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SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES UNIVERSITY OF GHANA



**ASSESSING MEDICATION ADHERENCE AMONG PATIENTS WITH
DIABETIS MELLITUS ATTENDING THE DIABETES CLINIC AT KINTAMPO
MUNICIPAL HOSPITAL.**

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**THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA,
LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
AWARD OF MASTER OF PUBLIC HEALTH (MPH) DEGREE.**

JANUARY 2021

DECLARATION

I, Haruna SEIDU declare that with the exclusion of references made to other people's work which I have accordingly acknowledged, this dissertation is the result of my research work executed under supervision and has not in whole nor in part been presented to the University or elsewhere for another degree.

Signature



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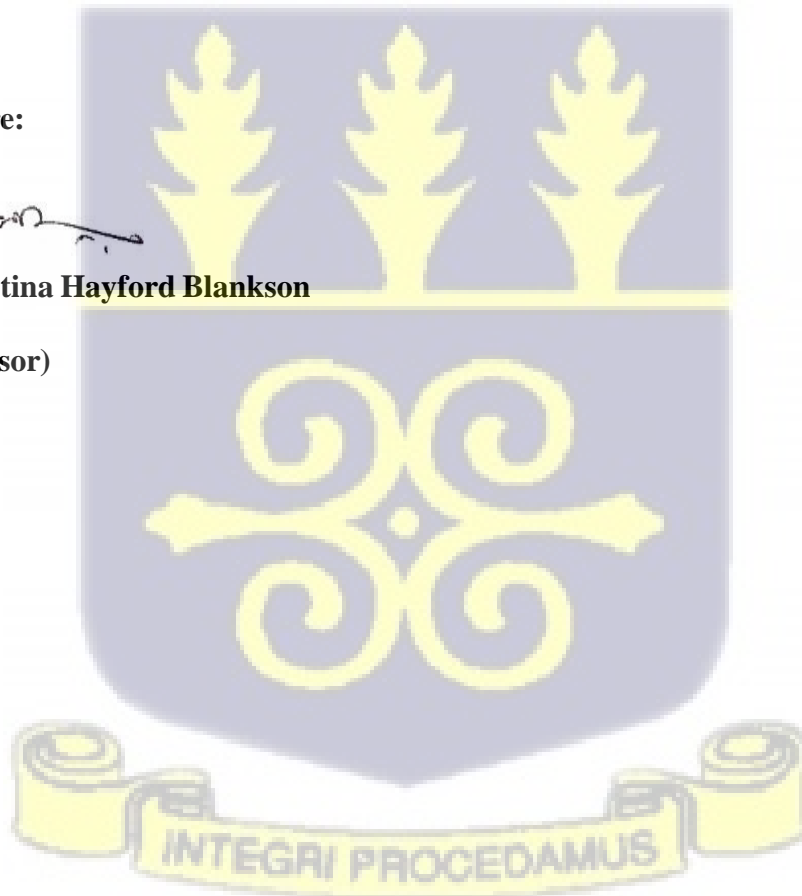
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Date: 02/08/2022

Dr. Faustina Hayford Blankson

(Supervisor)



DEDICATION

I dedicate this dissertation to my family and staff and patients of the diabetes clinic of the Kintampo Municipal Hospital.



Acknowledgement

I am very grateful to the almighty God for the inspiration and wisdom throughout this work.

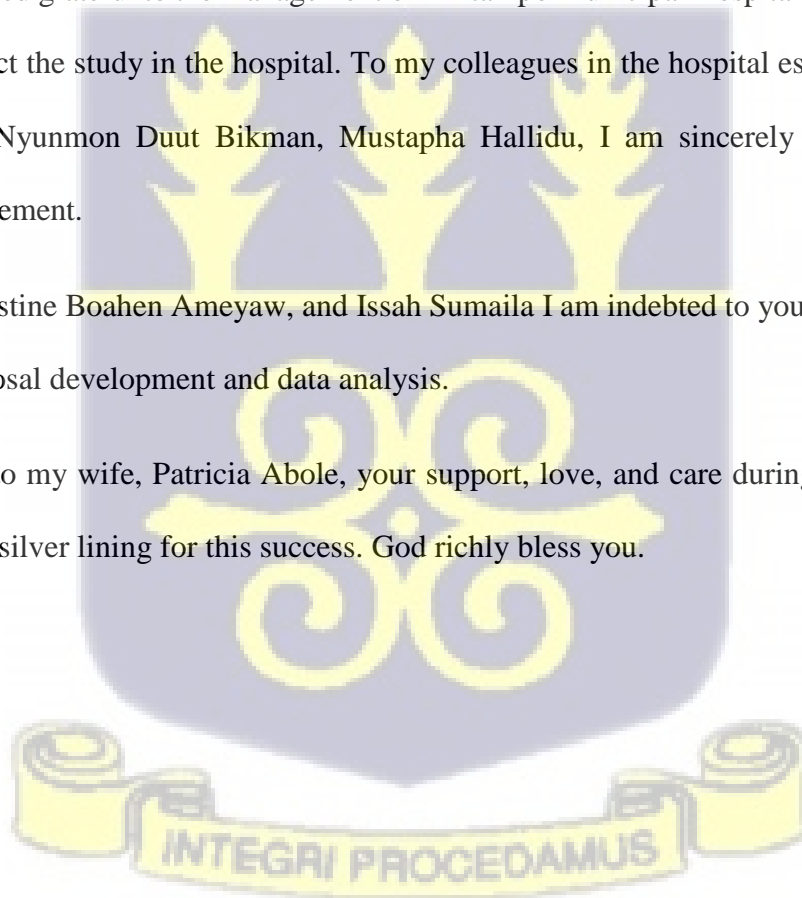
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Abstract

Introduction: Globally, adults with type 2 diabetes struggle adhering to anti-diabetes medication. Thirty-three percent of people living with diabetes are non-adherent to their prescribed medication. Medication adherence among patients with diabetes mellitus is undocumented in the Kintampo Municipal thus affecting diabetes care. This study examined medication adherence among patients with diabetes attending the diabetes clinic at the Kintampo Municipal Hospital.

Methods: This was a quantitative cross-sectional study of 248 patients with diabetes. Systematic random sampling was used to select the participants. A structured questionnaire and Morisky's Medication Adherence Scale-8 were used. STATA version 16.0 was used to perform the analysis. A Chi-square test was used to determine the association between medication adherence and the independent factors. Ordinal logistic regression analysis was done to assess the degree of association.

Results: Of the 248 participants, 146 (58.9%) were males. The mean age was 57.9 ± 11.8 years. Majority of the respondents 121 (48.8%) were 60 and above years. The prevalence of medication adherence among patients with diabetes was 5.6% (95% C.I 3.4% - 9.3). In multiple ordinal regression, knowledge of the type of diabetes medication (aOR=0.16 95% CI=0.03 - 0.65) was significantly associated with medication adherence.

Conclusion: The prevalence of medication adherence is low. Knowledge of the type of medication decreases the odds of adherence. Targeted diabetes counseling and education in diabetes clinics may increase medication adherence.

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List of Abbreviations

CRNA: Cost Related Non-adherence

GSS: Ghana Statistical Survey

MMAS-8: Morisky's Medication Adherence Scale -8

STATA: Statistical Software Package for Data Analysis

WHO: World Health Organization



Chapter One

Introduction

1.1 Background

Globally, adults with type 2 diabetes struggle adhering to anti-diabetes medication. Studies estimate 33% of people living with diabetes are non-adherent to their prescribed medication (Kirkman et al., 2015). This is noted to be worse in individuals with lower socio-economic status (Mayberry et al., 2016). Non-adherence to diabetes medication is costly and connected with poor glycemic control, stroke, heart attack, and death (Berkowitz SA, Seligman HK, 2014).

The World Health Organization has indicated that medication adherence is a central facet to the treatment and management of diabetes. Research has revealed that medication adherence in developed nations is outrageously <50% and worse in lower-middle-income countries. About \$100 billion in in-patient care costs and \$2,000 per single out-patient visit annually are spent as a result of medication non-adherence (Chisholm-burns & Spivey, 2012).

Non-adherence to recommended treatments is the source of health complications to the client. The risk of institutional care is twice in patients with diabetes and other cardiovascular conditions who are non-adherent to recommended instructions than in the general population. (Chisholm-burns & Spivey, 2012). Globally, 415 million individuals are currently living with diabetes, an estimate of 1 in 11 of the world's adult population, and 642 million people would be living with diabetes by 2040. Notably, up to 46% of the global population has undiagnosed diabetes (diabetes.co.uk, 2018). The International Federation of Diabetes has estimated that the direct cost of care for diabetes for the ages 20-79 years will plummet from the current \$153 billion to \$286 billion in 2025 (Saeedi et al., 2019).

Insufficient blood sugar control poses a worldwide public health challenge and is the bane of

complications in the management of diabetes (Waari et al., 2018). Adherence to anti-diabetes medications is fundamental to blood sugar control and prevention of complications in diabetes management, however reduces drastically especially one year after initiation of treatment (Arifulla et al., 2014). In a meta-analysis study of 27 papers, only 6 of the reviewed papers reported a prevalence of adherence >80%. Poor compliance to medical orders especially in the management of diabetes remains a key challenge to healthcare workers (Anderson et al., 2009). More than 50% of efforts to ensure and increase adherence often fail. Non-adherence is a continuous challenge in the management of diabetes (Krass et al., 2015). Suboptimal glyceic control is a recipe for diabetes complications (Vodkaïlo et al., 2011).

In a Kenyan study among 290 diabetes patients, medication adherence was found to be suboptimal (Waari et al., 2018). In another study by Shobhana et al., 1999, the rate of non-adherence was found to be very high as only 25% of the diabetes patients were found to adhere to medication and dietary orders and an estimated 20% of the subject remained indifferent about medication orders given to them. Sharma et al., 2014 in their study among type 2 diabetes patients, found only 16% adherence and non-adherence to prescribed medication was found to be very high. In a cross-sectional study among 150 diabetes clients in the Ho Municipal Hospital, there was a high prevalence of poor glyceic control though adherence was found to be 60.67%. Glyceic control was higher (33.3%) among clients who were adherent to medical instruction (Osei-Yeboah et al., 2019).

The prevalence of adherence in developed nations is estimated at 50% and worse in resource-constrained and low socio-economic regions (Saeedi et al., 2019). Studies have found global adherence rates in diabetes management to range from 36% to 93% (Rathish et al., 2019). In the United States, non-adherence is estimated to increase to >50% after twelve months of treatment

initiation (Zullig et al., 2015), resulting in bad treatment outcomes, the progression of disease symptoms and complications, and increasing healthcare costs (Association, 2003 and Vanelli et al., 2009). An estimated 5million (9.9%) worldwide and 6.0% crude mortality in the Africa stretch were associated with diabetes in 2017 (DiMatteo et al., 2002). Medications only work in patients who adhere to instructions for the full benefit to be realized (Kassavou & Sutton, 2017 and Sharma et al., 2014). Medication non-adherence is rife among people living with diabetes and undermines the safety and efficacy of medicines (Arifulla et al., 2014). The lack of treatment adherence among patients with diabetes results in poor glycemic control and can consequently lead to complications associated with disease advancement, frequent hospital attendance, incapacitation, and death together with cost to the family and the health system (Amaltinga, 2017).

Medication adherence is a complex and self-motivated behavioral activity that occurs in patients as they relate to the healthcare system. Appreciation of the management program, treatment schedule complexity, perception of the benefits of treatment, adverse effects, costs of medications, and emotional well-being have a direct bearing on treatment adherence. A composite program of various drugs and medical coaching are usually required to achieve blood glucose control goals thus a huge challenge to adherence. (Dobbels et al., 2005). Recurrent blood glucose checks, behavior adjustments, and intake of medications are required for the management of diabetes (Sharma et al., 2014) to achieve the ultimate aim of drug therapy –glycemic control (Arifulla et al., 2014). Although these agents can substantially reduce diabetes-related morbidity and mortality, the extent of treatment benefits may be limited by a lack of treatment adherence (Arifulla et al., 2014).

Given that the level of adherence to diabetes medication and glycemic control remain unknown and undocumented in the Kintampo Municipal Hospital, this study examined medication adherence

and the factors underlying the adherence among the diabetes clients attending the diabetes clinic in the hospital.

1.2 Problem Statement

Diabetes mellitus is one of the difficult non-communicable diseases in the 21st century. Medication adherence is a critical component for the successful management of diabetes mellitus. Non-adherence to medication is a great challenge globally and worse in lower-middle-income nations (van et al., 2010).

Glycemic control is a correlate of adherence (van et al., 2010). Forty to 60% of diabetes clients worldwide and 74% in Sub-Saharan Africa have uncontrolled blood glucose (Jha et al., 2012).

In Ghana, a study at the Korle-Bu Teaching Hospital found that diabetes accounted for 6.8% of total admissions and 7.8% of death in 2009 (Amoah, 2002). According to the ministry of health, diabetes is among the top 10 causes of in-patient mortality in Ghana (GHS Report, 2017). A few studies conducted in Ghana have reported varying estimates of medication adherence. In the Ho municipality, Osei-Yeboah et al., 2019 found an adherence level of 70.67%. However while findings at the Korle-Bu Teaching Hospital reported adherence as low as 38.5%, another study in the Tamale metropolis found an adherence level of 84.5% (Afaya et al., 2020 and Bruce et al., 2015). In a district hospital study in the Ahafo region, Prosper Mandela Amaltinga, 2017 found a reasonable adherence rate of 68.5%.

In the Kintampo Municipal hospital, diabetes mortality accounted for 16.39/1000 diabetes admission in 2020 compared with 5.96/1000 diabetes admission in 2019. The average population of diabetes clients attending the clinic by the end of 2020 was 744 (Facility Annual report, 2020). Uncontrolled glycemic emergencies and complications accounted for 42% of diabetes admissions through the Accidents and Emergency Department in the Kintampo Municipal Hospital. Diabetic

ketoacidosis, a complication of uncontrolled diabetes was the leading presentation in 65% of the diabetes patients reporting to the Emergency Room of the Kintampo Municipal Hospital.

Following the varying rates of medication non-adherence from the few studies done and the absence of baseline medication adherence data in the Kintampo Municipal Hospital, this study examined medication adherence and the underlying factors among patients with diabetes.



1.3 The Conceptual Framework: Factors Influencing Medication Adherence in Diabetes Mellitus

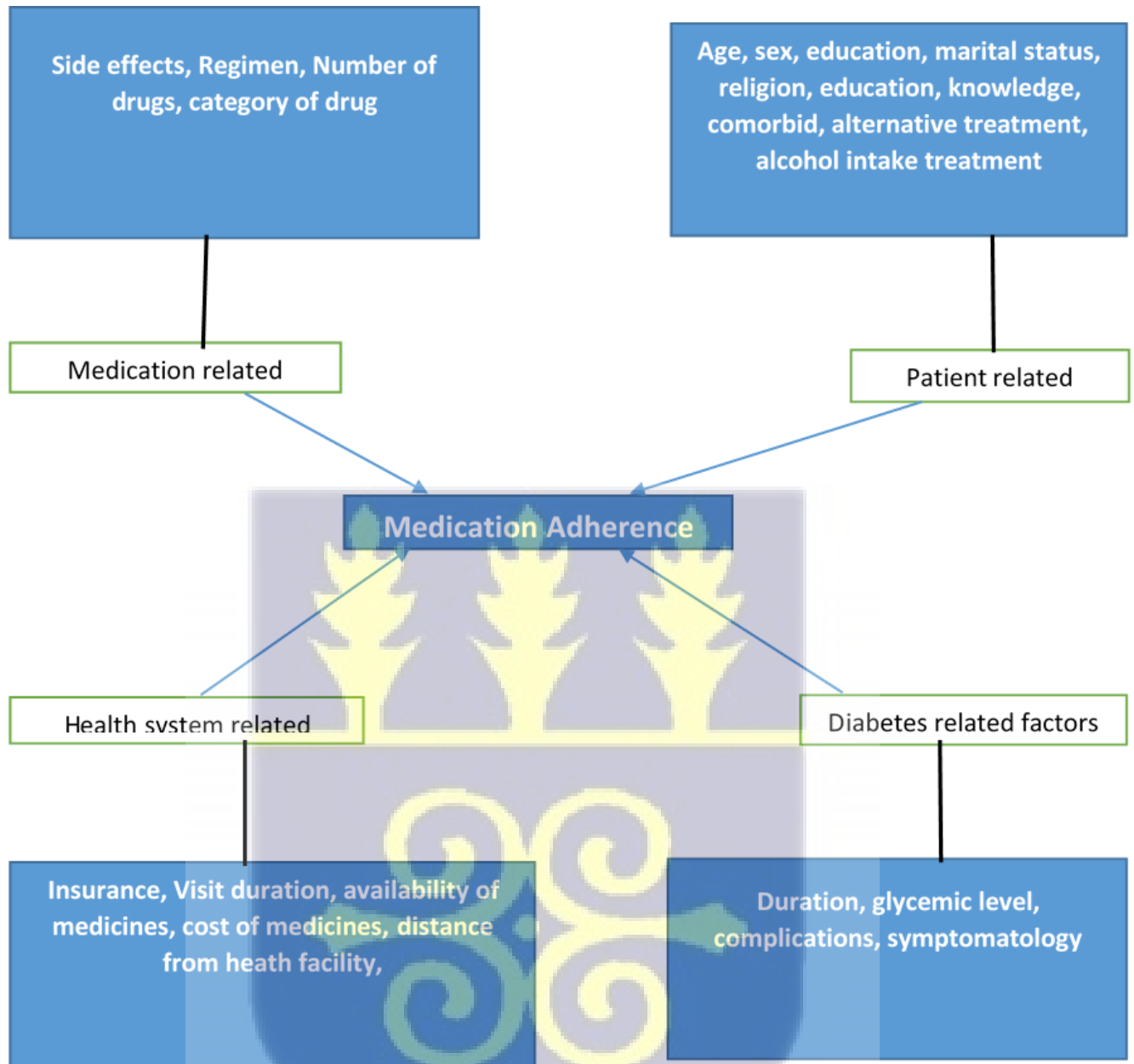


Figure 1:1. Conceptual Framework (adapted and modified from Jaam et al., 2018)

1.4 The narrative of the conceptual framework.

Figure 1.1 is a conceptual framework intended to present an illustrative explanation of elements that influence medication adherence. They are grouped into patient factors, diabetes factors, medication factors, and health system factors.

