

**Addis Ababa University College of Health Sciences, School of
Nursing and Midwifery Department of Adult Health Nursing, Post
Graduate Program**

TITLE: PREVALENCE AND ADHERENCE TO MULTIPLE PRESCRIBED
MEDICATIONS AND ITS PREDICTORS AMONG TYPE 2 DIABETIC
PATIENTS ATTENDING TERTIARY HOSPITALS IN ADDIS ABABA,
ETHIOPIA, 2019

BY: -AMAN MAMO (BSc)

A RESEARH THESIS SUBMITTED TO NURSING DEPARTMENT, SCHOOL
OF NURSING AND MIDWIFERY, COLLEGE OF HEALTH SCIENCES,
ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE IN ADULT
HEALTH NURSING.

**JUNE, 2019
ADDIS ABABA**

**ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF NURSING AND MIDWIFERY
DEPARTMENT OF ADULT HEALTH NURSING
PREVALENCE AND ADHERENCE TO MULTIPLE PRESCRIBED
MEDICATIONS AND ITS PREDICTORS AMONG TYPE 2 DIABETIC
PATIENTS ATTENDING TERTIARY HOSPITALS IN ADDIS ABABA,
ETHIOPIA, 2019**

PRINCIPAL INVESTIGATOR: -AMAN MAMO (BSc)

**A RESEARH THESIS SUBMITTED TO NURSING DEPARTMENT,
SCHOOL OF NURSING AND MIDWIFERY, COLLEGE OF HEALTH
SCIENCES, ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE
IN ADULT HEALTH NURSING.**

**ADVISORS: DR. AMSALE CHERIE (PHD, ASSOCIATE PROFESSOR)
MR. WUDMA ALEMU (MSC, PHD CANDIDATE)**

**JUNE, 2019
ADDIS ABABA**

APPROVAL BY THE BOARD OF EXAMINATION

This thesis by “**Prevalence and Adherence to Multiple Prescribed Medications and its predictors among Type 2 Diabetic patients attending Tertiary Hospitals in Addis Ababa, Ethiopia, 2019**” is accepted in its present form by the board of examiners as satisfying thesis requirement for the degree of masters in Adult Health Nursing.

EXAMINER:

<u>Mr. Niguse Tadele (MSc, Assistant Professor)</u>	_____	_____
NAME	RANK	SIGNATURE DATE

RESEARCH ADVISORS:

<u>Dr. Amsale Cherie. (PhD, Associate prof)</u>	_____	_____
NAME	RANK	SIGNATURE DATE

<u>Mr. Wudma Alemu.</u>	<u>(MSc, PhD candidate)</u>	_____	_____
NAME	RANK	SIGNATURE	DATE

DEPARTMENT HEAD

<u>Mr. Berhanu Wordofa (MSc, Assistant Professor)</u>	_____	_____
NAME	RANK	SIGNATURE DATE

STATEMENT OF DECLARATION

By my signature below, I declare and affirm that this thesis is my own work. I have followed all ethical principles of scholarship in the preparation, data collection, data analysis and completion of this thesis. All scholarly matter that is included in the thesis has been given recognition through citation. I affirm that I have cited and referenced all sources used in this document. Every effort has been made to avoid plagiarism in the preparation of this thesis.

This thesis is submitted in partial fulfillment of the requirement for a graduate degree from the Addis Ababa University at college of Health Sciences, School of Nursing and Midwifery. The thesis will deposit in the Addis Ababa University digital Library and is made available to local, national and international scientific community. I solemnly declare that this thesis has not been submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

Brief quotations from this thesis may be used without special permission provided that accurate and complete acknowledgement of the source is made. Requests for permission for extended quotations from, or reproduction of, this thesis in whole or in part may be granted by the Head of the Department or advisors of the thesis when in his or her judgment the proposed use of the material is in the interest of scholarship and publication. In all other instances, however, permission must be obtained from the author of the thesis.

STUDENT

NAME: _____ SIGNATURE: _____ DATE: _____

RESEARCH ADVISORS:

1. _____	_____	_____	_____
NAME	RANK	SIGNATURE	DATE
2. _____	_____	_____	_____
NAME	RANK	SIGNATURE	DATE

ACKNOWLEDGEMENT

First of all, I would like to thank Mettu University for sponsoring me to attend my Master of Science (MSc) and Addis Ababa University, college of health science, school of nursing and midwifery for allowing me to conduct this study.

