This study was conducted to address the gap in the literature that relates to whether ethnicity moderates the relationship between the type of healthcare professional that manages the patient's condition and antihypertensive medication adherence. Two hundred and thirty participants who were between 25 years and 60 years of age, diagnosed with hypertension and took at least one antihypertensive medication completed the online survey comprising of demographic questions and the Hill-Bone medication adherence scale. Multiple regression analysis was conducted to determine the extent to which ethnicity moderated the relationship between type of healthcare professional and antihypertensive medication adherence. Findings from the present study revealed that ethnicity predicted medication adherence while type of healthcare professional did not predict medication adherence and ethnicity did not moderate the relationship between type of healthcare professional and antihypertensive medication adherence.

Interpretation of the Findings

This research study was guided by the theoretical domains framework and the biopsychosocial model of health because the relationship between the type of healthcare professional as a social factor, medication adherence as a psychological factor, and

ethnicity as a social factor were reflected across the two theories. The null hypothesis for Research Question 1 was not rejected, as there was no significant relationship between type of healthcare professional and antihypertensive medication adherence. Type of healthcare professional did not predict antihypertensive medication adherence. Burnier et al. (2021) established that patients are sometimes seen by more than one healthcare professional where initial diagnosis is made by the doctor and ongoing management is overseen mostly by nurses and pharmacists. Previous studies that examined collaborative approach to hypertension management between health professionals (physicians, nurses, and pharmacists) and its impact on medication adherence found a positive relationship between a team-based care and medication adherence (Santschi et al., 2021; Woodham et al., 2020) where improvement in adherence and blood pressure control was seen among patients managed by a team of health professionals compared to patients seen by only a physician which contrasts the findings from this study.

The null hypothesis for Research Question 2 was rejected, indicating a significant relationship between ethnicity and antihypertensive medication adherence. Findings from this multiple regression analysis indicated that Blacks reported significantly lower levels of antihypertensive medication adherence compared to Whites. This is consistent with findings from previous studies that examined the relationship between ethnicity and medication adherence (Dong et al., 2021; Gerber et al., 2010; Xie et al., 2019). There is a consistent report of Blacks having a higher level of nonadherence to antihypertensive medication and these studies suggest that underemployment, low income, and financial constraints were common causes of low adherence among the Blacks. The present study

found that approximately 60% of the Black participants reported that they forget to get their prescription filled, forget to take their blood pressure medication, and decide not to take their blood pressure medication which demonstrates poor memory, intentional non-adherence to medication, and poor decision making. This may also reflect differences in literacy, health beliefs, or socioeconomic status which are involved in the medication-decision process. Memory, attention, decision process, and intentions are domains of the theoretical domain framework and medication adherence is a psychological factor from the biopsychosocial model. Memory, attention, decision process, and intentions were linked to improved medication adherence which is consistent with findings from previous studies that targeted these domains among patients with long-term conditions (Morrissey et al., 2017; Presseau et al., 2017). Findings from this study revealed that ethnicity did not moderate the strength of relationship between type of healthcare professional and medication adherence. The current study was the first to examine the moderating effect of ethnicity on type of healthcare professional and medication adherence.

Limitations of the Study

There were several limitations to this study. One of the limitations to this study was in relation to response bias. Participants' responses might have been portrayed in a manner that suggested social desirability bias which could pose a threat to internal validity. Though screening questions were asked to minimize this threat, a small proportion of the participants indicated that they were not hypertensive, were not on any antihypertensive medication, and checked none of the above to all the survey questions which may have portrayed dishonesty. To avoid threat to internal validity, such responses

were excluded from the results. The study may also have been limited by the size of the Black population; there were not as many Black participants who responded to the online survey which could have affected the statistical analysis for Research Question 3. Therefore, ethnicity being a non-moderator of the relationship between type of healthcare professional and medication adherence, as suggested by the finding, may not be reliable. There may also be limits in generalizing the results to all Black and White adults who take antihypertensive medication due to not using a random sample. Random sampling enhances the ability to generalize results because it helps ensure that the sample is unbiased and representative of the population. Since I used nonprobability convenience sampling, it is possible that the sample does not represent the population of Black or White adults who take antihypertensive medication. Finally, the research design used in this study may be a drawback as correlational designs do not allow causal inferences to be made from the data.