1.4.1 System-related factors and Healthcare provider factors

Poor patient-provider communication and education skills are noted to negatively affect adherence. Financial issues, care process, and availability of resources. Having a valid health insurance registration coupled with the availability of the medications and logistics for managing diabetes influences adherence positively. Generally, when patients have to pay out of pocket, it negatively affects adherence. The visit duration, continuity of care, and availability of strict guidelines with the poor patient-provider communication.

1.4.2 Patient-related factors

Advancing age and low level of education are noted to negatively affect medication adherence. An individual's health-seeking behavior is influenced by their level of education. It is the custom for the enlightened to have an awareness and to be very accountable for their well-being and thus more likely to adhere to the prescribed regimen. Marital status is said to be a source of support to the affected spouse and so has a direct influence on adherence. The use of alternative medicines and alcohol intake have a negative toll on adherence to diabetes medication. Knowledge of disease and medication positively influences adherence. The presence of comorbidities increases the number of drugs the patient would have to take and negatively affect the commitment to taking the medication. The religious affiliation of the patient could influence the adherence as some denominations are inclined to faith healing and may abandon the prescribed drug.

1.4.3 Diabetes-related factors

The duration of a patient on diabetes medication tends to influence their medication adherence or

not. This may be informed by the presence or absence of side effects. The level of glycemetic control and absence of significant symptoms or presence of any complications may cause a patient to defer taking a drug at the prescribed regimen.

1.4.4 Medication-related factors

Drug regimens, drug class, and adverse effects are noted to negatively affect the commitment to adherence. For example poly-pharmacy, the number of injections, treatment duration, and method of administration tend to affect the patient level of adherence. Individuals taking metformin and short-acting insulin tend to have worse adherence than their counterparts on sulfonylureas and long-acting insulin. Lifestyle associated deviations such as changes in medication dose based on diet and cessation of medicines when exercising turn to influence medication adherence.

1.5 Significance

Some studies have been done in the teaching hospitals in Ghana and one district hospital within the Brong Ahafo regions. However, the setting and the patient characteristic of those study areas are a landslide away from the setting of the Kintampo Municipal. The Kintampo municipal is a cosmopolitan area with settler and migrant farmers from all parts of the middle and northern parts of Ghana. In the current situation where nothing is known about glycemetic control, adherence levels to medication, and the factors underlying them in the Kintampo hospital, the findings of this study would be useful in evaluating the effectiveness or otherwise of current management protocols and strategies. The findings would also help to improve the quality of diabetes care and education. The finding would be useful in initiating the development of care guidelines for individualized patient care in the hospital to improve the counseling of patients in their strides to attaining and maintaining quality lives living with diabetes.

1.6 Study Objectives

1.6.1 Main Objectives

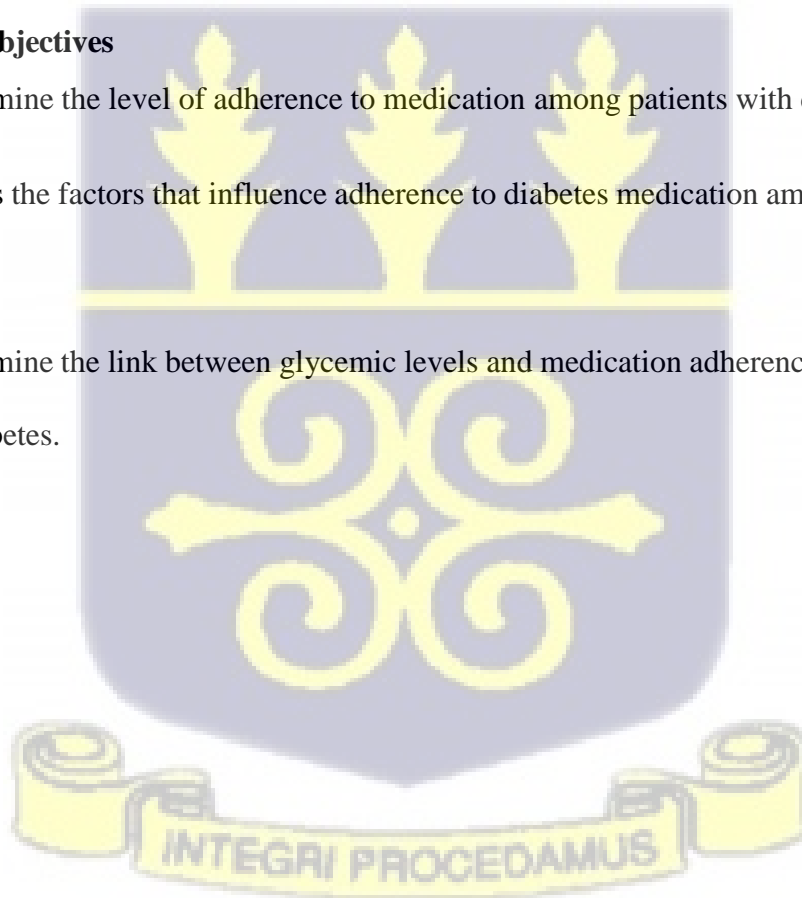
This study sought to assess medication adherence among patients with diabetes attending the diabetes clinic in the Kintampo Municipal Hospital.

1.6.2 Research Questions

1. The study sought to answer the following specific questions to achieve the main objective.
2. What is the level of adherence to medication among patients with diabetes?
3. What factors influence adherence to diabetes medication among patients with diabetes?
4. What is the link between adherence and glycaemic level among patients with diabetes?

1.6.3 Specific Objectives

1. To determine the level of adherence to medication among patients with diabetes.
2. To assess the factors that influence adherence to diabetes medication among patients with diabetes.
3. To determine the link between glycaemic levels and medication adherence among patients with diabetes.



CHAPTER TWO

2.0 Literature Review

2.1 Introduction

This chapter entails the review of related literature on medication adherence. It cover the main topics of medication adherence and then expands on four risk factors associated with medication non-adherence: patient-related factors, health system related factors, disease-related factors, and medication-related factors.

2.2 Medication Adherence

Medication adherence is the greatest challenge within the management of chronic diseases requiring lifetime pharmacotherapy (Burnier, 2019). Approximately, >50% of patients on medication for chronic diseases such as diabetes and hypertension are plagued by this phenomenon (Kleinsinger, 2018). About \$672.7 billion annually is spent on prescription drug-related morbidity and mortality resulting from medication non-adherence (Aungst, 2018). Medication adherence has been conceptualized into five dimensions by the WHO thus: disease-related factors, medication-related factors, patient-related factors and socio-economic factors, and health system-related factors (Wiecek et al., 2019). It is noted that other population variables may have direct or indirect effects on adherence, however, the elements and barriers for adherence are similar in different medications and clinical conditions (Wiecek et al., 2019). Mohiuddin, 2019 noted in his “Art and Science of Patient Compliance” the statement by C Everett Koop, a general surgeon that “drugs don’t work if people don’t take them” to point to the outcome of medication non-adherence.

There is an array of causes of medication non-adherence and may include psychosocial (alcohol use, depression, stigma), structural (distance from clinics, medication costs), therapy-related (side-effects, toxicities, number of drugs prescribed), and health system-related barriers (lack of counseling, poor user-experience with the health system) (Subbaraman et al., 2018). Sufficient studies have adduced evidence to suggest the linkage between patients’ beliefs about medicines

and their perception of their illness and poor adherence. Globally medication non-adherence is estimated to be >50% with a lower limit of 25%. About 125,000 deaths and 10% of in-patient attendance are attributed to medication non-adherence (Zullig et al., 2018).

In a systematic review of 27 studies, only 6 (22.2%) reported an adherence level of more than 80%. The overall adherence was found to be 38.5% to 93.1%. Depression and medication cost were found to be consistent and potentially modifiable predictors for diabetes medication-taking behavior (Krass et al., 2015). In a study among 521 patients with diabetes in two hospitals in Uganda, the level of adherence was found to be 83.3%. This was independently linked with being on anti-diabetes medication for at least three years (OR = 1.89, 95% CI=1.11-3.22), diabetic drugs availability (OR= 2.59, 95% CI=1.54-3.70), and having had diabetic health education (OR= 4.24, 95% CI =1.15 - 15.60) (Bagonza et al., 2015). In Uganda, Kalyango et al. 2008, non-adherence was found to be 28.9% and associated with the female gender, poor understanding of the drug regimen, inability to purchase the required medication, and prolonged review date. In Mwanza city, a study among 272 patients with diabetes found an association between non-adherence (28.3%) and alcohol intake, medication side effects, and distance traveled to health facilities (Fedrick & Temu, 2012). The socio-demographic characteristics of the patients were found to have no association with adherence to anti-diabetes medication. In another study in Palestine, Sweileh et al., 2014 found a non-adherence level of 42.7% with Morisky's Medication Adherence Score (MMAS-8) of <6 among 405 patients with diabetes. Alqarni et al., 2018 in their study of adherence among 375 patients with diabetes using the MGLS-4 scale, detected a 35.7% adherence level. Current medication, glycated hemoglobin (A1C<70), and no associated comorbidities were found to be strongly associated with medication adherence. Multivariate analysis linked non-adherence with: knowledge of disease, beliefs about anti-diabetic medications, concerns about adverse events of diabetes medications, and beliefs that medicines are harmful. Knowledgeable patients and those with

strong beliefs of their anti-diabetic medications were less likely to be non-adherent. In a review study of 23 papers on patients with diabetes, many patients receiving both oral hypoglycemic medications and insulin were non-compliers (Cramer, 2004).

2.3 Measurement of Medication Adherence

The selection of a particular measure in clinical practice depends on the anticipated use of the information, the resources available to the clinician, as well as patient reception and convenience of the technique. Indirect methods of measuring adherence in the outpatient setting include self-reporting, electronic adherence monitoring, pharmacy refill rates, and pill counts. Direct methods comprise the use of bioassays or biomarkers, which involve laboratory detection of the medication biologic fluid, or laboratory finding of a biologic marker (Hawkshead & Krousel-Wood, 2007a).

2.3.1 Self-Reporting

Self-reporting is the simplest and commonest methods of determining adherence to medication. Approaches implored for self-reporting vary and include patient-keeping diaries of medication taken, interviews conducted during office visits, and responses to adherence-specific surveys questions. Several multi-item questionnaires have been developed and tested in outpatient settings with the explicit aim of ascertaining valid and reliable estimates of adherence to medications (Culig & Leppée, 2014). In an effort to facilitate the identification of barriers to adequate compliance, (Jackson et al., 2015) developed the medication adherence survey (MAS), a multi-item scale designed to assess patient adherence to blood pressure medication regimens in the outpatient setting. Another multi-item scale, the Hill-Bone compliance to high blood pressure therapy scale comprises 14 items, eight of which are directed at assessing. Questionnaire and diary methods tended to have better concordance with other adherence measures than interview methods; this may be due to the increased specificity of questionnaires and diaries compared with interviews or to a greater perception of anonymity on the part of the patient when completing a

written survey versus participating in an interview (Morisky et al., 1986).

The advantages of self-reporting are that the method is simple and economical; information on social, situational, and behavioral factors that impact adherence can also be gathered. Disadvantages include recall bias, the possibility of over-estimating compliance, and the tendency to evoke socially acceptable responses. Interviewer skill levels and the construction of the questions that are asked can affect the validity of results obtained, as can the timeframe covered by the questions. Supplementing self-report data with more objective information, such as prescription fill data, may allow more accurate and complete measurement of medication adherence (Farmer, 1999).

2.3.2 Electronic Adherence Monitoring

Some consider electronic means of measuring medication as the gold standard for adherence assessment. The first electronic dispenser was developed by Eisen and colleagues and further refined by the Aprex Corporation as a medication event monitoring system (MEMS) consisting of a cap that fits standard medication bottles and contains a computer chip that records the date and time the bottle is opened (Hawkshead & Krousel-Wood, 2007b). The recorded medication events can be transferred to a computer for analysis. Electronic devices to monitor medication adherence such as MEMS have been reported to be highly reliable and have been used as a means of validation of other measurement methods used in the context of intervention trials (Hamilton, 2003). MEMS has been reported to be acceptable to patients in research studies and effective in identifying 'white coat compliers': patients who only take prescribed medications prior to their visit with their healthcare provider. In addition, monitoring alone with electronic systems has improved blood pressure control. In 69 patients with refractory hypertension, monitoring of adherence itself reduced blood pressure, with blood pressure returning to normal in one-third of patients, significantly improving in one-third of patients, and unchanged in the remaining third

during the Effective monitoring period. However, several limitations to its use in the outpatient setting exist. There is the potential for patients to manipulate the device, resulting in inaccurate measurements. Also reactivity bias, that is, change in behavior brought on by the patient's knowledge of his or her behavior being under observation, may negatively affect the reliability of measures obtained via with patients soon returning to their regular medication-taking patterns. Furthermore, electronic measurement devices can be subject to misuse by the patient, defects in manufacture, or battery-related malfunction. In addition, the electronic caps may be cumbersome to carry and may be impractical for patients requiring monitoring of multiple drugs as one cap per prescription bottle is required. Finally, the limited availability and additional cost of electronic medication-measurement systems further limits the widespread use of these modalities in ambulatory clinical settings (Hawkshead & Krousel-Wood, 2007b).

2.3.3 Pharmacy Refill Rates

Choo et al. (1998) assessed the validity of pharmacy dispensing records and pill counts (using electronic monitoring as the standard measure) as methods of measuring adherence in 286 hypertensive individuals. They reported that both pharmacy dispensing records and pill count were highly correlated with dose-count adherence assessed by electronic monitoring. Steiner and Prochazka identified three attributes to characterize refill adherence: (i) distribution of the adherence variable (continuous vs. dichotomous); (ii) number of refill intervals evaluated (single vs. multiple); and (iii) use of the measure to assess either the time period over which medications were available to the patient or the time interval during which gaps in therapy occurred. Typically, cut points for determining adherence with pharmacy fill data are as follows: <80% = under adherence, 80–120% = adherence, >120% = over adherence (typically resulting from stockpiling pills) (Christensen et al., 1997).

Pharmacy refill rates reflect not only the patients' decision to continue therapy without the

influences of pharmaceutical company promotion and sampling to physicians but also the patients' effort to obtain the medication as the first step towards taking the medication. This method of measurement is unobtrusive and patients are not aware that adherence is being monitored; thus, this method is not subject to behavior change secondary to monitoring. Finally, it provides estimates of the length of time that a patient has medication available and any gaps in availability that might exist with delays in refill. Limitations to the use of refill rates in the outpatient setting is the lag time for data availability, which can take up to 3 months or longer; the possibility of incomplete data if the patient does not use a closed pharmacy system, obtains free samples, or purchases medications through mail order; and the fact that the method is insensitive to variations in prescribed use. Further, pharmacy fill records may not reflect changes made to prescribed medications by healthcare providers, which may have been prompted by a request from the patient or by health plan administrators (Grant et al., 2005).