Next, I extend my heartfelt thanks to my advisors Dr. Amsale Cherie (PhD, Associate professor) and Mr. Wudma Alemu (MSc, PhD fellow) for their guidance, support, encouragement, unreserved precious comment and frank criticism from the beginning of proposal writing to the end of study. I have learned a lot from them and I will never forget their expertise, patience, guidance, commitment to professionalism, and their sense of responsibility.

I am grateful to all of the participants of my study who share their precious time to complete my questionnaire. This study would not be made possible without your help and I thank you all very much. My appreciation goes as well to the IRB committee of Tikur Anbessa specialized hospital, Saint Paulos hospital millennium medical college and Torhayloch specialized and compressive hospital for their willingness to grant me permission to conduct my research.

I am very happy to extend my deepest gratitude to all my lovely family, friends, classmates, and colleagues for their support, encouragement and sharing experiences that motivated me to persevere and kept me strong.

Lastly, but not the least, I would like to acknowledge all data collectors and supervisors for their cooperation and commitment during data collection from bottom of my heart. Without your shore up, this study would not have come to reality. I would like to say thank you all.

ABBREVIATION AND ACRONYMS

ADA	American Diabetic Association
AOR	Adjusted Odds Ratio
BMI	Body Mass Index
COR	Crude Odds Ratio
DC	Data Collector
DEC	Data Entry Clerk,
DM	Diabetes Mellitus
IDF	International Diabetic Federation
IHRERC	Institutional Health Research Ethical Review Committee,
MCC	Multiple Chronic Comorbidities
MMA	Multiple Medication Adherence
MMAS-8	Morisky Medication Adherence Scale 8-item medication
MPM	Multiple Prescribed Medication
PI	Principal Investigator
PLWD	People Living With Diabetes
SPHMMC	Saint Paulos hospital and millennium medical college
SPSS	Statistical Package of Social Science
TASH	Tikur Anbessa Specialized Hospital
TSCH	Torhayloch specialized and comprehensive hospital

Contents

ACKNOWLEDGEMENT	IV
ABBREVIATION AND ACRONYMS	V
LISTS OF TABLE	VIII
LISTS OF FIGURES	IX
ABSTRACT	X
1. INTRODUCTION	I
1.1. Back Ground	I
1.2. Statements of the Problem	III
2. LITERATURE REVIEW	V
2.1. Introduction	V
2.2. Prevalence of Multiple Prescribed Medications among Diabetic Patient	V
2.3. Factors associated with Multiple Prescribed Medications among Diabetic patients	VII
2.4. Adherence to Multiple Prescribed Medication among Diabetic Patients	VII
2.5. Predictors of Adherence to Multiple Prescribed Medications	IX
3. JUSTIFICATION OF THE STUDY	XII
4. SIGNIFICANCE OF THE STUDY	XIII
5. OBJECTIVES	XIV
5.1. General Objective	XIV
5.2. Specific Objectives	XIV
6. METHODS AND MATERIALS	XV
6.1. Study Area and period	XV
6.2. Study Design	XV
6.3. Population of the Study	XV
6.4. Eligibility Criteria	XVI
6.4.1. Inclusion	XVI
6.4.2. Exclusion criteria	XVI
6.5. Sample Size Determination	XVI
6.6. Sampling Technique	XVII
6.7. Operational Definitions	XVIII
6.8. Study Variables	XVIII
6.8.1. Objective one and Two	XVIII