Recommendations

Medication adherence is a topic that is widely studied among researchers across the globe however, there are still gaps to be filled and it is important for future researchers to continue to explore healthcare provider and system-related factors that influence adherence among the minority ethnic groups. Medication adherence has been widely studied mostly using a qualitative approach therefore, to follow up on the findings from this study, future research should consider further quantitative analysis and a longitudinal study aimed at understanding how ethnicity moderate type of healthcare professional-medication adherence relationship (Onyedibe, 2019). Also, a wider age

range, 18 years and older, should be included in future research to increase generalizability, and significant changes in the recruitment procedure may be necessary to include equal distribution of participants representing each ethnic group.

In addition, further research is needed in a larger sample of Blacks who have a diagnosis of hypertension. Research has shown that the minority ethnic groups are not well represented in clinical research compared to their White counterparts for reasons such as poor knowledge about health research and wrong perception about clinical research (Dawson et al., 2022). However, one of the strategies recommended to improve recruitment from the minority ethnic group includes recruitment from settings that are familiar to this group of people. Therefore, to improve participation among the Black population, future research should consider recruitment from a local organization or from settings that are familiar to the target audience and build a trust relationship with the local organisation (Dawson et al., 2022).

Implications

Findings from this study may have implications for positive social change at individual, family, organizational, and societal levels. Adherence to antihypertensive medications contributes immensely to blood pressure control, reduces morbidity/mortality rate, reduces cardiovascular disease risks, and increases patient's quality of life which drive positive social change for individuals and their families. This study has the potential to impact care delivery in the management of long-term conditions especially among the minority ethnic group. Medication adherence intervention could be tailored to meet the specific needs of this group which may lead to positive outcomes.

Allied health professionals such as mental health practitioners and health psychologists may be valuable resources in the primary care sector to help assess psychological and mental health needs, identify/differentiate intentional and non-intentional non-adherence to medication, help with stress management, and signpost to social support systems or other healthcare facilities where appropriate.

Conclusion

Hypertension remains a silent killer claiming millions of lives annually and antihypertensive medications are proven effective pharmacological treatment in restoring patients from the state of illness to health (American Heart Association, 2022). Patient involvement is however paramount to the success of treatment as adherence to treatment regimen produces the desired results. Adherence support by healthcare providers have a major role to play in identifying adherence issues among patients and taking a step further to offer patient-centred intervention, thereby bridging the racial gap in medication adherence among hypertension patients. The findings from this study supported a significant relationship between ethnicity and medication adherence where Blacks showed lower adherence to their antihypertensive medication therefore, the results indicated the need for further adherence strategies to support the Black population which could lead to improved medication adherence, blood pressure control, and improved quality of life.

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Appendix A: Demographic Information

Answer the following questions and tick the option that applies to you.

What is your age? (Please type in the box) ☐

What is your gender? Male ☐ Female ☐

Do you have high blood pressure which has lasted more than 3 months? Yes ☐ No ☐

Do you take blood pressure medication(s)? Yes ☐ No ☐

Do you have other cardiovascular related diseases such as heart failure, stroke, coronary heart disease, peripheral arterial disease, or atrial fibrillation? Yes ☐ No ☐

Who manages your high blood pressure in terms of diagnosis and treatment plan (tick all that applies)? Doctor ☐ Pharmacist ☐ Nurse ☐

What is your ethnic group? White ☐ Black ☐

Appendix B: Hill-Bone Scales

Hill-Bone HBP Compliance to High Blood Pressure Therapy Scale (HB-HBP)

No.	Item	Response: 1. All of the Time 2. Most of the Time 3. Some of the Time 4. None of the Time
1	How often do you forget to take your **high blood pressure** medicine?	
2	How often do you decide NOT to take your **high blood pressure** 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 **high blood pressure** pills?	
10	How often do you skip your **high blood pressure** medicine before you go to the doctor?	
11	How often do you miss taking your **high blood pressure** pills when you feel better?	
12	How often do you miss taking your **high blood pressure** pills when you feel sick?	
13	How often do you take someone else's **high blood pressure** pills?	
14	How often do you miss taking your **high blood pressure** pills when you are careless?	