2.3.4 Pill Counts.

A simple method for measuring medication adherence is by counting the dosage units (tablets, capsules, or other dosage units such as vials) that the patient has not taken by the time of his or her clinic visit. To measure adherence via pill count, the number of dosage units not used is compared with the number of units received at the most recent filling of the prescription and the time elapsed since the pharmacy dispensed the medication. For example, on a visit to the clinic made 21 days after receiving a 30-day supply of tablets that are supposed to be taken at a dosage of one tablet once per day, the patient should have nine tablets remaining (assuming that that day's dosage has been taken at the time of the visit) (Hamilton, 2003). If, however, he or she has 12 tablets remaining, it can be deduced that the patient has missed three doses and adherence is less than optimal. The possibility of over-adherence can also be suggested by pill counts: for example, if the patient has fewer doses remaining at the time of the visit than he or she should have based on

the time elapsed since the prescription was filled. The equation that can be used to measure adherence using pill count is $A = \frac{N - R}{D} \times 100$, where A is adherence, N is the number of pills dispensed, R is the number of pills remaining, and D is the number of days since the prescription was filled. The advantages of using pill count to measure adherence are the simplicity and low cost of the method; hence, its use is common in both clinical trials and practice. Hamilton reported significant correlations between pill count and partial-to-complete compliance as measured by MEMS ($r = 0.29-0.39$; $p < 0.01$) in a study of 107 hypertensive patients participating in a clinical study to enhance patient adherence in clinical trials (Coleman et al., 2012). However, there are drawbacks to using pill count as a single measure of patient adherence in clinical practice. The dispensing date shown on the medication label may not accurately reflect the date the patient began to consume the current supply of medication, leading to an erroneous measure of adherence. Many reviews have noted the tendency of pill counting to err on the side of overestimating adherence, which can occur in the case of pill dumping or pill sharing. There is also the potential for underestimation of adherence if refills are obtained earlier than when pill consumption was supposed to have begun; however, potential penalties to pharmacies imposed by health plans if refills are given before the date designated by the pharmacy benefits manager limits this occurrence (Steiner & Prochazka, 1997).

2.4 Risk Factors Associated With Medication Non-Adherence

2.4.1 Patient-Related Factors.

Numerous patient-related factors, such as inadequate comprehension of their disease, non-participation in treatment decision making, and sub-optimal medical literacy add to medication non-adherence (Brown & Bussell, 2011). An estimated 90million adults in the US have insufficient health knowledge, putting increased risk for hospitalizations and bad outcomes (Knight, 2014). The beliefs and attitudes about the effectiveness of the treatment, together with previous experiences in medicines negatively affect adherence to medication (Brunner et al., 2009). High medication cost, lack of transportation, poor appreciation of medication instruction, long wait time

at pharmacies, and lack of family of social support were strongly associated with non-adherence in an inner-city study in the US. These factors were also good predictors of poorer outcomes (Brown & Bussell, 2011). Kirkman et al., 2015 found in their study of determinants of diabetes medication adherence sufficient association between adult age, male sex, higher education, and higher income.

In a study among 405 patients with diabetes, Sweileh et al., 2014 established that adverse views about a medication regimen are a powerful barrier to adherence. They found no association between patients who adhere and those who do not, considering age, period of the disease, sexual role, level of tutelage, and anti-diabetic regimen. They however established an association between non-adherence and marital status, comorbidity, and disease-specific knowledge. Being married and knowing reflected the participant's unlikeliness to be non-adherent. They also established in a multivariate analysis that the belief in the necessity of the diabetes medication and concerns about the adverse effects were directly associated with adherence. Those with high knowledge and a strong belief of necessity were less likely to be non-adherent. However, Gholamaliei et al., 2017 in another diabetes medication adherence study, found a significant relationship between age and adherence. The study also found a strong association between other patient-related factors such as occupation, level of education, and patient beliefs in the therapy being administered. In both bivariate and multivariate levels in a Malaysian study by Sufiza Ahmad et al., 2013 knowledge on the medication type was significantly associated with medication adherence. Jannoo & Mamode Khan, 2019 study in Malaysia also found a strong association between age and the presence of comorbidity.

Alqarni et al., 2018, found that the occupational status of the 375 patients with diabetes was significantly associated with adherence. Davidsson et al., 2016 found that adherence was linked with poverty, lack of knowledge, non-access to medications, the use of alternative medicines, and

non-access to health care. Additionally, while the findings of the study indicated that knowledge (46%) about diabetes was associated with adherence, 44.7% did not know about their disease or medication.

In a review of 196 publications on diabetes medication adherence, age, race, health beliefs, medication cost, insurance, insulin use, health literacy were noted to affect adherence.

Good glycemic control and low medical costs were linked with higher medication adherence (Capoccia et al., 2015). In another study, diabetes knowledge and adherence in Palau Penang hospital, Al-Qazaz et al., 2011 found a strong association between diabetes knowledge and medication adherence.

Lee et al., 2017, found in a study among patients with diabetes receiving poly-therapy in an Asian community, that younger age is negatively associated with adherence. In a study to assess the association between health belief and medication adherence among patients with diabetes in Saudi Arabia, 119 of the 220 respondents were male with a mean age of 52 ± 11.2 . More than 50% had lower than senior high education (Alatawi et al., 2016).

According to MuKherjee et al., 2013, medication-non-adherence is higher in lower-socioeconomic groups with an adherence rate of only 30%. Lack of understanding of the disease and insight into treatment contributed to about 50% of non-adherence. In the aged, medication non-adherence is greatly attributed to poor cognition and a greater number of medications (Zelko et al., 2016).

Individuals with chronic disorders are more adherent with daily regimens as compared to more frequent regimens in the day (Coleman et al., 2012)

In an adherence determinants study in a large pharmacy database, adherence was sufficiently associated with older age, male sex, higher education, higher income, use of mail-order versus retail pharmacies, primary care versus non-endocrinology specialist prescribers, higher daily total

pill burden, and lower out-of-pocket costs. Patients who were new to diabetes therapy were significantly less likely to be adherent (Kirkman et al., 2015).

In a diabetes medication adherence study in Lagos Nigeria, there was a significant association between age, gender, and medication adherence. This study however found no association between the levels of education of the patients with diabetes and their levels of adherence. The overall adherence rate was found to be 86.8% (Awodele & Osuolale, 2015).

2.4.2 Health System Related Factors

Poor coordination in the healthcare system creates barriers and bottlenecks for clients by inhibiting access to care. High-priced drugs or copayments also add to poor medication adherence. In an overburdened health care system in which healthcare workers see a huge number using limited resources, the time spent with patients is deficient to appropriately evaluate and appreciate their medication-taking behaviors. This greatly affects the time required to engage the patient in discussing effective strategies to attain medication adherence (Brown & Bussell, 2011).

In a study to determine the factors that affect adherence among patients with diabetes, Davidsson et al., 2016 found that financial constraints were the main reason for non-adherence to treatment as 32% did not take their medication at all and 80% did not follow any recommended instruction from their care providers. In a diabetes medications adherence determinant study where adherence was found to be 96%, it was noted to be strongly inversely associated with lower out-of-pocket costs (Kirkman et al., 2015).

Healthcare team and health system factors have been found to affect the degree of medication adherence in patients with diabetes. In a study by Gholamaliei et al., 2017b where 59.44% of poor adherence was detected, therapy and healthcare team and health system factors were had a strong association with non-adherence. It was found in another study that patients with diabetes who

received more information about their disease and the medication were more adherent (86.7%) to medication (Gimenes et al., 2009).

Lack of health insurance and the price of medicines are additionally noted to be key factors to restricting as cost-related non-adherence (CRNA) to medications, a prevalence of 4% to 36% has been recorded in Canadian studies (Brown & Bussell, 2011). A study in Kenyatta National Hospital in Kenya concluded family support, affordability of medications, and good healthcare-provider-patient communication were required for ensuring adherence to medications in diabetes management. Challenges in accessing medicines and dissatisfaction with attending clinicians were strongly associated with non-adherence, OR 1.76 and 1.36 respectively (Waari et al., 2018). A qualitative investigation by (Atinga et al., 2018) to determine the factors affecting long-term medication adherence among patients with diabetes and hypertensive patients in Ghana, non-adherence was found to be a result of perceptions that the medications were not effective. Patients with these perceptions were also users of alternative remedies perceived as accessible, affordable, and efficacious for managing their conditions. Atinga et al., 2018 also found that poly-pharmacy, tight- work schedules poor prescription instructions had an association with non-adherence.

2.4.3 Disease-Related Factors

Gimenes et al., 2009 found that how long one had been on treatment of the patients with diabetes had an inverse relationship with the level of adherence. Prevalence of adherence in subjects with five years or less of diagnosis was 80%, against 77.4% in those with more than five years. Patients with diabetes who had more knowledge about their disease management but had poor control had a prevalence of 87% than those who had poor glucose control (68.2%). Significantly, the prevalence of non-adherence in those with HbA1 greater than 7% was 85.7%. Diabetes-related factors have also been found by Gholamaliei et al., 2017a to be associated with poor adherence ($p < 0.05$).

2.4.4 Medication-Related Factors

Sweileh et al., 2014 found that patients with diabetes who have high fears about adversarial concerns of anti-diabetic medicines and those with certainty that drugs are injurious are unlikely to adhere to their prescribed regimes. In a follow-up study involving 775 elderly American residents with type 2 diabetes mellitus, there was a dominant link to severity of comorbidities and reduced anti-diabetic medication possession ratios (Patel et al., 2010). In a study to determine patient and physician factors associated with adherence to diabetes medications, Schoenthaler et al., 2012 found that being newly diagnosed with diabetes and taking only oral hypoglycemic agents were linked with improved medication adherence.

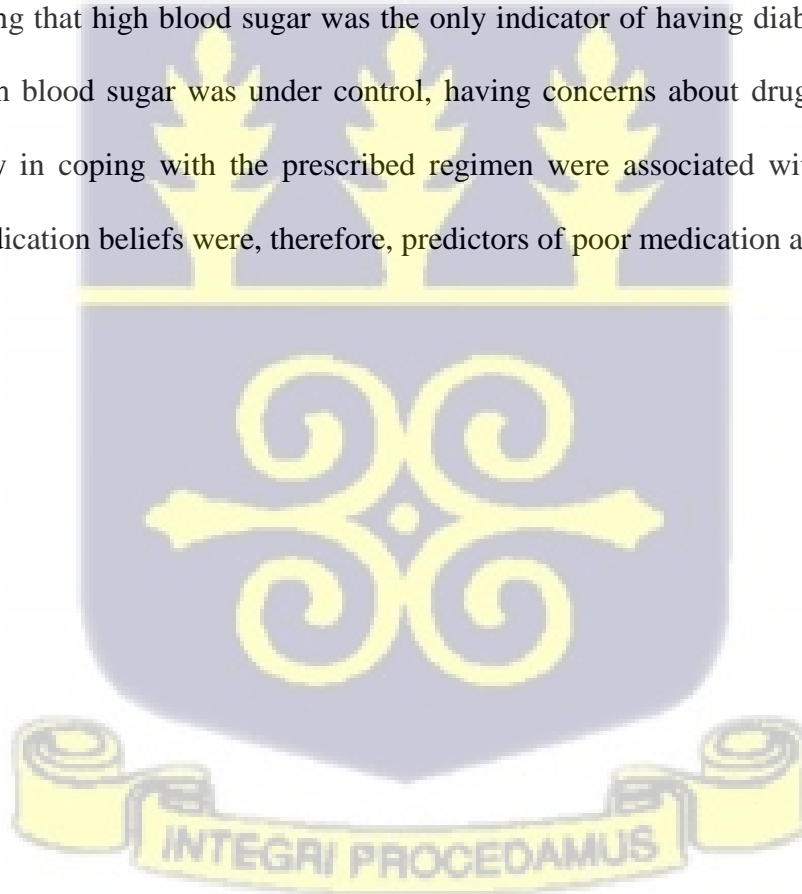
Capoccia et al., 2015 noted that the frequency of medication intake such as taking more than two times a day and the doubts about the effect of the medication were associated with non-adherence. Poly-therapy was however found to have no association to adherence in an Asian community study (Lee et al., 2017). Patient perception of susceptibility and benefits and self-efficacy have also been found to influence their adherence to medication (Alatawi et al., 2016). Olorunfemi & Ojewole, 2019, found a negative association between medication belief and medication adherence ($p=0.005$) as patients with diabetes with a negative perception about their medication were highly unlikely to take their medication because they were considered as toxic.

In another study among 300 type-2 patients with diabetes to determine medication adherence and its related factors, 59.4% were found to be non-adherent. The non-adherence was directly associated with medication factors such as the efficacy and concerns about the drug (Gholamaliei et al., 2017a).

Gimenes et al., 2009 noted that patients with diabetes who did not complain about side-effects of drugs had a higher adherence level than their counterparts who complained (93.8% versus 70%).

Side effects of medicines have also been found to be related to non-adherence. Patients tend to stop medications when they discover some symptoms they are experiencing are worse than the disease itself (Abdul Kader Mohiuddin, 2019). In a patient-reported perception study involving 445 patients with diabetes, 33% reported having experienced side effects and 85% indicated they had not reported their concerns to the physician. Analysis of their responses indicated a link between non-adherence and having experienced side-effects to oral hypoglycemic agents ($\beta = -0.15$; $P < 0.010$) (Chao et al., 2007).

In a study by Mann et al., 2009 to predict the role of disease and belief in medication adherence, 28% of the 151 patients with diabetes were poor adherers to treatment. Multivariate analysis revealed believing that high blood sugar was the only indicator of having diabetes, stopping the medication when blood sugar was under control, having concerns about drug side-effects, and having difficulty in coping with the prescribed regimen were associated with non-adherence. Disease and medication beliefs were, therefore, predictors of poor medication adherence.



CHAPTER THREE

3.0 Methodology

3.1 Study Area

The study was carried out in the Kintampo Municipal Hospital in the Bono East region. Apart from being the municipal capital, the Kintampo Municipal Hospital is the largest government hospital in the Bono East region with a functioning diabetes clinic with clients from all seven sub- districts and the neighboring Savannah and Ahafo regions attending (Ghana Statistical Service, 2014). The study was conducted in the Kintampo Municipal Hospital diabetes clinic because that is the only well-established diabetes clinic in the municipality. It is the main management center for all patients with diabetes The Municipal Hospital is the chief referral hospital in the Kintampo Municipal and neighboring districts. The hospital has three general medical officers and 170 nurses of all categories. It has two pharmacists and 10 physician assistants and over 100 other paramedical and support staff. The facility provides 24hour inpatient and emergency services, general outpatient services, maternal and child health, surgeries, and 24hours emergency care. The hospital also hosts the regional treatment center for managing mild to moderate covid 19 patients.

3.2 Design

A quantitative cross-sectional design was used. This design was used as it would allow for the study of multiple variable at the same time with little or no additional cost. Data was collected using a pretested questionnaire and the MMAS-8. The study was conducted among patients with diabetes attending the diabetes clinic from September 2021 to December 2021.

3.3 Sample Size

A sample size of 232 diabetes clients in addition to a non-response rate of 10% (Nair et al., 2008) was used for the study and thus making a total sample size of 256. The sample size was calculated from the Raosoft online sample size calculator (www.raosoft.com/samplesize.html) (Raosoft, 2004). A confidence level of 95%, 5% margin of error, a response distribution of 68.5%, and a

total population of 774 diabetes clients were entered into the software for the computation. The z-score is 1.96 at the 95% confidence interval.

3.4 Inclusion Criteria

Patients with diabetes and visiting the diabetes clinic in the hospital were eligible for the study. Participants were above 18 years of age.

3.5 Exclusion Criteria

All newly diagnosed patients with diabetes (less than 6 months on medication) were excluded from the study. All type 1 diabetes and diabetes insipidus were also excluded from the study.

3.6 Sampling

At the diabetes clinic in the Kintampo Municipal Hospital, the patients attend a monthly clinic. The clinic is run weekly. The 774 diabetes clients are scheduled for their next review 4 clear clinical weeks from the last visit. Each patient comes in a particular week of the month for review and refills their medications. The population of people with diabetes was the sampling frame. The systematic random sampling method was used. The sampling frame of 774 patients with diabetes was divided by the sample size of 255 to get the sampling interval of 3. A random figure table was used to generate a number from 1, 2, and 3 to select the first respondent. On a clinic day, the first three patients to report to the clinic were assigned the numbers 1, 2, and 3 in the order in which they come. The number generated from the random number table was then applied and the first respondent was selected and interviewed. The questionnaire was administered to every other diabetic on the clinic visit. This was done on every clinic day for the period of the study to attain the required sample size. During this process, if a selected patient declined to partake in the study, the next patient was selected and interviewed.

3.7 Study Variables

3.7.1 The Outcome Variable

Adherence to diabetes medication is the outcome variable. This was measured using Morisky's Medication Adherence Scale (Culig & Leppée, 2014 and Morisky, 2008). This is a self-reporting method with a basic assumption that failure to adhere to medication be due to multiple factors such as: do you sometimes have problems remembering to take your medication, do you sometimes forget to take your medication, do you ever feel hassled about sticking to your treatment plan. The scale is phrased such that the bias of answering "yes" to all questions is minimized. The items in the scale estimated medication-taking attitude and not a determinant of adherence behavior. The responses are binary "Yes" or "No" except for the last question which is a five-point Likert response.