Dependent Variable	XVIII
Independent Variables	XVIII
6.8.2. Objective three and four	XVIII
Dependent variable	XVIII
Independent Variables	XIX
6.9. Methods of Data Collection	XIX
6.9.1. Data collection Instruments/tool	XIX
6.9.2. Data Collectors and Data Collection Procedure	XX
6.10. Data Quality Control	XX
6.11. Data Processing and Analysis	XXI
6.12. Ethical Considerations	XXI
6.13. Dissemination of Results	XXII
7. RESULTS	XXIII
7.1. Socio-demographic characteristics of the respondents	XXIII
7.2. Prevalence of Multiple Prescribed Medications	XXIV
7.3. Predictors of Multiple Prescribed Medications	XXV
7.4. Adherence to Multiple Prescribed Medications	XXVIII
7.5. Predictors of Adherence to Multiple Prescribed Medications	XXVIII
8. DISCUSSION	XXXIII
9. STRENGTH AND LIMITATION OF THE STUDY	XXXVII
9.1. Strength	XXXVII
9.2. Limitation	XXXVII
10. CONCLUSION AND RECOMMENDATION	XXXVIII
10.1. Conclusion	XXXVIII
10.2. Recommendation	XXXIX
11. REFERENCE	XLI
12. ANNEX-	XLV
Appendix I: Information Sheet	XLV
Appendix II: English Questionnaire	XLVI
Appendix III: Amharic Version Questionnaire	LII

LISTS OF TABLE

Table 1. Socio-demographic Characteristics of T2DM patient at tertiary hospitals in Addis Ababa, 2019.	XXIII
Table 2. Disease and disease related factors among Type 2 diabetic patients attending tertiary hospitals in Addis Ababa, 2019. (n:417)	XXIV
Table 3. Predictors of multiple prescribed medications among socio-demographic characteristics and disease related factors using logistic regression.	XXVII
Table 4. Binary and multivariate Logistic Regression among socio-demographic characteristics, disease related factors and factors associated with adherence to MPMs.	XXX

LISTS OF FIGURES

Figure 1 conceptual frame work on Adherence to Multiple Prescriptions and associated factors among Type 2 Diabetic Patients at Addis Ababa tertiary Hospitals, 2019.	XI
Figure 2 flow chart of sampling technique on prevalence and adherence to multiple medications among Type 2 Diabetic Patients at Addis Ababa Tertiary Hospitals, 2019	XVII
Figure 3. Number of medication used among Type 2 diabetic patients at tertiary hospitals in Addis Ababa, 2019.	XXV
Figure 4. Types of complications among T2DM patients at tertiary hospitals in Addis Ababa, 2019.	XXV
Figure 5. Level of adherence to MPMs among type 2 diabetic patients attending Tertiary hospitals in Addis Ababa, Ethiopia. 2019	XXVIII
Figure 6. Reasons cited for non-adherence to MPMs among type 2 diabetic patients attending Tertiary hospitals in Addis Ababa, Ethiopia. 2019	XXXII

ABSTRACT

Prevalence and Adherence to Multiple Prescribed Medications and Its Predictors among Type 2 Diabetic Patients Attending Tertiary Hospitals in Addis Ababa, Ethiopia, 2019

AMAN MAMO

Background: -Patients with diabetes often take multiple prescription of medication due to existence of concomitant disease. Medication adherence is associated with improved health outcomes, including decreased health care costs, hospital stay, and mortality. Therefore, the aim of the study was to assess the prevalence and Adherence to multiple prescription of medications and its predictors among Type 2 Diabetic Patients visiting Diabetic Clinic of Addis Ababa tertiary Hospitals, 2019. An institutional based, cross-sectional study conducted on 417 patients with type 2 diabetes mellitus using systematic random sampling. Data were collected by using pre-tested interview based structured questionnaire and checklist guided document review and adherence was assessed using Morisky Medication Adherence Scale-8 (MMAS-8). From total study participants' 233(55.9%) used multiple prescribed medications (concurrent use of multiple clinically indicated medication). Multiple Prescription Medications is significantly associated with raised BMI (AOR: 0.149 CI: 0.056-0.40, $p < 0.001$), increased number of complication (AOR: 0.022 CI: 0.003-0.180) at $p\text{-value} \leq 0.05$. Of all study participants, 89(38.2%) participants had high adherence, 59(25.3%) medium and 85(36.5%) low adherence to multiple prescribed medication. Young age (AOR: 4.9 CI: 1.82-12.1, $p = 0.012$), short time since diagnosis (AOR: 0.21, CI: 0.05-0.93, $p = 0.039$), positive views about cost of medication (AOR: 7.85, CI: 1.31-47.3, $p = 0.024$), lower number of medications (AOR: 4.73 CI: 1.02, 21.88, $p = 0.048$) and knowing targets of glycemic control (AOR: 6.21 CI: 2.70-14.24, $p < 0.001$) were significantly associated with adherence to multiple prescription of medications at $p\text{-value} \leq 0.05$. Conclusively, type 2 diabetes mellitus gets complicated in many of the patients with it (as multiple prescribed medications are used to manage the complications) making proportion of multiple prescription higher, and adherence to this multiple prescriptions were continued to be suboptimal. Predictors were identified in the study which could help develop policies for improving adherence in diabetics to change the disease from fatal incurable disease to manageable chronic illness.