* Reverse coding

Note:
Scale and subscale scores are calculated by summing individual items.
Reducing sodium intake subscale: Items 3,4,5

Appointment keeping subscale: Items 6,7
Medication taking subscale: Items 1, 2, 8,9,10,11,12,13,14

Hill-Bone Medication Adherence Scale (HB-MAS)

No.	Item	Response: 1. All of the Time 2. Most of the Time 3. Some of the Time 4. None of the Time
1	How often do you forget to take your **high blood pressure** medicine?	
2	How often do you decide NOT to take your **high blood pressure** medicine?	
3	How often do you forget to get prescriptions filled?	
4	How often do you run out of **high blood pressure** pills?	
5	How often do you skip your **high blood pressure** medicine before you go to the doctor?	
6	How often do you miss taking your **high blood pressure** pills when you feel better?	
7	How often do you miss taking your **high blood pressure** pills when you feel sick?	
8	How often do you take someone else's **high blood pressure** pills?	
9	How often do you miss taking your **high blood pressure** pills when you are careless?	

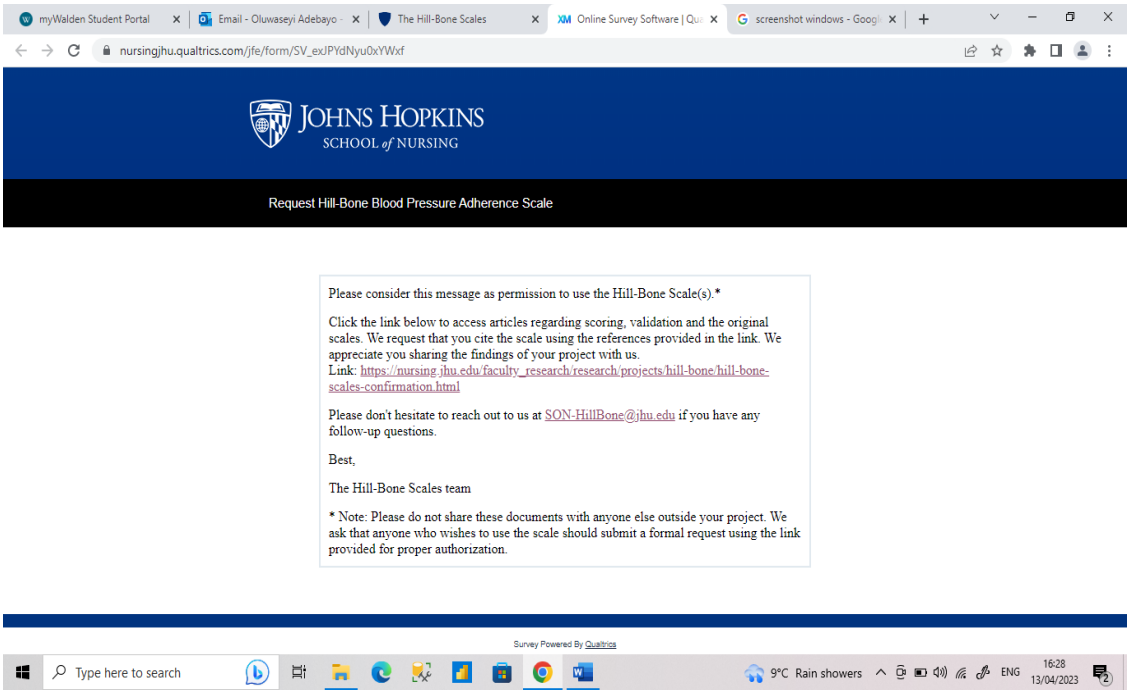
Note:
This 9-item scale has broad application across various chronic diseases and conditions for self-assessment of medication adherence. The words "**high blood pressure"** may be replaced with other conditions as applicable.

Details on scale scoring and psychometric properties are provided in the references below:

Kim, M.T., Hill, M.N., Bone, L.R., Levine, D.M. Development and testing of the Hill-Bone compliance to high blood pressure therapy scale. Progress in Cardiovascular Nursing Summer 2000, 90-96. https://www.ncbi.nlm.nih.gov/pubmed/10951950

Lambert EV, Steyn K, Stender S, Everage N, Fourie JM, Hill M. Cross-cultural validation of the Hill-Bone compliance to high blood pressure therapy scale in a South African, Primary Health Care Setting. Ethnicity & Disease 2006; 16:286-291. https://www.ncbi.nlm.nih.gov/pubmed/16599385

Appendix C: Permission to Use Hill-Bone Scales



myWalden Student Portal | Email - Oluwaseyi Adebayo | The Hill-Bone Scales | Online Survey Software | Qu | screenshot windows - Googl

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Request Hill-Bone Blood Pressure Adherence Scale

Please consider this message as permission to use the Hill-Bone Scale(s).*

Click the link below to access articles regarding scoring, validation and the original scales. We request that you cite the scale using the references provided in the link. We appreciate you sharing the findings of your project with us.
Link: https://nursing.jhu.edu/faculty_research/research/projects/hill-bone/hill-bone-scales-confirmation.html

Please don't hesitate to reach out to us at SON-HillBone@jhu.edu if you have any follow-up questions.