3.7.2 The Independent Variables

The independent variables studied were under the ensuing categories: patient factors, healthcare system factors, diabetes factors, and medication factors. Tables 3.1, 3.2, 3.3, and 3.4, below show the detailed description of the variable with their operational definition, scales of measurement, and sources.

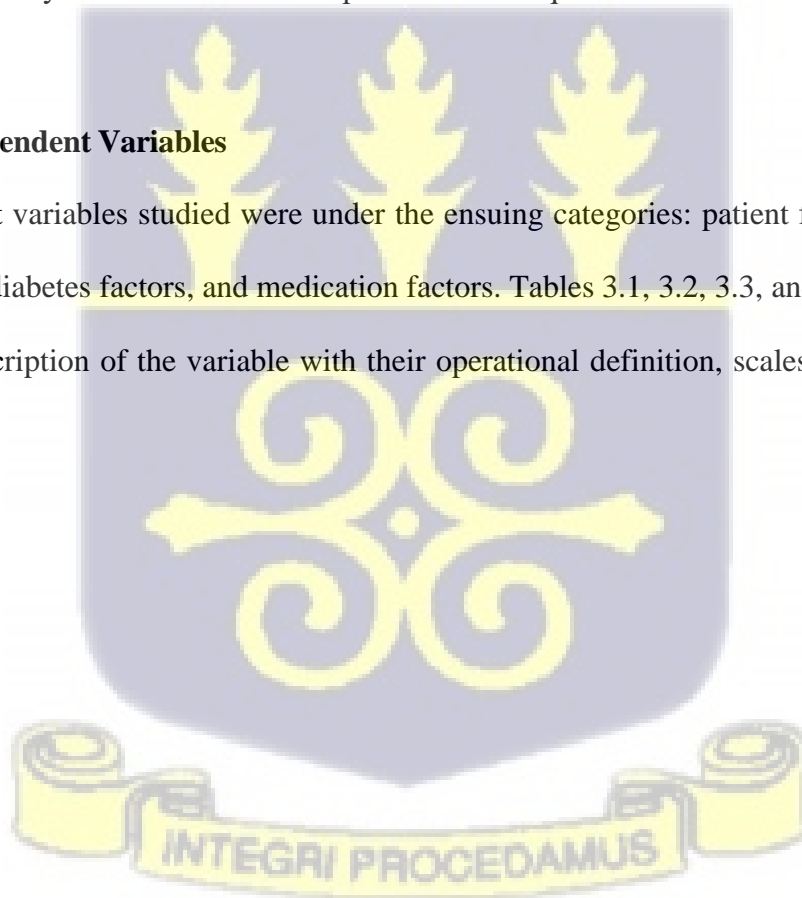


Table 3. 1: Operational definition of patient factors

Operational definition of patient factors			
Variable	Operational definition	Scale of measurement	Source of data
Age	Age at last birthday	Continuous- in years	Patient folder
Gender	Being male or female	Binary: Male or Female	Patient folder or asking the patient.
Marital status	Public status of the respondent in respect of marriage	Nominal: Single Married Divorced Widowed Co-habiting	Patient folder or by asking the respondent
Level of education	The last level of education achieved	Ordinal None, Basic, Secondary, Tertiary	Respondent
Knowledge	Respondent knowledge on medications, glycemic levels, and complications	Binary: Yes, No	Respondent
Comorbidity	Additional diagnosis requiring life-long medication	Binary: Yes No	Respondent's folder or by asking the respondent
Alternative treatment	Anything other than prescribed medication taken in by mouth to control participants' blood glucose	Binary: Yes No	Respondent

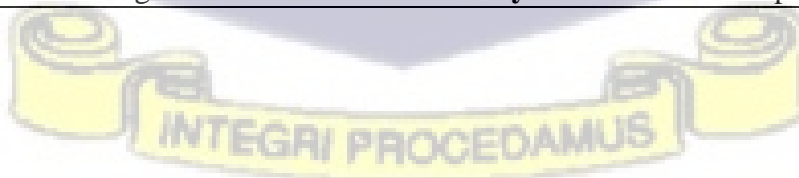


Table 3. 2: Operational definitions of healthcare system factors

Operational definitions of healthcare system factors			
Variable	Operational definition	Scale of Measurement	Source of data
Health insurance	Having an active health insurance number with the national health insurance scheme or any scheme	Binary: Yes No	From the folder or respondent
Visit duration	Having additional engagement with clinician aside from regular review	Binary: Yes No	From folder or respondent
Availability of medication	Patient regular anti- diabetic drugs available at the time review	Binary: Yes No	From respondent or folder
Location	Respondent's residence in the past 6 month	Nominal: Lives in Kintampo or Outside Kintampo	From respondent or folder
Healthcare cost	Respondent view of the amount used to buy prescription anti-diabetes drug	Ordinal: Inexpensive, Moderate, Expensive	From participants



Table 3. 3: Operational definition of medication factors

Operational definition of medication factors			
Variable	Operational definition	Scale of Measurement	Source of data
Side effects	Any noted complaints from the respondent attributed to the anti-diabetes medication being taken	Binary: Yes, No	From respondent or folder
Number of drugs	Number of anti-diabetes drugs plus drugs for any comorbidity defined in this study	Ordinal: Mono-therapy Dual therapy Triple therapy Others	From folder or respondent
Regimen	The prescribed number of times medications are taken within 24hours	Ordinal: Once Twice Thrice Complex	From the folder or respondent
Route of Medication	Means by which prescribed drug is taken by the respondent	Nominal: Oral Others	From folder or respondent



Table 3. 4: Operational definition of diabetes factors

Operational definition of diabetes factors			
Variable	Operational definition	Scale of measurement	Source of data
Duration	Number of years since diabetes diagnosis	Binary: 6-12months Above year	Folder respondent or
Glycemic control	Fasting Blood glucose at the time of visit	Binary: Controlled, Not controlled	Glucometer reading of respondent's blood glucose before breakfast
Complications	A medical label noted as a consequence of the diabetes	Binary: Yes No	Folder of respondent
Asymptomatic	Having diabetes-related symptoms at the time of visit	Binary: Yes No	Respondent's folder or respondent



3.8 Data collection tools & techniques

3.8.1 Structured Questionnaire

A structured pretested questionnaire was used to conduct a face-to-face interview with the study participants to collect the patient factor data, health system factors data, disease factor data, and medication factor data. The knowledge of participants was assessed using the knowledge assessment tool in the diabetes clinic in the Kintampo municipal hospital. It assessed the basic knowledge of respondents in their diseases by asking them questions such as: do you know the symptoms of diabetes? Yes, NO. Do you know the complications related to you disease condition: Yes, No (KMH, 2020).

3.8.2 Morisky's Medication Adherence Scale-8 (MMAS-8)

This was used to measure the medication adherence of the participants. This is an 8-item scale with binary responses of 'yes' or 'no'. Every "no" response is rated "1" and a "yes" response is rated "0" except for item number 5 where a "no" response is rated "0" and a "yes" response is rated "1". Item number 8 is such that a "0" response is rated "1" while a "4" response is rated "0". Response "1", "2", and "3" are respectively rated "0.25", "0.75", and "0.75". The MMAS-8 total score could lie between 0 and 8 and have been further categorized into three-level: low adherence (score<6), medium adherence (6 to <8), and high adherence (=8) (Okello et al., 2016).

3.9 Pilot Study

The study tools (questionnaire and MMAS-8) were piloted in the Kintampo South District Hospital and the necessary adjustments were made to ensure the appropriateness of the instruments and the design for the study.

3.10 Blood Glucose Measurement

The fasting blood sugar of the participants was checked using an Accu-check glucometer and strip. The fasting blood glucose was taken following the participant having fasted for 6-8 hours. Measurements >6.9mmol/l would be categorized as high (Leanne Riley, 2021).

3.12 Data quality control

The data collection tool was pre-tested before the study on twenty (20) participants in the Kintampo South district Hospital. Two field workers were trained and their ability to accurately record responses of participants was assessed. The principal investigator actively participated and oversaw the data collection. The principal investigator randomly selected some completed questionnaires and re-administered them to verify the accuracy of the data. Some completed questionnaires were selected at random and re-administered by the principal investigator to verify the data collected.

3.13 Data handling and analysis

Data cleaning and coding were done in Microsoft Excel Sheet and exported to STATA IC version 16.0 for exploration. Categorical variables were expressed in frequencies and percentages. Continuous variables were presented in means and standard deviations. Results were presented in graphs and tables. Tests of association (χ^2) were done to determine the links between adherence (outcome) and related factors. A univariate ordinal regression analysis was conducted with adherence to medication as the dependent variable and all other variables as independent variables. A 95% confidence interval and a p-value < 0.05 was considered statistically significant. Variables identified to be statistically significant were entered into a multiple ordinal logistic regression to determine if they remain statistically significant.

3.13 Ethical concerns

3.13.1 Clearance

The Ghana Health Service Ethics Committee issued ethical clearance (GHS-ECR: 041/05/21).

3.13.2 Study area authorization

Approval for the study area was obtained from the head of the hospital and the in charge of the diabetes clinic.

3.13.3 Informed consent

Participation in the study was voluntary and participants could withdraw from the study at any time they wished. The contents of the study were explained to the participants in a language they understood and

informed consent was administered. A person who consented to participate in the study appended their signature or thumbprint on the consent form.

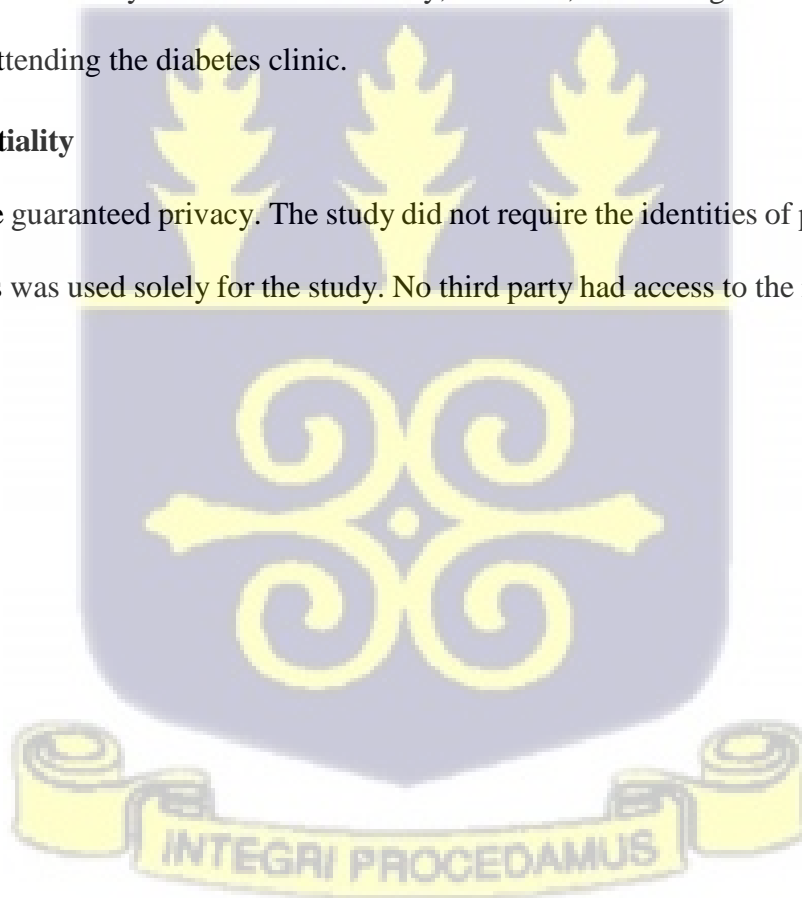
3.13.4 Risk or benefit/compensation

The risk of contracting covid 19 is real was considered. Strict adherence to the national guideline and protocols on reducing covid 19 infections were observed. The social distancing, wearing of a naso-facial mask, hand washing, and use of sanitizers were adhered to strictly. A naso-facial mask was provided for each participant and the team members to wear. Before and after contact with any participant, the investigator and research assistants applied alcohol-based sanitizers intermittently where hand washing was unnecessarily delaying the participant.

Participants did not directly benefit from the study, however, the findings of the research would improve care for clients attending the diabetes clinic.

3.13.5 Confidentiality

Participants were guaranteed privacy. The study did not require the identities of participants. Data collected from participants was used solely for the study. No third party had access to the information collected from the participants.



CHAPTER FOUR**4.0 Results****4.1 Socio-Demographic Characteristics**

The study was conducted among 256 persons with diabetes, however, 248 responded with complete information. The analyses were done using 248 respondents. Of the 248 participants, 146 (58.9%) were males. The ages in years of the respondents were between 18 and 85, mean age of 57.9 ± 11.8 years. Most of the participants 121 (48.8%) were 60 years and above. On respondents' level of education, majority, 106 (42.7%) had no formal education. One-hundred and fifty-nine representing 64.1% of the respondents were married and 163 (59.7%) of the respondents were Christians while 15 (6.0%) were unemployed.

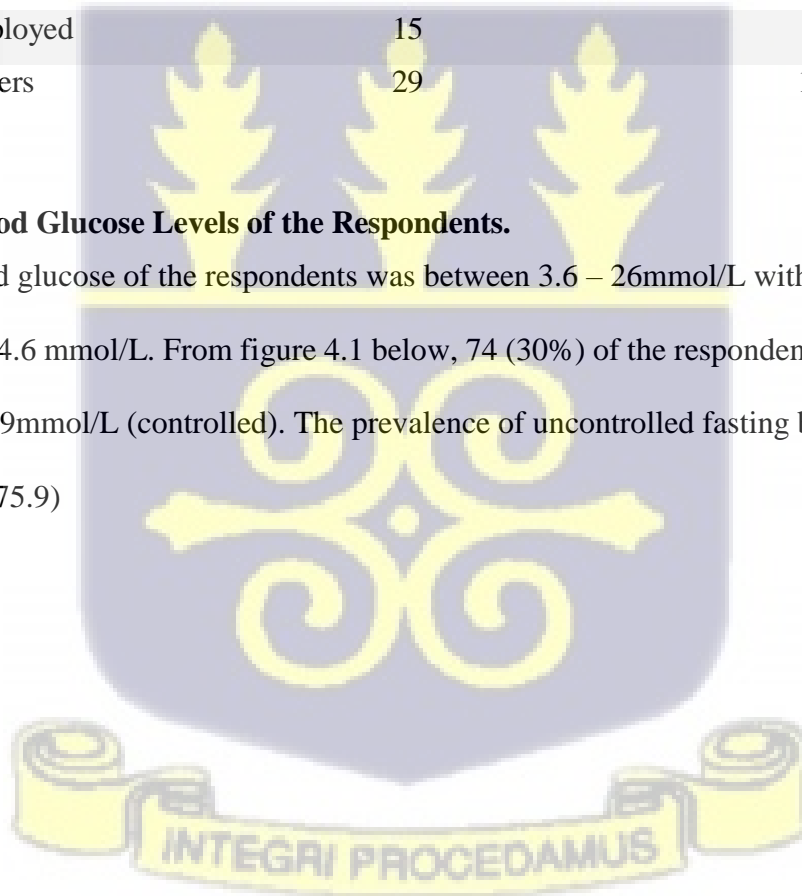
Table 4. 1: Socio-demographic characteristics of respondents

VARIABLES	FREQUENCY (N=248)	PERCENTAGE (%)
Age		
18-39	20	8.0
40-59	107	43.2
60 and above	121	48.8
Level of Education		
None	106	42.74
Basic	74	29.84
Secondary	40	16.13
Tertiary	28	11.29
Sex		
Female	146	58.87
Male	102	41.13
Marital Status		
Married	159	64.1
Single	30	12.1
Co-habiting	3	1.2

Divorced	25	10.1
Widowed	31	12.5
Religion		
Christianity	163	65.7
Islam	67	27.1
African traditional religion	10	4.0
Others	8	3.2
Occupation		
Salaried work	58	23.4
Farming	65	26.2
Trading	81	32.7
Unemployed	15	6.0
Others	29	11.7

4.2. Fasting Blood Glucose Levels of the Respondents.

The fasting blood glucose of the respondents was between 3.6 – 26mmol/L with a mean fasting blood glucose of 9.7 ± 4.6 mmol/L. From figure 4.1 below, 74 (30%) of the respondents had their fasting blood glucose below 6.9mmol/L (controlled). The prevalence of uncontrolled fasting blood sugar was 70.6% (95% CI=64.6 - 75.9)



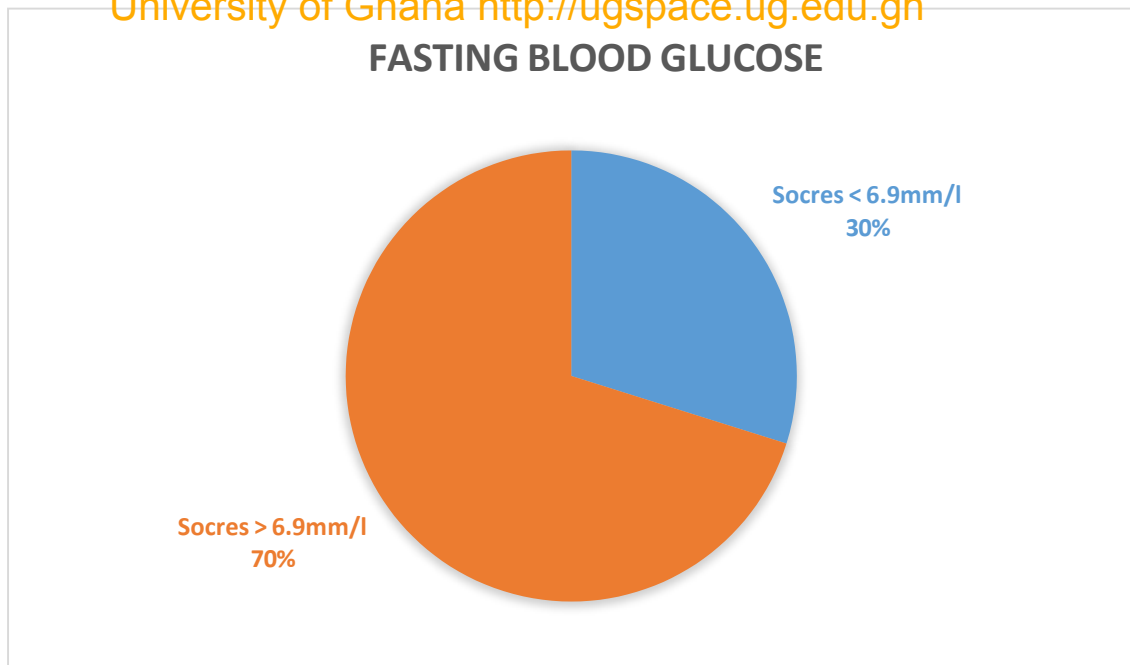


Figure 4. 1: Fasting Blood Glucose Levels of the Respondents.