Key words: Multiple Prescription, Adherence, Type 2 Diabetes, Adherence scale

1. INTRODUCTION

1.1. Back Ground

One of the greatest challenges facing health systems globally in the 21st century is the increasing burden of chronic diseases like diabetes mellitus (1). The adult population with multiple chronic diseases especially, diabetes mellitus (DM) has led to a rising prescription of medications due to acute, chronic complication and to slow progression of the disease (2, 3). Diabetes Mellitus is a common chronic metabolic disorder that affects nearly 8.8% of the total world population (4). Prevalence of DM is increasing worldwide and is more in developing countries which are already suffering from communicable diseases with expected 70% of them reside in developing countries by the year 2030 (5).

In Africa, an estimated 2.8 billion USA dollar was spent on healthcare expenditure because of diabetes in 2011. This report forecasts the expenditure will rise by 61% in the year 2030; meanwhile, the prevalence of diabetes is expected to almost double in the same time period(6, 7).

Multiple prescribed medications (MPM) and medication adherence taken together present a unique challenge for the patient, their caregiver(s), and the healthcare team. Evidence from systemic review suggests there is mixed relation between multiple prescribed Medicine and medication adherence due to the connection with patient, health-system, and provider factors as a mediators of the association between multiple prescription of medication and medication non adherence (8, 9).

Multiple prescription of medications which is similar with prescribed polypharmacy is concurrent use of multiple medication items by one individual which is considered something to be avoided in the past. But, currently, it is accepted in many circumstances as it is therapeutically beneficial, especially in patients with a chronic condition like diabetes (10). Its definition varies according to the literature, and hence there is no consensus definition of multiple medication prescription, prescribed polypharmacy and appropriate polypharmacy. But, for this study MPM and polypharmacy were used interchangeably, which ranges from the concurrent use of two or more to ten or more prescription drugs(1, 8, 10-12) . However, for this study it is defined as the concurrent use of four or more prescription drugs (11, 13-15).

People with Type 2 Diabetic often have multi morbidity (co-occurrence of two or more chronic condition in one patient) like macro vascular complication, micro vascular complication, and neuropathic complication. For this reason, the patient needs multiple medications to treat hyperglycemia, comorbidity regularly and slow the progression of disease. Therefore, multiple medication prescription is unavoidable, given that multiple drug therapy has become the standard of care in these chronic conditions (15-18).

Although, reduction of MPM is salutary according to some study (2, 19, 20) by being too occupied with reduction approach one might fail to consider inappropriate prescribing in its entirety. Means, inappropriate prescribing does not only incorporate over-prescribing (more drugs than clinically necessary) and mis-prescribing (incorrect prescribing of a necessary drug), it also includes under-prescribing (failure to prescribe a clinically indicated drug) (14, 21-23).

Medication adherence (multiple medication adherence in case) is defined as the extent to which a patient medication taking behavior coincides with the intention of the health advice he or she has been given (7, 24). It is the most important factors that determine therapeutic outcome, especially in a patient suffering from a chronic illness like diabetes mellitus (7). But, non-adherence to this multiple prescribed medicine is another public health issue that can determine the quality of life, treatment outcome, mental status which is responsible for therapeutic failure and vital organ damage that increases the risk of death by 80% in a diabetic patient (25-28).

Even though adherence to medications leads to beneficial outcomes, it is often poor especially in patients with chronic disease who are taking multiple drugs (12, 20, 29), even some study reports patients perceive increased number of prescribed medicine will increase side effects, toxicities and risks of death, although the truth is far from the myth (30). Therefore, it is crucial to study about the prevalence and adherence to multiple prescribed medications and its predictors among Type 2 Diabetic patients attending diabetic clinic.