Best,

The Hill-Bone Scales team

* Note: Please do not share these documents with anyone else outside your project. We ask that anyone who wishes to use the scale should submit a formal request using the link provided for proper authorization.

Survey Powered By Qualtrics

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Appendix D: Statistical Assumptions for Multiple Regression Analysis

Table D1

Test of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df		Statistic	df	
Medication Adherence total score	0.188	230	0.000	0.836	230	0.000
Ethnic Group	0.462	230	0.000	0.547	230	0.000
Type of Healthcare Professional	0.491	230	0.000	0.490	230	0.000

Table D2

Test of Independence of Residuals

					Change Statistics					
Model	*R*	R Square	Adjusted R^2	SE	R^2	*F* Change	df1	df2	*p*	Durbin-Watson
1	.344	0.118	0.107	2.961	0.118	10.102	3	226	0.000	1.935

Table D3

Test of Multicollinearity

							Correlations			Collinearity Statistics	
Model		*B*	*SE*	*β*	*t*	*p*	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	37.096	1.877		19.762	0.000					
	Ethnic Group	-4.110	1.406	-0.577	-2.924	0.004	-0.333	-0.191	-0.183	0.100	10.000
	Type of Healthcare Professional	-1.592	1.484	-0.204	-1.073	0.285	0.031	-0.071	-0.067	0.108	9.245
	Interaction Variable	1.452	1.111	0.349	1.307	0.193	-0.194	0.087	0.082	0.055	18.245

Figure D1

P-P Plot for Medication Adherence

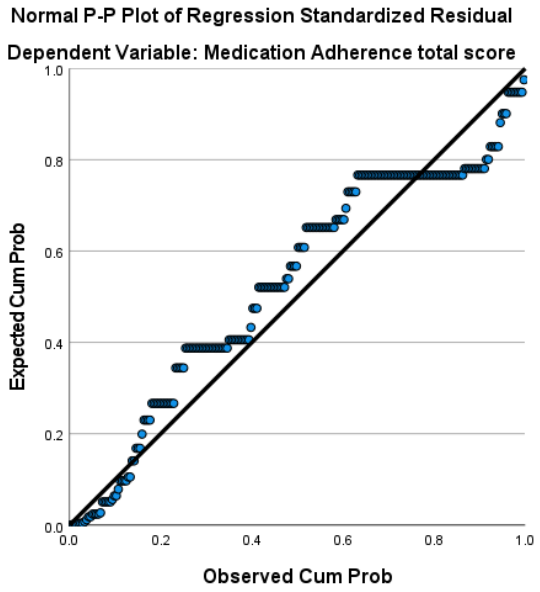
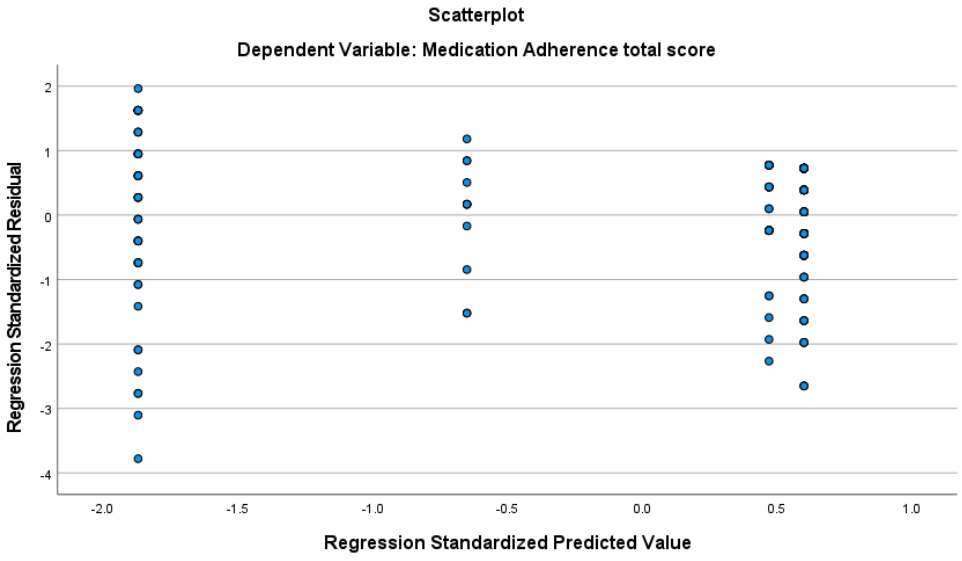