4.3. Morisky's Medication Adherence Scores of Respondents

The prevalence of medication adherence among the respondents was 5.6% (95% C.I 3.4% - 9.3). From figure 2 below, majority 151 (60.9%) of the respondents had low adherence to their medication, only 14 (6%) were found to have high adherence to medication. Low and medium adherence were regrouped as non-adherence making a prevalence of 94.4% while high adherence was classified as adherence and maintained a prevalence of 5.6% (95% C.I 3.4% - 9.3).



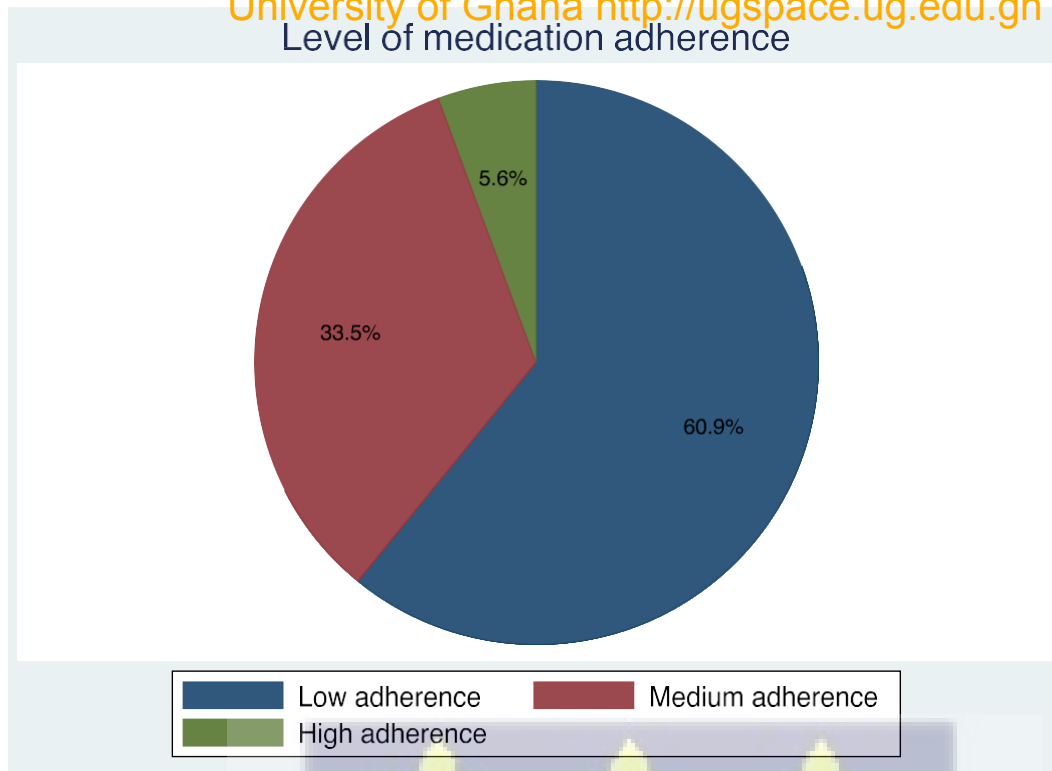


Figure 4. 2: Morisky’s Medication Adherence Score of Respondents

4.4 Patient-Related Factors

From table 4.2 below, 113 (45.6%) of the respondents indicated a lack of knowledge of the type of medications they are taking for the management of their blood glucose. On respondents’ knowledge of the normal level of blood glucose, 150 (60.5%) indicated a lack of knowledge. One-hundred and forty-nine (60.2%) reported taking unprescribed medication/alternative medicines to manage their blood glucose. Majority, 150 (60.5%) of the respondents did not know the abnormal blood glucose level. However, 155 (62.5%) indicated knowledge of the consequences of abnormal blood glucose levels.



Table 4. 2: Patient-related factors

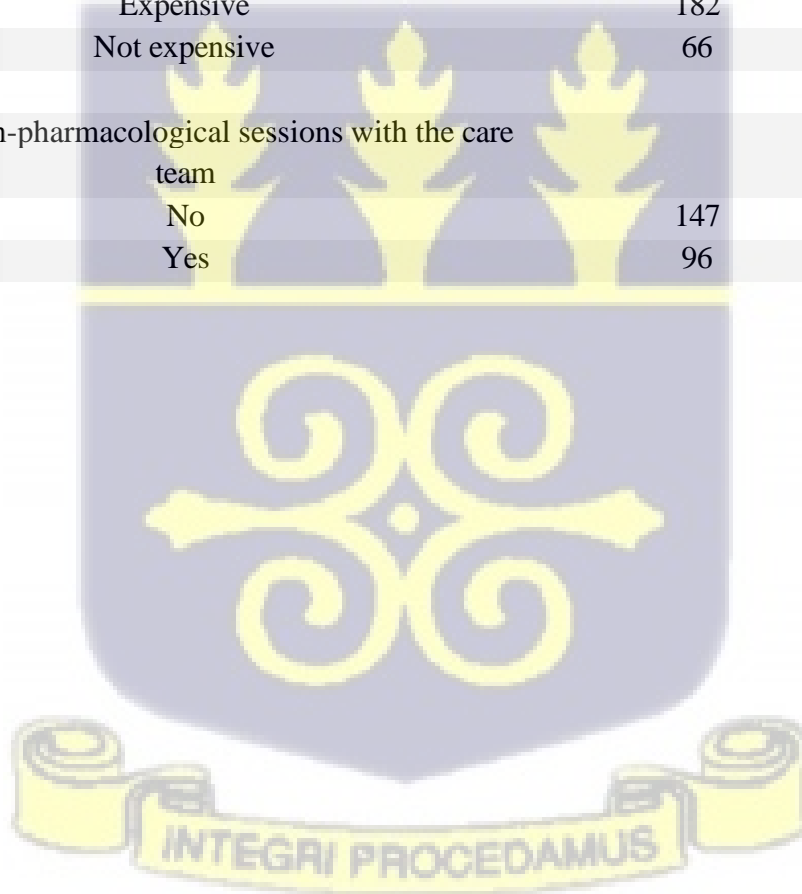
VARIABLES	FREQUENCY (N=248)	PERCENTAGE (%)
Knowledge of the type of medication		
No	113	45.6
Yes	135	54.4
Knowledge of normal blood glucose level		
No	150	60.5
Yes	98	39.5
Knowledge of abnormal blood glucose level		
No	150	60.5
Yes	98	39.5
Knowledge of consequences of abnormal blood glucose		
No	93	37.5
Yes	155	62.5
Taking other prescribed lifelong medications		
No	99	39.92
Yes	149	60.08
Taking alternative/unprescribed medications		
No	190	76.6
Yes	58	23.4

4.5 Health system-related factors

Of the 248 respondents, 219 (88.3%) were registered with the national health insurance scheme. Eighty-five (34.3%) of the respondents indicated that prescribed medications are not available. Majority of the respondents 182 (73.4%) said out-of-pocket purchases of unavailable medication are expensive. For proximity to the diabetes clinic, 84 (33.9%) of the respondents indicated that they stay outside of Kintampo thus making it difficult to attend the clinic regularly and as per schedule. Majority, 147 (60.5%) of the respondents indicated that apart from reporting to the clinic for medication refill and medical reviews, the care team did not engage them in any non-pharmacological strategies.

Table 4. 3: Health system-related factors

VARIABLES	FREQUENCY (N=248)	PERCENTAGE (%)
Health Insurance status		
No	29	11.7
Yes	219	88.3
Availability of prescribed medications		
No	85	34.3
Yes	163	65.7
Proximity to Primary Diabetes Clinic		
No	84	33.9
Yes	164	66.1
Out of pocket medication purchases		
Expensive	182	73.4
Not expensive	66	26.6
Having non-pharmacological sessions with the care team		
No	147	60.5
Yes	96	39.5

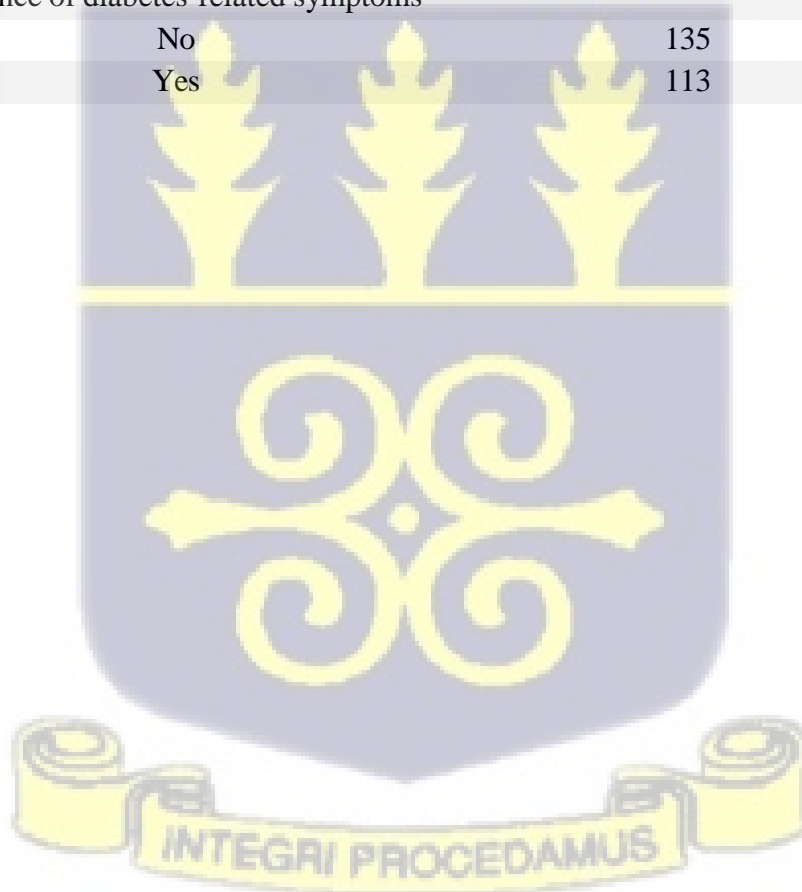


4.6. Diabetes-related factors

For blood glucose control, only 73 (29.4%) of the respondents had <6.9 mmol/L (controlled). The presence of diabetes complications was reported in 71 (28.6%) of the respondents, table 4.4 below.

Table 4. 4: Diabetes-related factors

VARIABLES	FREQUENCY (N=248)	PERCENTAGE (%)
Fasting blood glucose		
<6.9 mmol/l (controlled)	73	29.4
>6.9 mmol/l (uncontrolled)	175	70.6
Presence of diabetes complication		
No	177	71.4
Yes	71	28.6
Presence of diabetes-related symptoms		
No	135	54.4
Yes	113	45.6



4.7 Medication-related factors

From table 4.5 below, majority of the respondents had been on diabetes medication for between 1 to 5 years. Only 55 (22.2%) indicated being on medication for 6 months to less than a year.

Table 4. 5: Medication-related factors

VARIABLES	FREQUENCY (N=248)	PERCENTAGE (%)
Duration on diabetes medication		
6-11 months	55	22.2
1-5 years	134	54.0
>5 years	59	23.8
Experiencing medication side effects		
No	149	60.1
Yes	99	39.9
A 24-hour regimen of diabetes medication		
Once	25	10.1
Twice	193	77.8
Thrice	30	12.1
Type of diabetes medication therapy		
Mono-therapy	36	14.5
Dual therapy	177	71.4
Triple therapy	35	14.1
Route of medication		
Other routes	11	4.4
Oral	237	95.6

Majority, 237 (95.6%) of the respondents were on only oral medication. However, 177 (71.4%) indicated being on dual-therapy (two anti-diabetes drugs) for the management of their blood glucose. Majority, 193 (77.8%) indicated they take their medications twice a day. Ninety-nine (39.9%) said they were experiencing side effects of the medications they were taking.

4.8 Association between socio-demographic factors and medication adherence

In table 4.6 below, of the 248 respondents, 16 of the 20 were within the age of 18 – 39 years non-adherent.

Non-adherence increased with age. There was no statistical association between age and medication adherence ($\chi^2=1.21$, p-value = 0.546).

Of the 106 participants who had no formal education, 96 (90.6%) were non-adherent. None of the 28 (100%) respondents with tertiary-level education were adherent to their medication. Participants' education level and medication adherence had no significant statistical association ($\chi^2=5.63$, p-value = 0.131). Of the 146 females in this study, only 7 (4.8%) were adherent to their medication. Seven (7), 6.7% of the 102 males in the study were adherent to their medication. Sex was not statistically significantly associated with medication adherence ($\chi^2 =8.31$, p-value=0.487). Marital status p-value=0.081 and religion p-value=0.655 were not statistically significantly associated with medication adherence. However, occupation was found to be significantly associated with medication adherence at $\chi^2=11.26$, p-value= 0.024.