1.2. Statements of the Problem

Diabetes is estimated the ninth among the top 10 causes of morbidity and mortality worldwide and its numbers are increased by four times from 1980 to 2014(2, 31). About 1 in 11 adults worldwide now have diabetes mellitus, 90% of whom have type 2 diabetes mellitus(31).

In African region approximately around 14.2 million peoples have diabetes of which 1.3 million people live in Ethiopia that makes the country among top four countries with the burden of adult diabetes from Sub Saharan African countries (32, 33).

Patients with Multiple Chronic Comorbidities (MCCs) constitute a majority of the diabetes population. For instance, from 1,389,016 eligible patients, 97.5% of patients had at least one comorbid condition in addition to T2DM and 88.5% had at least two comorbidities. The most common comorbid conditions include hypertension (HTN) in 82.1%; overweight/obesity in 78.2%; hyperlipidemia in 77.2%; chronic kidney disease (CKD) in 24.1%; and cardiovascular disease (CVD) in 21.6% of the patients (34, 35).

Presence of complication like hypertension, dyslipidemia, coronary artery disease, depression and chronic kidney disease, requires the use of multiple medications to treat the conditions. This put patients with diabetes at high risk of multiple prescription (administration or use of more medications that are clinically indicated), as inevitable choice with an estimated prevalence of 54%–84% of patients with diabetes using five or more medications in countries like Saudi Arabia, USA, and Italy (2, 13, 36, 37).

Even though, these required medication (clinically indicated multiple medication) substantially linked with improved health outcome, health care cost and reduce diabetes-related morbidity and mortality, the extent of treatment beneficial aspects may be limited by a lack of treatment adherence (20, 38, 39). Having this benefits, the adherence of people with multi morbidity to multiple prescription are relatively low which ranges from 51.7%-80% (26, 37, 40, 41).

Studies report factors affecting MPMs among patients with diabetes is sex, age, obesity, presence and types of comorbidities average time of diagnosis, consultation per year, adverse drug reaction and educational level (42-45). While factors associated with Adherence to MPMs were complex and multifaceted which include factors like: age, sex, number of medication,

appointment schedule, unavailability of transport, forgetfulness, poor communication between physician and patient, adverse outcomes such as weight gain and hypoglycemia, lack of education and understanding of the long term benefits of treatment, cost of medication, knowledge of the patient about medications, follow up frequencies, beliefs about medicine, income, health care provider interaction at (prescription, at filling and adherence supporter), duration of disease, asymptomatic nature of the disease, and availability of pharmacy (13, 20, 40, 46-51)

According to some studies, methods of improving adherence to multiple medications can be grouped into four general categories: Patient education; improved dosing schedules; increased hours when the clinic is working (including duty time) and therefore shorter wait times; and improved/clear communication between physicians and patients(13, 26, 52)

To date, no studies have examined the prevalence and adherence to multiple medication prescriptions among adults with Type 2 diabetes living in Addis Ababa and assessed the specific factors associated with adherence to multiple medications.

Identifying prevalence and adherence to multiple prescriptions of medication and its predictors among type 2 diabetic patients will facilitate effective interventions for optimal blood glucose control and pharmacovigilance efforts in clinical practice setting to improve micro vascular, cardiovascular outcomes, prevent hyperglycemia and its related complication.

Therefore, this study determined the prevalence and adherence to multiple prescribed medications and its predictors among adults with type 2 diabetes in Tertiary Hospitals in Addis Ababa.

2. LITERATURE REVIEW

2.1. Introduction

The literature review of this study was made on articles related to multiple prescriptions of medication/polypharmacy in diabetic, in chronic disease and in adults, adherence to multiple prescribed medications/ Polypharmacy, factors associated with multiple prescribed medications and adherence to diabetic medication among Type 2 diabetic mellitus visiting diabetic clinic since 2002-to present, because of limited availability of articles. We use the literatures for this study on article titled as Multiple prescribed medications, multiple medication prescriptions, polypharmacy and multiple regimen since they used interchangeably by this and some other studies (22). To search those literature different printed materials and computer data-bases like; AAU library data base, HINARI, Google scholar, Pub Med, CINAHL and reports of study setting for study sample have been used.