Figure D2

Scatterplot for Medication Adherence



Appendix E: Histograms and Q-Q Plots

Figure E1

Histogram for Medication Adherence

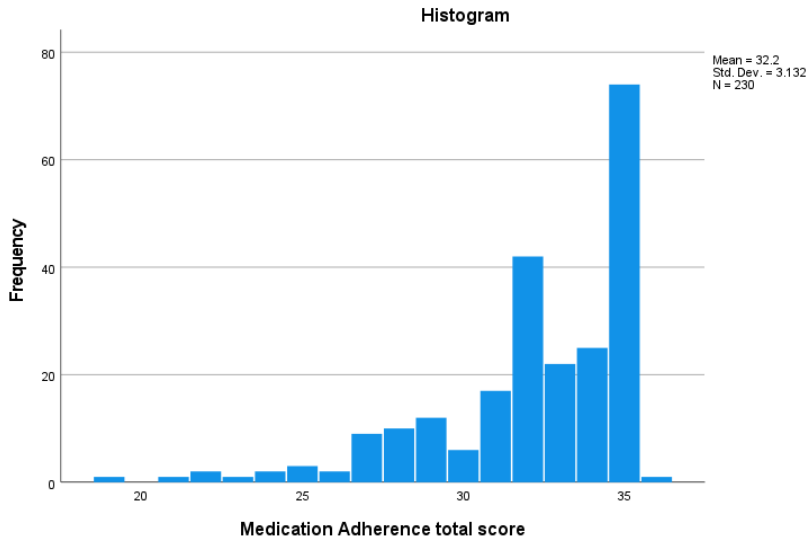


Figure E2

Normal Q-Q Plot for Medication Adherence

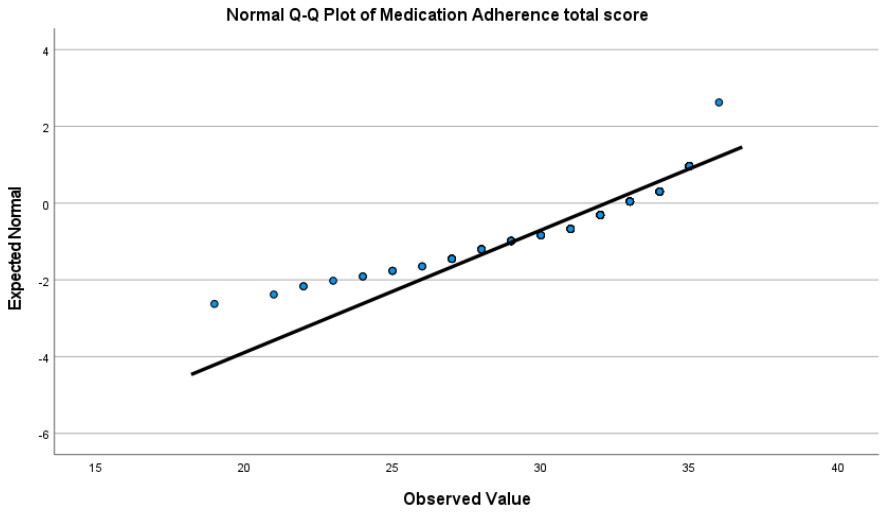


Figure E3

Histogram for Ethnicity