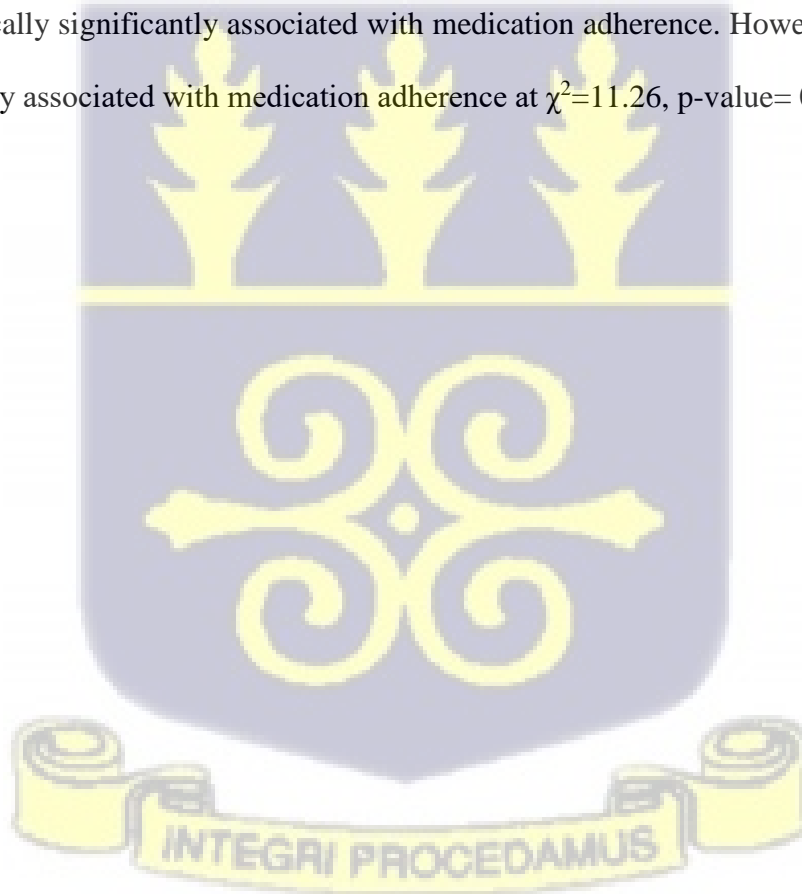


Table 4. 6: Test of association between socio-demographic characteristics and medication adherence

VARIABLES	MEDICATION ADHERENCE N=248		χ^2	P-VALUE
	Non-adherence n (%)	Adherence n (%)		
Age			1.21	0.546
18-39	19 (95.0)	1 (5.0)		
40-59	99 (92.5)	8 (7.5)		
60 and above	116 (95.9)	5 (4.1)		
Level of Education			5.63	0.131
None	96 (90.6)	10 (9.4)		
Basic	71 (96.0)	3 (4.0)		
Secondary	39 (97.5)	1 (2.5)		
Tertiary	28 (100.0)	0 (0.0)		
Sex			0.48	0.487
Female	139 (95.2)	7 (4.8)		
Male	95 (93)	7 (6.7)		
Marital Status			8.31	0.081
Married	145 (91.2)	14 (8.8)		
Single	30 (100)	0 (0.0)		
Co-habiting	3 (100.0)	0 (0.0)		
Divorced	25 (100.0)	0 (0.0)		
Widowed	31 (100.0)	0 (0.0)		
Religion			1.62	0.655
Christianity	152 (93.3)	11 (6.7)		
Islam	64 (95.5)	3 (4.5)		
African traditional religion	10 (100.0)	0 (0.0)		
Others	8 (100.0)	0 (0.0)		
Occupation			11.26	0.024*
Salaried work	57 (98.3)	1 (1.72)		
Farming	62 (95.4)	3 (4.6)		
Trading	71 (87.7)	10 (12.6)		
Unemployed	15 (100)	0 (0.0)		
Others	29 (100.0)	0 (0.0)		

* Significance at $p < 0.05$.

4.9 Test of association between patient factors and medication adherence

For patient-related factors, only knowledge of type medication taken was found to be statistically significantly associated with medication adherence at $\chi^2=9.64$, p-value= 0.002. Knowledge of normal blood glucose level, p-value= 0.154, knowledge of abnormal blood glucose level, p-value= 0.154, knowledge of consequences of abnormal blood glucose, p-value= 0.887, taking other prescribed lifelong medications, p-value= 0.372 and taking alternative/unprescribed medications, p-value= 0.139 all had no statistically significant association, table 4.7 below.

Table 4. 7: Test of association: patient factors and medication adherence

VARIABLES	MEDICATION ADHERENCE		χ^2	P-VALUE
	Non-adherence n (%)	Adherence n (%)		
Knowledge of the type of medication			9.64	0.002*
No	101 (89.4)	12 (10.6)		
Yes	133 (98.5)	2 (1.5)		
Knowledge of normal blood glucose level			2.03	0.154
No	139 (92.7)	11 (7.3)		
Yes	95 (96.9)	3 (3.1)		
Knowledge of consequences of abnormal blood glucose			0.02	0.887
No	88 (94.6)	5 (5.6)		
Yes	146 (94.2)	9 (5.8)		
Taking other prescribed lifelong medications			0.80	0.372
No	95 (96.0)	4 (5.0)		
Yes	139 (93.3)	10 (6.7)		
Taking alternative medications			2.19	0.139
No	117 (93.2)	13 (6.8)		
Yes	57 (98.3)	1 (1.7)		

* Significance at p<0.05.

4.10 Test of association between health system factors and medication adherence

From table 4.8 below, having an active health insurance subscription was found to be statistically significantly associated with medication adherence, $\chi^2= 4.09$, p-value= 0.043. The rest of the health system-related factors: availability of prescribed medications, p-value=0.297, proximity to the diabetes clinic, p-value=0.111, out of pocket medication purchases, p-value=0.428, having non-pharmacological sessions with the care team, p-value=0.389, were found to be statistically not significantly associated with medication adherence.

Table 4. 8: Test of association: health system factors and medication adherence

VARIABLES	MEDICATION ADHERENCE		χ^2	P-VALUE
	Non-adherence n (%)	Adherence n (%)		
Health Insurance status			4.09	0.043*
No	25 (86.2)	4 (13.8)		
Yes	209 (95.4)	10 (4.6)		
Availability of prescribed medications			1.09	0.297
No	82 (96.5)	3 (3.5)		
Yes	152 (93.2)	11 (6.8)		
Proximity to the diabetes clinic			2.54	0.111
No	82 (97.6)	2(2.4)		
Yes	152 (92.7)	12 (7.3)		
Out of pocket medication purchases			0.63	0.428
Expensive	173 (95.1)	9 (5.0)		
Not expensive	61 (92.4)	5 (7.6)		
Having non-pharmacological sessions with the care team			0.74	0.389
No	137 (93.2)	10 (6.8)		
Yes	92 (95.8)	4 (4.2)		

4.11 Test of association between diabetes factors and medication adherence

From table 4.9 below, the presence of diabetes complications in a respondent, $\chi^2=5.95$, p-value=0.015 and presence of diabetes-related symptoms $\chi^2=5.85$, p-value=0.016 were statistically significantly associated with medication adherence. However, the blood glucose of the respondent was found not statistically significantly associated with medication adherence, p-value= 0.499.

Table 4. 9: Test of association: diabetes factors and medication adherence

VARIABLES	MEDICATION ADHERENCE		χ^2	P-VALUE
	Non-adherence n (%)	Adherence n (%)		
Fasting blood glucose			0.46	0.499
<6.9 mmol/l (controlled)	70 (95.9)	3 (4.1)		
>6.9 mmol/l (uncontrolled)	164 (93.7)	11 (6.3)		
Presence of diabetes complication			5.95	0.015*
No	163 (92.1)	14 (77.9)		
Yes	71 (100.0)	0 (0.0)		
Presence of diabetes-related symptoms			5.85	0.016*
No	123 (91.1)	12 (8.9)		
Yes	111 (98.2)	2 (1.8)		

* Significance at p<0.05.

4.12 Test of association between medication factors and medication adherence

Table 4.10.1 show the chi-square test of association between medication adherence of respondents and medication-related factors. All the medication-related factors were found not statistically significantly associated with medication adherence: duration on diabetes medication, p-value=0.305, experiencing medication side effects, p-value=0.372, a 24-hour regimen of diabetes medication p-value=0.432, type of diabetes medication therapy, p-value=0.244 and route of medication, p-value=0.407.

Table 4. 10: Test of association: medication factors and medication adherence

VARIABLES	MEDICATION ADHERENCE		χ^2	P-VALUE
	Non-adherence n (%)	Adherence n (%)		
Duration on diabetes medication			8.88	0.305
6-11 months	54 (98.2)	1 (1.8)		
1-5 years	124 (92.5)	10 (7.5)		
>5 years	56 (94.9)	3 (5.1)		
Experiencing medication side effects			0.80	0.372
No	139 (93.3)	10 (6.7)		
Yes	95 (96.0)	4 (4.0)		
A 24-hour regimen of diabetes medication			1.68	0.432
Once	23 (92.0)	2 (8.0)		
Twice	184 (95.3)	9 (4.7)		
Thrice	27 (90.0)	3 (10.0)		
Type of diabetes medication therapy			2.82	0.244
Mono-therapy	36 (100.0)	0 (0.0)		
Dual therapy	166 (93.8)	11 (6.2)		
Triple therapy	32 (91.4)	3 (8.6)		
Route of medication			0.69	0.407
Other routes	11 (100.0)	0 (0.0)		
Oral	123 (95.1)	14 (5.9)		

* Significance at $p < 0.05$.

4.13 Bivariate and multiple ordinal logistic regression of related factors with medication adherence

Ordinal logistic analysis was conducted for all the variables with significance at 95% CI and a p-value < 0.05 at the chi-square analysis, table 4.1 below. The variables were occupation, knowledge of type of diabetes medication, health insurance status, presence of diabetes-related symptoms, and presence of diabetes-related complications. Only one (1) variable was significant and associated with medication adherence (p-value < 0.05).

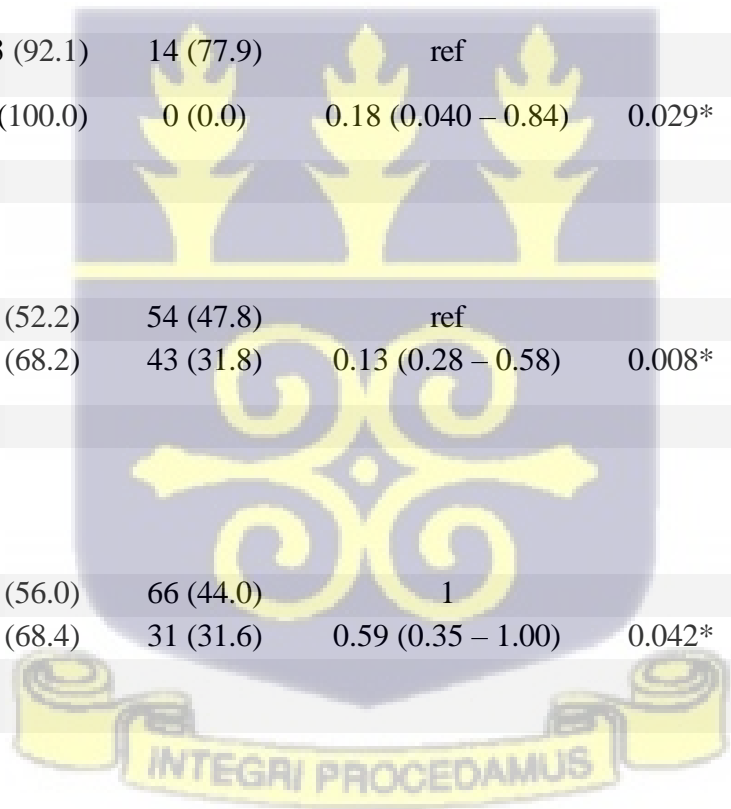
Table 4.1 above shows the association of the variable with medication adherence using bivariate and multivariate ordinal logistic regression to examine the adjusted odds ratios and their respective 95% CI and p-values. Upon controlling for all variables in multiple ordinal regression, the odd of medication non-adherence increased by 0.16 (84%) in respondents who knew the diabetes medication they were taking than those who did not know the medication they were taking (aOR=0.16 95% CI=0.03 - 0.65).



Table 4.11: Ordinal logistic and multiple ordinal logistic modeling analysis of related factors with medication adherence

VARIABLES	MEDICATION ADHERENCE		UNADJUSTED	P-VALUE	ADJUSTED	P-VALUE
	Non-adherence n (%)	Adherence n (%)	OR (95% CI)		OR (95% CI)	
Presence of diabetes-related symptoms						
No	163 (92.1)	14 (77.9)	ref			
Yes	71 (100.0)	0 (0.0)	0.18 (0.040 – 0.84)	0.029*	0.47(0.08 – 2.73)	0.402
Knowledge of the type of medication						
No	59 (52.2)	54 (47.8)	ref			
Yes	92 (68.2)	43 (31.8)	0.13 (0.28 – 0.58)	0.008*	0.16 (0.03 – 0.65)	0.013*
Knowledge of normal blood glucose reference level						
No	84 (56.0)	66 (44.0)	1			
Yes	67 (68.4)	31 (31.6)	0.59 (0.35 – 1.00)	0.042*		

* Significance level at p<0.05.



CHAPTER FIVE

5.0 Discussion

5.1 Introduction

The study was conducted among patients with diabetes in the diabetes clinic in the Municipal Hospital.

The main aim was to examine medication adherence among the diabetic. The discussion is structured under the four main factors of in this study: disease factors, patient factors, health system factors and medication factors.

5.2 Disease Related Factors

The overall prevalence of medication adherence among diabetes patients was 5.6% (95% C.I 3.4% - 9.3%). The findings in this study are far lower than those found by Osei-Yeboah et al., 2019 (60.7%) in their Ho medication adherence study among diabetes clients. In an analogous study by Sharma et al., 2014, non-adherence was found to be 84%, this consolidates the findings in this study. The findings in this study are consistent and also far higher than the 33% non-adherence found by Kirkman et al., 2015.

Glycemic control in this study (30.0%) was consistent with the findings in Osei-Yeboah et al., 2019. The prevalence of uncontrolled blood glucose in this study (70%) is consistent with the 40% to 60% worldwide but less than the 74% for Sub-Saharan Africa as found by Jha et al., 2012. The findings in this study demonstrate that glycemic control is not associated with medication adherence. This sharply disagrees with Capoccia et al., 2015. It is also inconsistent with Al-Qazaz et al., 2011 study in Palau Penang hospital.

In the current study, lack of knowledge of the type of medication taken was found to be 45.6%. This is inconsistent with finding in a Malaysian study by Sufiza Ahmad et al., 2013 who found a 4% lack of knowledge among the diabetes clients they studied. Notably in this study, at both the bivariate and multiple regression levels, knowledge on the medication type was associated with medication adherence. This is consistent with the findings in the Malaysian study by Sufiza Ahmad et al., 2013.

However, there was no association between adherence to medication and age and the presence of comorbidities in this current study. This disagrees with the findings by Sufiza Ahmad et al., 2013, Jannoo & Mamode, 2019 and Khan Gholamaliei et al., 2017, who found a significant association between age and medication adherence.

5.3 Patient Related Factors

In this current study, occupation was not associated with medication adherence. This is inconsistent with the finding of Alqarni et al., 2018 among 375 patients with diabetes. While Davidsson et al., 2016 found that adherence was associated with lack of knowledge, non-access to medications, the use of alternative medicines, and non-access to health care, the findings in this study differ greatly as none of these factors were found to be associated with medication adherence. Additionally, while the findings of Davidsson et al., 2016 indicated that knowledge (46%) about diabetes was associated with adherence, 44.7% did not know about their disease or medication. This current study had a similar proportion (45.6%) of the respondents who lacked knowledge about their disease condition. While the high-level illiteracy could explain the lack of knowledge in the current study, it is unclear what contributed to the phenomenon in the Davidsson et al., 2016 study.

The findings in this study suggest that the presence of an additional chronic disease is not associated with medication adherence. This is however different from the findings of Coleman et al., 2012 who found higher adherence in individuals with chronic disorders.

Concerning the level of education, the findings in this study are consistent with Awodele & Osuolale, 2015, study of medication adherence among diabetes clients in Nigeria where they found no association. This is also consistent with the 54% non-adherence that was found in the study population in Saudi Arabia among those who had a lower than the secondary level of education (Alatawi et al., 2016).

According to Brown & Bussell, 2011, lack of time and additional engagement with clients negatively affect clients' adherence to medication. The findings in this study suggest otherwise. Additional

sessions with the care team were found to have no association with medication adherence. It is worth noting however that in the present study, 93% had no additional sessions with the care team. This absence of additional non-pharmacological sessions with clients could account for the lack of association with adherence.

While this study did not find any association between out of pocket payment and medication adherence, the findings disagree with Davidsson et al., 2016 who found that financial constraints were the main reason for non-adherence to treatment (32% did not take their medication at all and 80% did not follow any recommended instruction from their care providers). The findings are also inconsistent with Kirkman et al., 2015 in a diabetes medications adherence determinant study where adherence was found to be 96% and strongly inversely associated with lower out-of-pocket costs.

5.4 Health System Related Factors

Healthcare team and health system factors have been found to affect the degree of medication adherence in patients with diabetes. In a study by Gholamaliei et al., 2017b where 59.44% of poor adherence was detected, therapy and healthcare team and health system factors had a strong association with non-adherence. It was found in another study that patients with diabetes who received more information about their disease and the medication were more adherent (86.7%) to medication (Gimenes et al., 2009).

In a univariate analysis in this study, having valid health insurance was associated with medication adherence. This finding is consistent with Brown & Bussell, 2011 Canadian study of factors affecting medication adherence among patients with diabetes. The association was however lost at the bivariate and multivariate ordinal regression analysis. Some background variables could have accounted for the false association of having valid health insurance with medication adherence. Waari et al., 2018 study in Kenyatta National Hospital in Kenya concluded family support, affordability of medications, and good healthcare-provider-patient communication were required for ensuring adherence to medications in diabetes management. The findings are discordant with that of this study.

While multiple drug therapy and use of alternative and unprescribed medication were found by Atinga et al., 2018 in their diabetes-hypertensive study in Ghana to have a strong association with medication non-adherence, the findings in this study suggest contrary.

Gimenes et al., 2009 found an inverse relationship between duration of treatment and adherence to medication, this study did not find any association though in the current study non-adherence increased after one year of treatment. This was consistent with the reduction of adherence from 80% in clients on treatment for less than a year to 77.4% in clients on treatment for more than five years. Additionally, the findings of Schoenthaler et al., 2012 in a study to determine patient and physician factors associated with adherence to diabetes medications, found that being newly diagnosed with diabetes and taking only oral hypoglycemic agents were linked with improved medication adherence is consistent with the findings in this study.