The findings of these literature was searched, analyzed, categorized and presented into five subsections: prevalence of MPMs among diabetes, factors associated with MPMs, Adherence to MPMs among diabetes, predictors of adherence to MPM among diabetes and diabetic related problems and conceptual frame work of the study to conceptualize the summery of the literatures.

2.2. Prevalence of Multiple Prescribed Medications among Diabetic Patient

A cross sectional study conducted in Saudi Arabia on 8932 adults with diabetes, 78% had multiple medications which was more likely among women as compared with men and more likely among older adults (age ≥ 60 years) as compared with the adults. Also, multiple medication was two times as likely among patients with coexisting cardiovascular conditions (AOR=2.89; 95% CI 2.54 to 3.29), respiratory disease (AOR=2.42; 95% CI 1.92 to 3.03) and mental health conditions (AOR=2.19; 95% CI 1.74 to 2.76), and three times as likely among patients with coexisting musculoskeletal disease (AOR=3.16; 95% CI 2.31 to 4.30) as compared with those without these coexisting chronic conditions categories(2).

Multicenter cross-sectional survey conducted in Italy reveals, the percentage of the study sample receiving five or more drugs was 57.1% with more proportion of multiple dugs among elderly

(73.7 ± 5.6 years vs. 72.7 ± 5.3 , $p = 0.0020$), on long duration in Diabetic treatment (10 vs. 8 years, $p < 0.0001$), higher body mass index (BMI) (29.4 ± 5.0 kg/m² vs. 28.5 ± 4.7 , $p = 0.0014$) place of residence north Italian (60.1 vs. 47.7 %, $p < 0.0001$) and on those with complication of diabetes (15.8 vs. 6.9 %, $p < 0.0001$) (45).

The incidence of multiple prescriptions of medication (using ≥ 5 drugs) among type 2 diabetes patient admitted to general medicine attending rural tertiary care teaching hospital in south India were 82.89%. Multiple prescriptions of medication were common among smokers, alcohol users, hypertensive with dyslipidemia and hypertensive with thyroid disorders according to this study (53). Other report in medical outpatient of Saudi hospital reveals out of 766 patients included in the study, 683 (89%) participant have had multiple medications. The mean number of prescribed medications, oral pills and doses was 8.8, 9.6 and 12.1, respectively among the study participants (1). The mean rates of medicines among patients with T2DM in Greece for >5 drugs and >7 drugs were 79% and 54.1%, respectively (54).

A household survey in 63 municipal areas of Minas Gerais reports out of 2619 respondents with diabetes, 56.5% were on multiple medicine which is associated with age, comorbidities and increased access to health services (55). Similarly, according to a multicenter cross-sectional survey conducted in Italy from 1342 participants with type 2 diabetes 2.8 % participants took one drug to 0.3 % of them took ten or more drugs. The percentage of the study population receiving five or more drugs was 57.1 % (45).

According to evaluation of polypharmacy in patients with type 2 diabetes mellitus and its association with medication adherence and health care costs conducted in, 13,365 total sample population 22.4% had non-multiple medication, 39.3% had minor, 25.3% had moderate, and 13.0% had major multiple medication where, patients with no multiple medication (≤ 2 drugs), minor (3-5 drugs), moderate (6-8 drugs), and major (≥ 9 drugs) took the cumulative drugs respectively (56). Additionally, according to study conducted on drug utilization and factors associated with polypharmacy in Minas Geiras, the average number of prescribed medication were 5.2 ± 2.9 with 0-17 amplitude of medication administered (42).

2.3. Factors associated with Multiple Prescribed Medications among Diabetic patients

Study conducted in ELSA in 2018 reveals that there is significant association between low wealth condition, obesity, increasing age, and presence of chronic health condition (12). According to Italian, a multivariable logistic model reveals, there is significant association between Multiple prescribed medication and the female gender, living in Northern Italian regions, diabetes duration longer than 4 years, and having a body mass index of $>30 \text{ kg/m}^2$ (45).