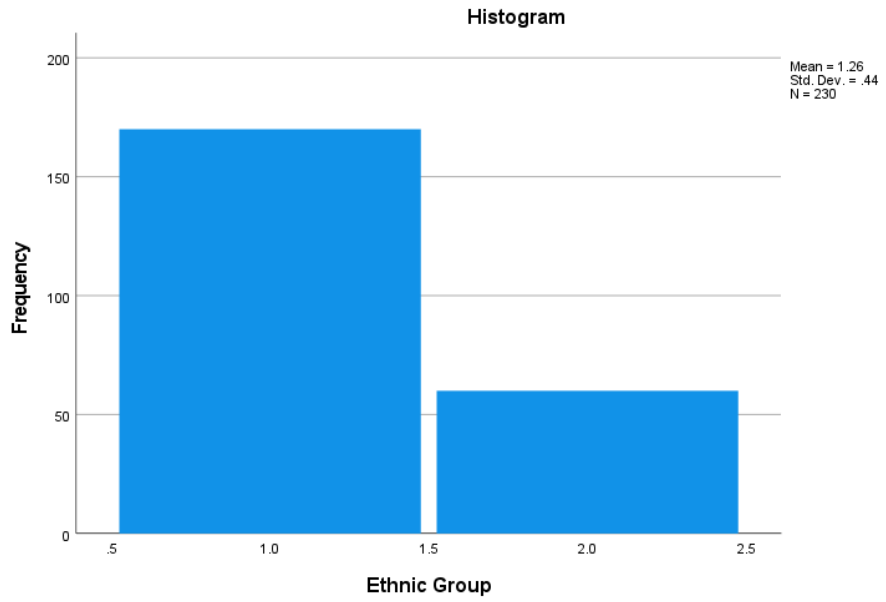


Figure E4

Normal Q-Q Plot for Ethnicity

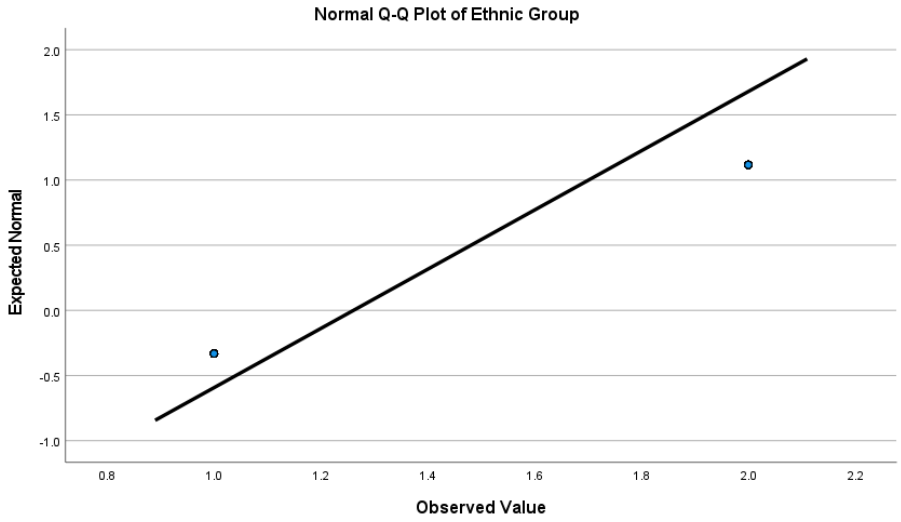


Figure E5

Histogram for Type of Healthcare Professional

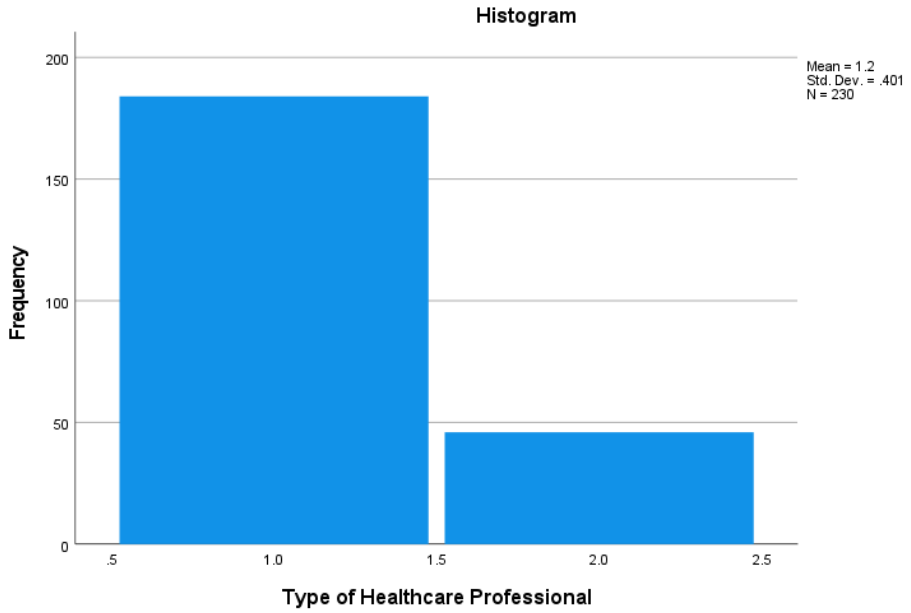


Figure E6

Normal Q-Q Plot for Type of Healthcare Professional