As with Gholamaliei et al., 2017a, the findings in this study are similar as increasing knowledge of blood glucose levels (normal and abnormal) increases the level of medication adherence. In this current study clients who knew about their condition were also found to have poor blood glucose control (70.6% (95% CI=64.6 - 75.9).

5.5 Disease Related Factors

The link between non-adherence to medication and diabetes-related symptoms and complications in this study at bivariate ordinal regression is consistent with Gholamaliei et al., 2017a.

Diabetes medication side effects and the fear of same were found in Sweileh et al., 2014 to be associated with non-adherence. The findings in this study agree with Sweileh et al., 2014. This is further consolidated with the findings of Gimenes et al., 2009 that patients with diabetes who did not complain about side effects of drugs had a higher medication adherence.

Capoccia et al., 2015 noted that the frequency of medication intake such as taking more than two times a day and the doubts about the effect of the medication were associated with non-adherence. The findings in this study are inconsistent with their findings. The current study agrees with Lee et al.,

University of Ghana <http://ugspace.ug.edu.gh>

2017 in their study in an Asian community that poly-therapy (dual therapy, triple therapy) had no association with medication adherence.



Chapter Six

6.0 Summary of Findings, Conclusions and Recommendations

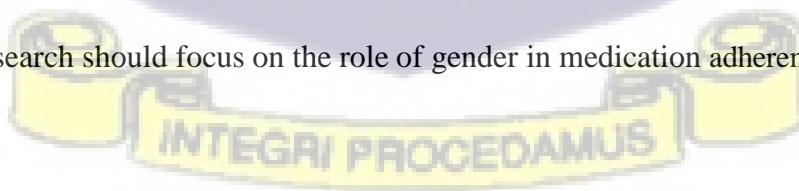
6.1 Conclusions

This study set out to examine medication adherence among patients receiving diabetes care at the diabetes clinic at the Municipal Hospital. The study concluded that medication adherence in the patients with diabetes in the Kintampo municipality is low. Low adherence is directly accountable to the prevalence of poor glucose control. The approach to enlightening patients about their condition can be counter-productive because, increasing knowledge in the medication type impacts negatively on adherence.

6.2 Recommendations

The ensuing are suggested;

1. The Municipal Hospital should re-examine the education and counseling at the diabetes clinic especially on the medications given to the diabetic patients.
2. The diabetes clinic should have focused counseling sessions for clients 1 to 5 years in therapy as they tend to be more non-adherent.
3. The Kintampo Municipal Health Directorate should use the radio stations to engage the public on diabetes educations.
4. The health directorate should form a community diabetes association to encourage the diabetes community to adhere to medication.
5. Future research should focus on the role of gender in medication adherence.



References.

- A. B., Trygstad, T., Liu, L. Z., & Bosworth, H. B. (2015). Improving diabetes medication adherence: successful, scalable interventions. *Patient Preference and Adherence*, 9, 139–149. <https://doi.org/10.2147/PPA.S69651>
- Afaya, R. A., Bam, V., Azongo, T. B., Afaya, A., Kusi-Amponsah, A., Ajusiyine, J. M., & Abdul Hamid, T. (2020). Medication adherence and self-care behaviors among patients with type 2 diabetes mellitus in Ghana. *PLOS ONE*, 15(8), 1–14. <https://doi.org/10.1371/journal.pone.0237710>
- Alatawi, Y. M., Kavookjian, J., Ekong, G., & Alrayees, M. M. (2016). The association between health beliefs and medication adherence among patients with type 2 diabetes. *Research in Social and Administrative Pharmacy*, 12(6), 914–925. <https://doi.org/https://doi.org/10.1016/j.sapharm.2015.11.006>
- Alqarni, A. M., Alrahbeni, T., Qarni, A. Al, & Qarni, H. M. Al. (2018). Adherence to diabetes medication among diabetic patients in the Bisha governorate of Saudi Arabia - a cross-sectional survey. *Patient Preference and Adherence*, 13, 63–71. <https://doi.org/10.2147/PPA.S176355>
- Al-Qazaz, H. K., Sulaiman, S. A., Hassali, M. A., Shafie, A. A., Sundram, S., Al-Nuri, R., & Saleem, F. (2011). Diabetes knowledge, medication adherence, and glycemic control among patients with type 2 diabetes. *International Journal of Clinical Pharmacy*, 33(6), 1028–1035. <https://doi.org/10.1007/s11096-011-9582-2>
- Amoah, A. (2002). Comprehensive care in a low-income country: The Ghana Experience. *Diabetes Voice*, 47(2), 20–22.
- Anderson, R. T., Girman, C. J., Pawaskar, M. D., Camacho, F. T., Calles, J., Kelly, W. S., Demuro, C., & Balkrishnan, R. (2009). Diabetes medication satisfaction tool. *Diabetes Care*, 32(1), 51–53. <https://doi.org/10.2337/dc08-0856>
- Arifulla, M., John, L. J., Sreedharan, J., Muttappallymyalil, J., & Basha, S. A. (2014). Patients' adherence to anti-diabetic medications in a Hospital at Ajman, UAE. *Malaysian Journal of Medical Sciences*, 21(1), 44–49.
- Association, A. P. (2003). Medication Compliance Adherence Persistence (CAP) Digest. Washington, DC: APhA.
- Atinga, R. A., Yarney, L., & Gavu, N. M. (2018). Factors influencing long-term medication non-adherence among diabetes and hypertensive patients in Ghana: A qualitative investigation. *PLoS ONE*, 13(3), 1–15. <https://doi.org/10.1371/journal.pone.0193995>
- Awodele, O., & Osulale, J. A. (2015). Medication adherence in type 2 diabetes patients: Study of patients in alimosho general hospital, Igando, Lagos, Nigeria. *African Health Sciences*, 15(2), 513–522. <https://doi.org/10.4314/ahs.v15i2.26>
- Bagonza, J., Rutebemberwa, E., & Bazeyo, W. (2015). Adherence to anti-diabetic medication among patients with diabetes in eastern Uganda; a cross-sectional study. *BMC Health Services Research*, 15(1), 168. <https://doi.org/10.1186/s12913-015-0820-5>
- Brown, M. T., & Bussell, J. K. (2011). Medication adherence: WHO cares? *Mayo Clinic Proceedings*, 86(4), 304–314.
- Bruce, S. P., Acheampong, F., & Kretchy, I. (2015). Adherence to oral anti-diabetic drugs among patients attending a Ghanaian teaching hospital. *Pharmacy Practice*, 13(1), 1–5. <https://doi.org/10.18549/PharmPract.2015.01.533>

- Brunner, R., Dunbar-Jacob, J., LeBoff, M. S., Granek, I., Bowen, D., Snetselaar, L. G., Shumaker, S. A., Ockene, J., Rosal, M., & Wactawski-Wende, J. (2009). Predictors of adherence in the women's health initiative calcium and vitamin D trial. *Behavioral Medicine*, 34(4), 145–155.
- Capoccia, K., Odegard, P. S., & Letassy, N. (2015). Medication Adherence With Diabetes Medication: A Systematic Review of the Literature. *The Diabetes Educator*, 42(1), 34–71. <https://doi.org/10.1177/0145721715619038>
- Chao, J., Nau, D. P., & Aikens, J. E. (2007). Patient-reported perceptions of side effects of antihyperglycemic medication and adherence to medication regimens in persons with diabetes mellitus. *Clinical Therapeutics*, 29(1), 177–180. <https://doi.org/https://doi.org/10.1016/j.clinthera.2007.01.014>
- Chisholm-burns, M. A., & Spivey, C. A. (2012). We cannot afford to accept. *Journal of the American Pharmacists Association*, 52(6), 823–826. <https://doi.org/10.1331/JAPhA.2012.11088>
- Coleman, C. I., Limone, B., Sobieraj, D. M., Lee, S., Roberts, M. S., Kaur, R., & Alam, T. (2012). Dosing frequency and medication adherence in chronic disease. *Journal of Managed Care Pharmacy*, 18(7), 527–539.
- Cramer, J. A. (2004). A Systematic Review of Adherence with Medications for Diabetes. *Diabetes Care*, 27(5), 1218 LP – 1224. <https://doi.org/10.2337/diacare.27.5.1218>
- Culig, J., & Leppée, M. (2014). From Morisky to Hill-bone; self-reports scales for measuring medication adherence. *Collegium Antropologicum*, 38 1, 55–62.
- Davidsson, J., Aarts, C., & Lundberg, P. (2016). *Factors that affect adherence to recommended treatment among diabetes patients in Kampala*. 1–49.
- diabetes.co.uk. (2018). *Diabetes prevalence*. Diabetes Prevalence. https://doi.org/10.1787/health_glance_eur-2018-18-en
- DiMatteo, M. R., Giordani, P. J., Lepper, H. S., & Croghan, T. W. (2002). Patient adherence and medical treatment outcomes a meta-analysis. *Medical Care*, 794–811.
- Dobbels, F., Van Damme-Lombaert, R., Vanhaecke, J., & De Geest, S. (2005). Growing pains: non-adherence with the immunosuppressive regimen in adolescent transplant recipients.
- Fedrick, F., & Temu, M. J. (2012). Factors contributing to non-adherence to diabetes treatment among diabetic patients attending the clinic in Mwanza city. *East African Journal of Public Health*, 9(3), 90–95.
- Gholamaliei, B., Karimi-Shahanjarini, A., Roshanaei, G., & Rezapur-Shahkolai, F. (2017a). Medication Adherence and its Related Factors in Patients with Type II Diabetes. *Journal of Education and Community Health*, 2(4), 3–12. <https://doi.org/10.21859/jech-02042>
- Gholamaliei, B., Karimi-Shahanjarini, A., Roshanaei, G., & Rezapur-Shahkolai, F. (2017b). Medication Adherence and its Related Factors in Patients with Type II Diabetes. *Journal of Education and Community Health*, 2(4), 3–12. <https://doi.org/10.21859/jech-02042>
- Gimenes, H. T., Zanetti, M. L., & Haas, V. J. (2009). Factors related to patient adherence to antidiabetic drug therapy. In *Revista Latino-Americana de Enfermagem* (Vol. 17, pp. 46– 51). scielo.
- Jaam, M., Awaisu, A., Mohamed Ibrahim, M. I., & Kheir, N. (2018). A holistic conceptual framework model to describe medication adherence in and guide interventions in diabetes Mellitus. *Research in Social and Administrative Pharmacy*, 14(4), 391–397. <https://doi.org/10.1016/j.sapharm.2017.05.003>

- Jha, A. K., Aubert, R. E., Yao, J., Teagarden, J. R., & Epstein, R. S. (2012). Greater adherence to diabetes drugs is linked to less hospital use and could save nearly \$5 billion annually. *Health Affairs*, 31(8), 1836–1846.
- Kalyango, J. N., Owino, E., & Nambuya, A. P. (2008). Non-adherence to diabetes treatment at Mulago hospital in Uganda: Prevalence and associated factors. *African Health Sciences*, 8(2), 67–73. <https://doi.org/10.4314/ahs.v8i2.7052>
- Kassavou, A., & Sutton, S. (2017). Reasons for non-adherence to cardiometabolic medications, and acceptability of an interactive voice response intervention in patients with hypertension and type 2 diabetes in primary care: a qualitative study. *BMJ Open*, 7(8), e015597.
- Kirkman, M. S., Rowan-Martin, M. T., Levin, R., Fonseca, V. A., Schmittiel, J. A., Herman, W. H., & Aubert, R. E. (2015). Determinants of adherence to diabetes medications: findings from a large pharmacy claims database. *Diabetes Care*, 38(4), 604–609.
- Kleinsinger, F. (2018). The unmet challenge of medication nonadherence. *The Permanente Journal*, 22.
- Knight, G. D. (2014). Health literacy: An essential ingredient for better health outcomes—Overview of health literacy theoretical concepts. In *Handbook of Research on Adult and Community Health Education: Tools, Trends, and Methodologies* (pp. 280–307). IGI Global.
- Krass, I., Schieback, P., & Dhipayom, T. (2015). Adherence to diabetes medication: a systematic review. *Diabetic Medicine*, 32(6), 725–737.
- Leanne Riley. (2021). *THE GLOBAL HEALTH OBSERVATORY: Mean fasting blood glucose*. WHO. www.who.int/data/gho/indicator-metadata-registry/imr-details/2380#:~:text=The expected values for normal, and monitoring glycemia are recommended.
- Lee, C. S., Tan, J. H. M., Sankari, U., Koh, Y. L. E., & Tan, N. C. (2017). Assessing oral medication adherence among patients with type 2 diabetes mellitus treated with polytherapy in a developed Asian community: a cross-sectional study. *BMJ Open*, 7(9), e016317. <https://doi.org/10.1136/bmjopen-2017-016317>
- Mann, D. M., Ponieman, D., Leventhal, H., & Halm, E. A. (2009). Predictors of adherence to diabetes medications: the role of disease and medication beliefs. *Journal of Behavioral Medicine*, 32(3), 278–284. <https://doi.org/10.1007/s10865-009-9202-y>
- Mohiuddin, A. K. (2019). Arts and Science of Patient Compliance. *PharmaTutor*, 7(2), 1–15.
- Morisky, D. E. (2008). Predictive validity of a medication adherence measure for hypertension control. *Journal of Clinical Hypertension*, 10, 348–354.
- Morisky, D. E., Green, L. W., & Levine, D. M. (1986). Concurrent and predictive validity of a self-reported measure of medication adherence. *Medical Care*, 67–74.
- MuKherjee, S., SharMaSarKar, B., DaS, K. K., Bhattacharyya, A., & Deb, A. (2013). Compliance to anti-diabetic drugs: observations from the diabetic clinic of a medical college in Kolkata, India. *Journal of Clinical and Diagnostic Research: JCDR*, 7(4), 661.
- Olorunfemi, O., & Ojewole, F. (2019). Medication belief as correlate of medication adherence among patients with diabetes in Edo State, Nigeria. *Nursing Open*, 6(1), 197–202. <https://doi.org/https://doi.org/10.1002/nop2.199>
- Osei-Yeboah, J., Lokpo, S. Y., Owiredu, W. K. B. A., Johnson, B. B., Orish, V. N., Botchway, F., Ussher, F. A., & Avorkliyah, R. (2019). Medication Adherence and its Association with Glycaemic Control,

Blood Pressure Control, Glycosuria and Proteinuria among People Living With Diabetes (PLWD) in the Ho Municipality, Ghana. *The Open Public Health Journal*, 11(1), 552–561. <https://doi.org/10.2174/1874944501811010552>

Patel, I., Chang, J., Shenolikar, R. A., & Balkrishnan, R. (2010). Medication adherence in low income elderly type-2 diabetes patients: A retrospective cohort study. *International Journal of Diabetes Mellitus*, 2(2), 122–124. <https://doi.org/10.1016/j.ijdm.2010.05.003>

Pediatric Transplantation, 9(3), 381–390. <https://doi.org/10.1111/j.1399-3046.2005.00356.x>

Prosper Mandela Amaltinga, A. (2017). Non Adherence to Diabetic Medication Among Diabetic Patients, a Case Study of Dormaa Hospital Ghana. *Science Journal of Public Health*, 5(2), 88. <https://doi.org/10.11648/j.sjph.20170502.15>

Raosoft. (2004). *No Title*. Raosoft Sample Size Calculator. www.raosoft.com/samplesize.html

Rathish, D., Hemachandra, R., Premadasa, T., Ramanayake, S., Rasangika, C., Roshiban, R., & Jayasumana, C. (2019). Comparison of medication adherence between type 2 diabetes mellitus patients who pay for their medications and those who receive it free: A rural Asian experience. *Journal of Health, Population, and Nutrition*, 38(1), 1–8. <https://doi.org/10.1186/s41043-019-0161-9>

Report, A. (2017). 2016 Annual Report of the ABPN. *The American Journal of Psychiatry*, 174(8), 807–816. <https://doi.org/10.1176/appi.ajp.2017.174804>

Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., Colagiuri, S., Guariguata, L., Motala, A. A., & Ogurtsova, K. (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas. *Diabetes Research and Clinical Practice*, 157, 107843.

Schoenthaler, A. M., Schwartz, B. S., Wood, C., & Stewart, W. F. (2012). Patient and Physician Factors Associated With Adherence to Diabetes Medications. *The Diabetes Educator*, 38(3), 397–408. <https://doi.org/10.1177/0145721712440333>

Sharma, T., Kalra, J., Dhasmana, D., & Basera, H. (2014). Poor adherence to treatment: A major challenge in diabetes. *Journal, Indian Academy of Clinical Medicine*, 15(1).