A study conducted on “Drug utilization and factors associated with polypharmacy in individuals with diabetes mellitus in Minas Gerais, Brazil” indicated that factors like: age above 40 years, bad or very bad self-perceived health, presence of five or more comorbidities, average time of diagnosis above 10 years, four or more medical consultations in the last year, absence of regular physical activity, interruption of normal activities in the last 15 days, and access to a private health plan are significantly associated to the occurrence of prescription of multiple medication in DM patients (42). Similarly, according to study conducted by Austin and Rogers P. the predictors of multiple medication prescriptions are multiple prescribers, aging population, complex drug therapies, psychosocial contributions, and adverse drug reactions that may be interpreted as new medical conditions. According to this study presence of multiple drugs can also affect adherence to medication and quality of life of the patient (44).

A cross-sectional analysis of factors associated with excessive polypharmacy on 3904 patients with chronic disease, there is no association between excessive MPM and female sex, low educational level, and smoking. But, there is associated with multiple diagnosis, and age >85 years (38). Other, retrospective cross sectional study conducted on adult Saudi Arabian patients reports multiple prescribed medicines were high among older patients (OR=2.68, 95% CI=2.51-2.87), women (OR= 1.69, 95% CI= 1.59-1.80), married, and among patient with chronic condition like COPD, osteoporosis, ischemic heart disease and heart failure (43).

2.4. Adherence to Multiple Prescribed Medication among Diabetic Patients

Treatment guide lines of DM encourage the effort promote the medication adherence and appropriate intensification of medication to achieve therapeutically effective dose. But unfortunately, adherence among many patients are poor (57). A cross sectional study conducted

in Greece suggests from 644 outpatients participated in the study 47.8% of patients had been receiving anti diabetic medication mono therapy, 38.2% combination therapy with two anti-diabetic drugs, 11.8% with three drugs, and 2.2% with four drugs. Additionally, 44.4% of patients with comorbidities exhibited MMP, compared with 4.8% of patients who were diagnosed only with diabetes ($P = 0.001$)(41). A study on polypharmacy and medication compliance in patients with type 2 diabetes reports only 18% the patients took one drug with average drugs of four medications. From the study subject 92% of the patient were compliant to medications(20).

Retrospective study conducted in Cyprus suggests level of prescribed MPM was 87.6% of patients, whom 46.7% received more than 12 medications ($p \leq 0.001$). From those with MPM only 60.9% of the patient were adhered to their medication as per prescription. Moreover, 28.9% of patients often/very often missed taking their medications because they feel better and 22.7% increased drug dosage in order to feel better (58). Whereas, study conducted on 910 Boston Hospitals Reveals Patients were taking a mean of $4.1 (\pm 1.9)$ diabetes-related medicines with the average 7-day adherence of 6.7 ± 1.1 days. According to this study, total number of medicines prescribed was not correlated with medication adherence. But adherence was significantly lower for medicines not felt to be improving current or future health(37).

Study conducted on Evaluation of Adherence to Therapy in Patients with diabetes reports, 70% patients reported non-adherence to medication schedule. According to this prospective cross sectional study Morisky medication adherence questionnaire 0%, 26% and 74% of patients where highly, moderately and lowly adhered to prescribed medicine, respectively. Unawareness about need of each medicine (55.66%), forgetfulness (50.66%) and high cost (43.33%) were the common causes of non-adherence(40).

A study conducted on Assessment of medication adherence in type-2 diabetes patients on poly pharmacy and the effect of patient counseling given to them in a multispecialty hospital in Indian hospitals, on 240 patients, 51.7% of them where adhered to their prescribed medicines (26). Another survey study conducted on the effect of polypharmacy on drug compliance among diabetic and hypertensive patient reveals from 321 patient surveyed more than half (58.3%) of them are either not partially compliant or totally non-compliant to their prescribed medication (46).

2.5. Predictors of Adherence to Multiple Prescribed Medications

Questionnaire based interview conducted in Sri Lanka reports out of 247 patient interviewed a good compliance to medication were seen in 38.4% of patients with large number of tablets that they need to swallow, fear of side effects with long-term drug intake and unclear instructions as the main reasons for poor drug compliance(59).