Shobhana, R., Begum, R., Snehalatha, C., Vijay, V., & Ramachandran, A. (1999). Patients' adherence to diabetes treatment. *The Journal of the Association of Physicians of India*, 47(12), 1173–1175. <http://europepmc.org/abstract/MED/11225220>

Subbaraman, R., de Mondesert, L., Musiimenta, A., Pai, M., Mayer, K. H., Thomas, B. E., & Haberer, J. (2018). Digital adherence technologies for the management of tuberculosis therapy: mapping the landscape and research priorities. *BMJ Global Health*, 3(5).

Sweileh, W. M., Zyoud, S. H., Abu Nab'a, R. J., Deleq, M. I., Enaia, M. I., Nassar, S. M., & Al-Jabi, S. W. (2014). Influence of patients' disease knowledge and beliefs about medicines on medication adherence: findings from a cross-sectional survey among patients with type 2 diabetes mellitus in Palestine. *BMC Public Health*, 14(1), 94. <https://doi.org/10.1186/1471-2458-14-94>

van, D. S., Beulens, J. W. J., van der, S. Y. T., Grobbee, D. E., & Nealb, B. (2010). The global burden of diabetes and its complications: an emerging pandemic. *European Journal of Cardiovascular Prevention & Rehabilitation*, 17(1_suppl), s3–s8. <https://doi.org/10.1097/01.hjr.0000368191.86614.5a>

Vanelli, M., Pedan, A., Liu, N., Hoar, J., Messier, D., & Kiarsis, K. (2009). The role of patient inexperience in medication discontinuation: a retrospective analysis of medication non-persistence in seven chronic illnesses. *Clinical Therapeutics*, 31(11), 2628–2652.

- Vodkaïlo, L. V, Titov, V. L., & Moldomusaev, D. M. (2011). [Immunoglobulin content in newborn infants under conditions of both altitude of Kirghizia]. *Zdravookhranenie Kirgizii*, 1(5), 27–31. <https://doi.org/10.5897/ISAAB-JHE11.012>
- Waari, G., Mutai, J., & Gikunju, J. (2018). Medication adherence and factors associated with poor adherence among type 2 diabetes mellitus patients on follow-up at Kenyatta National Hospital, Kenya. *Pan African Medical Journal*, 29. <https://doi.org/10.11604/pamj.2018.29.82.12639>
- Wiecek, E., Tonin, F. S., Torres-Robles, A., Benrimoj, S. I., Fernandez-Llimos, F., & Garcia- Cardenas, V. (2019). Temporal effectiveness of interventions to improve medication adherence: A network meta-analysis. *PLOS ONE*, 14(3), e0213432. <https://doi.org/10.1371/journal.pone.0213432>
- Zelko, E., Klemenc-Ketis, Z., & Tusek-Bunc, K. (2016). Medication adherence in elderly with polypharmacy living at home: a systematic review of existing studies. *Materia Socio- Medica*, 28(2), 129.
- Zullig, L. L., Blalock, D. V, Dougherty, S., Henderson, R., Ha, C. C., Oakes, M. M., & Bosworth, H. B. (2018). The new landscape of medication adherence improvement: where population health science meets precision medicine. *Patient Preference and Adherence*, 12, 1225.
- Zullig, L. L., Gellad, W. F., Moaddeb, J., Crowley, M. J., Shrank, W., Granger, B. B., Granger,



Appendix 1: Participants Information Sheet

Study title: medication adherence among diabetic attending the diabetes clinic in the Kintampo Municipal Hospital.

Introduction: My name is Haruna SEIDU (Principal Investigator), a Master of Public Health student of the School of Public Health, University of Ghana. In partial fulfillment of the award of a Master of Public Health Degree, I am undertaking this study. I am available on the following at all times: 0244120468 and email: seidu2k@gmail.com.

Background and purpose of research: Diabetes is a chronic disease requiring lifelong lifestyle changes and modifications. Prevention of complications and glycemic control are the key targets of diabetes management. Medicines work only in people who take them. Medication adherence is central to the attainment of glycemic control. A diabetic who does not adhere to medication would suffer the complication of uncontrolled blood glucose. This study is intended to assess the level of medication adherence among patients with diabetes.

Nature of research: The study is a descriptive cross-sectional study and is to be conducted at the diabetes clinic of the Kintampo Municipal Hospital. Two hundred and fifty-five (255) diabetic patients attending the hospital will be included in the study. The study is about medication adherence. Using Morisky's Medication Adherence Scale 8, the study aims to assess the level of medication adherence among the patients with diabetes attending the Kintampo Municipal hospital.

The study findings would be useful in informing the care and management pathways of diabetes and also serve as baseline data for the assessment of strides in the management of diabetes.

Participant's involvement

Duration / what is involved: Participants are required to be above 18 years of age. Your participation in the study will require that you answer certain questions on socio-demography (age, sex, marital status, level of education, religion, and occupation), medication-taking attitude, and behavior. Your blood glucose will be measured by pricking your finger and collecting a drop of blood. This will approximately take 15 minutes. Either the Principal Investigator or Research Assistants will do the administration of the questionnaire and the measurements.

Potential Risks: Minimal risk is anticipated since some questions might be upsetting. You may however choose not to answer questions that appear uncomfortable to you. Additionally, the risk

of **contracting covid 19** following contact with contaminated surfaces and an infected person is real. You would be given a surgical nose mask to put on. You will also be provided with alcohol hand sanitizer to disinfect your hands if you come in contact with contaminated surfaces. The social distancing protocol would also be strictly observed to further reduce your risks of infection.

There will be minimal pain following the pricking of your finger for the blood sample to use for glucose checking. There is also a minimal risk of infection through the lancet prick. This minimal risk of infection would be reduced by disinfecting the finger with an antiseptic agent (methylated spirit) before and after the glucose check.

Benefits: There is no direct benefit to participating in this study. The findings from this study will however contribute to the management of diabetes.

Costs: There will be no cost for participating in the study.

Compensation: There is no compensation for participating in this study.

Confidentiality: Information about you would not be given to a third party. It shall be used for the sole purpose of this research work. Your name will not be captured on the questionnaire and neither will you be named in any of our reports.

Voluntary Participation/withdrawal: Your participation in this research is voluntary and you can withdraw from the study at any time without it affecting your further medical care in any way. During the interview, you also have the right not to answer questions if you find such questions discomforting.

Outcome and Feedback: Data collected will only be used for this study. No feedback on the data will be given to participants. However, the findings would be shared with the Kintampo Municipal Hospital and this would enhance and inform care rendered to patients with diabetes.

Appropriate alternatives Procedure and Treatment: You do not have to participate in the research to receive care. If you opt out of the study, you would still receive the standard care you are entitled to.

Feedback to participants: There would be no direct feedback. The recommendations from the study findings however would be made available to the Kintampo Municipal Hospital for adoption to improve care at the Kintampo Municipal Hospital. Your blood glucose level would be communicated to you at the point of checking.

Funding information: This research is self-financed by the Principal Investigator.

Sharing of participants Information/Data: Data generated from the study will only be used for this research. The Principal Investigator will own the data and only the team members of the research will have access to the data. No unauthorized person will have access to participants' information. To share the findings of this study with a wider population, it may be published in a research journal. Any such publication shall however not feature the name or identifying data of any study participant.

Storage of samples: The test strip that receives your blood drop to check your blood glucose level will be immediately discarded appropriately after use and thus your blood sample will not be stored for any future research.

Provision of Information and Consent for Participants

A copy of the Information sheet will be given to you to keep after it has been signed or thumb-printed.

Who to Contacts for Further Clarification/Questions: If you have further questions or issues regarding this study, which require clarification, you may contact:

Haruna SEIDU (Principal Investigator) – 0244120468

Dr. Blankson Hayford University of Ghana (Supervisor) – 0506564221

The Ghana Health Service Ethics Review Committee Administrator **Nana Abena Apatu** may also be contacted on **0503539896**, or via email: **ethics.reseach@ghsmail.org** for further inquiries and clarification on ethical issues and their rights as participants.



Appendix 2: Consent Form

TITLE OF THE STUDY: ASSESSING MEDICATION ADHERENCE AMONG PATIENTS WITH DIABETES ATTENDING THE DIABETES CLINIC IN THE KINTAMPO MUNICIPAL HOSPITAL.

PARTICIPANTS' STATEMENT

I acknowledge that I have read or have had the purpose and contents of the Participants' Information Sheet read and satisfactorily explained to me in a language I understand (English/Twi/Hausa). I fully understand the contents and any potential implications as well as my right to change my mind (i.e. withdraw from the research) even after I have signed this form.

I voluntarily agree to be part of this research.

Name or Initials of Participant..... ID Code

Participants' SignatureOR Thumb Print..... OR Mark (Please specify).....

Date...

INTERPRETERS' STATEMENT

I interpreted the purpose and contents of the Participants' Information Sheet to the participant to the best of my ability in the Twi/Hausa language to his proper understanding.

All questions, appropriate clarifications sorted by the participant, and answers were also duly interpreted to his/her satisfaction.

Name of Interpreter.....

Signature of Interpreter..... Date...

Contact Details



STATEMENT OF WITNESS

I was present when the purpose and contents of the Participant Information Sheet were read and explained satisfactorily to the participant in the language he/she understood (English/Twi/Hausa).

I confirm that he/she was allowed to ask questions/seek clarifications and the same were duly answered to his/her satisfaction before voluntarily agreeing to be part of the research.

Name...

Signature..... OR Thumb Print OR Mark (please specify).....

Date...

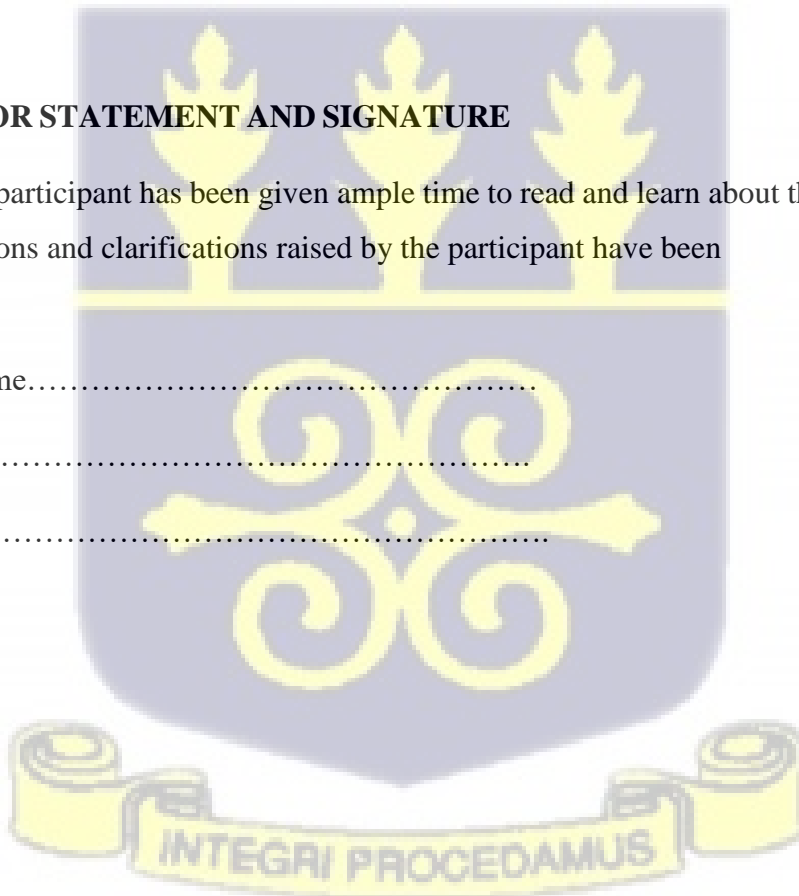
INVESTIGATOR STATEMENT AND SIGNATURE

I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant have been addressed.

Researcher's name.....

Signature

Date.....



APPENDIX 3: QUESTIONNAIRE

**APPENDIX A: QUESTIONNAIRE. QUESTIONNAIRE FOR ASSESSING
MEDICATION ADHERENCE AMONG PATIENTS WITH DIABETES
ATTENDING THE DIABETES CLINIC AT THE KINTAMPO MUNICIPAL
HOSPITAL.**

Questionnaire number:		Date: __/__/2021	Code
NO.	QUESTIONS		
1	Age years (completed years).....		Age
2	Sex: 1. Male 2. Female		Sex
3	Marital Status: 1. Married 2. Single 3. Co-habiting 4. Divorced 5. Widowed		marital
4	Religion: 1. Christian 2. Muslim 3. Traditionalist 4. Other...		Rel
5	Highest educational level: 1 None 2. Basic 3. Secondary 4. Tertiary		Edu
6	Occupation: 1. Salaried work 2. Farming 3. Trading 4. Unemployed 6. Other		occu
7	Do you know the type of drugs you take? 1. Yes, 2. No		knowdrug
8	Do you know the reference levels for normal blood glucose? 1. Yes, 2. No		gluclev
9	Do you know the reference level for abnormal blood glucose? 1 Yes 2. No		refgluc
10	Do you know that sustained abnormal blood glucose levels can cause complications? 1. Yes, 2. No		compli know

11	Are you taking any prescribed life-long medication? 1. Yes, 2. No	comordrug
12	Do you take anything other than your prescribed drug to control participants' blood glucose? 1. Yes, 2. No	herbdrug
	Do you have an active health insurance registration? 1. Yes, 2. No	nhis
13	Besides coming to refill your medication, do you have other sessions with the care team? 1. Yes, 2. No	extrasess
14	Do you get all your prescribed drugs in the hospital? 1. Yes, 2. No	drugavai
15	Where have you been living in the past 6 months? 1. In Kintampo 2. Outside Kintampo	distan
16	When you have to pay out of pocket for your drugs, what would you say about the cost? 1. Not expensive 2. Very expensive	drug cost
17	Have you experienced any side effects since taking your drug? 1. Yes, 2. No	sideeff
18	Several DM medications. 1. mono-therapy 2. Dual therapy 3. Triple therapy 4. Multi-therapy	therapy
19	How many times do you take your drug with 24hours? 1. Once 2. Twice 3. Thrice	regime
20	By what route do you take your drug? 1. By mouth 2. Other routes.	routedrg
21	How long (years) have you been taking your drug? 1. 6 months 2. 1-5 years 6-10 years	duradrg
22	Fasting Blood glucose at the time of visit...	bloodglu

23 Have you seen or been told you have a complication? 1. Yes, 2. No complicated

24 Do you have any diabetes-related symptoms now? 1. Yes, 2. No sypmt



THE MORISKY'S MEDICATION ADHERENCE SCALE

You indicated that you are taking medication for your diabetes. Individuals have identified several issues regarding their medication-taking behavior and we are interested in your experiences. Please answer each question based on your personal experience with your diabetes medication. There is no right or wrong answer.

Q1. Do you sometimes forget to take your diabetes pills? **YES NO**

Q2. People sometimes miss taking medication, for several reasons other than forgetfulness. Thinking over the past two weeks, were there any days you did not take your diabetes medication? **YES NO**

Q3. Have you ever cut back or stopped taking your medication without telling your doctor because you feel worse when you took it? **YES NO**

Q4. When you travel or leave home, do you sometimes forget to bring your diabetes medication?
YES NO

Q5. Did you take your diabetes medication yesterday? **YES NO**

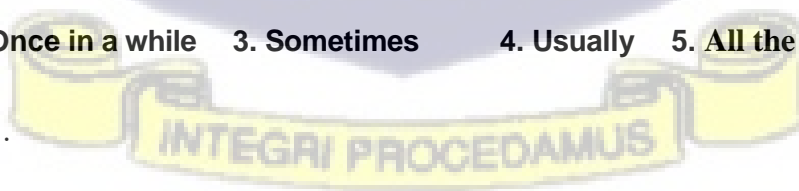
Q6. When you feel your diabetes is under control, do you sometimes stop taking your medicines?
YES NO

Q7. Taking medications every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your diabetes medication? **YES NO**

Q8. How often do you have difficulty remembering to take all your medication?

1. Never 2. Once in a while 3. Sometimes 4. Usually 5. All the time


Total Score:



APPENDIX 4: ETHICAL CLEARANCE

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this letter should be quoted.



Research & Development Division
Ghana Health Service
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Accra
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Fax: +233-302-685424
Email: ethics.research@ghs.gov.gh
8th July, 2021

My Ref: GHS/RDD/ERC/Admin/APP/21/257
Your Ref. No.

Haruna Seidu
University of Ghana
Legon

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	GHS-ERC: 041/05/21
Study Title	Assessing Medication Adherence among Diabetics Attending the Diabetes Clinic in the Kintampo Municipal Hospital
Approval Date	8 th July, 2021
Expiry Date	7 th July, 2022
GHS-ERC Decision	Approved

This approval requires the following from the Principal Investigator:


- Submission of a yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months.
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol.

SIGNED... 
Dr. James Akazili
(Head, Ethics & Research Management Department)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