A retrospective observational study conducted from 2006-2009 reveals Age, number of index medications, and physician-related factors like receiving medication for Diabetes and Hypertension from the same physician were significantly associated with Multiple Medication Adherence (MMA). But the proportion of multiple prescribers (when the patient followed different units regularly and prescribed medicine from different physician) was not significantly associated with MMA (47). Another study reveals variable independently associated with medication non adherence were increased number of medication, increased daily dose, concerns of side effects, taking metformin and presence of one or more microvascular complication (60).

A cohort study on Evaluation of Polypharmacy in Patients with Type 2 Diabetes Mellitus and Its Association with Medication Adherence and Health Care Costs reports higher level of multiple medicine was associated with a higher likelihood of adherence than the non-multiple medicine cohort (minor: OR=2.18, 95% CI=1.99-2.40; moderate: OR=3.58, 95% CI=3.20-3.99; major: OR=4.70, 95% CI=4.07-5.43) (56). Similarly, according to study conducted by Austin and Rogers P. the presence of multiple medicine by itself are determinants of adherence to medication and quality of life of the patient(44). A survey study conducted in Palestine reveals that, there is significant difference in the degree of adherence with respect to the number of medications taken by diabetic patients where, good adherence decreases and the total of poor plus the non-adherence increases with increasing the number of medications (46).

Mixed study conducted in University Diabetic Center of Riyadh, Saudi Arabia factors associated with adherence to anti diabetic medication were observed with increasing age (OR, 1.084; 95% CI, 1.056– 1.112), taking fewer non-diabetic medications (OR, 0.848; 95% CI, 0.728–0.986). But, reports has no evidence that gender, marital status, education level, income and diabetes duration) were associated with OHA adherence (48). Another study conducted in 2017 in Middle East and North Africa shows adherence to medication were Positively associated with knowledge about the disease and medications, regular follow-up visits, and patients' positive

beliefs about effectiveness and motivations about medications, while negatively associated with factors like forgetfulness, side effects, and polypharmacy(50).

A Cohort study conducted in 2015, at U. S describes Adherence was independently associated with older age, male sex, higher education, higher income, 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(51). A prospective questionnaire based cross sectional study reveals, not buying all medicines (58.66%), not taking prescribed dose of medicines (34%), taking additional non-prescribed medicines (30%) and not taking medicines for required duration (25.33%) were common types of non-adherence and unawareness about need of each medicine (55.66%), forgetfulness (50.66%) and high cost (43.33%) were the common causes of non-adherence(40).

A Proposed Holistic Conceptual Framework for Barriers to Medication Adherence in Diabetes in 2017, conceptualize barriers related to medication adherence as patient related (Sociodemographic factors, Beliefs on clinician's ability, Availability of pharmacy, Knowledge of the patient, Belief on effectiveness of drugs) , medication related like medication complexity (in terms of frequency, timing of medicine, number of injection per day and methods of administration) and Adverse drug reaction, disease related (duration and complication, asymptomatic), provider related (patient provider interaction, knowledge of the provider)- , system related (financial and accessibility)-, and societal (support, stigma and discrimination) related factors that can affect the Adherence to medication(49).

Generally, from literature review we can conceptualize that the prevalence of multiple prescribed medications ranges from 54%-84% having predictors like sex, age, obesity, presence and types of comorbidities, average time since diagnosis, consultation per year and educational level. Even though multiple prescription were inevitable in this chronic disease adherence to this multiple prescription ranges from 51.7%-80% which is associated with factors like age sex, number of medication, appointment schedule, unavailability of transport, forgetfulness, poor communication between physician and patient, adverse outcomes such as weight gain and hypoglycemia, lack of education and understanding of the long term benefits of treatment, cost of medication, knowledge of the patient about medications, follow up frequencies, beliefs about medicine, income, health care provider interaction, and duration of disease.

2.6. Conceptual Framework

The conceptual frame work of this study is conceptualized by the principal investigator based on the literature review mainly focusing on the factors related typically with adherence to Multiple Prescribed Medication which is extracted from study conducted by (12, 38, 40, 42, 43, 45, 49-51, 59).

The concept is headed by five main factors as socio-demographic related factors, disease related factors, health care related factors, medication related factors and presence of multiple prescribed medication which can affect adherence to Multiple Prescribed Medications.

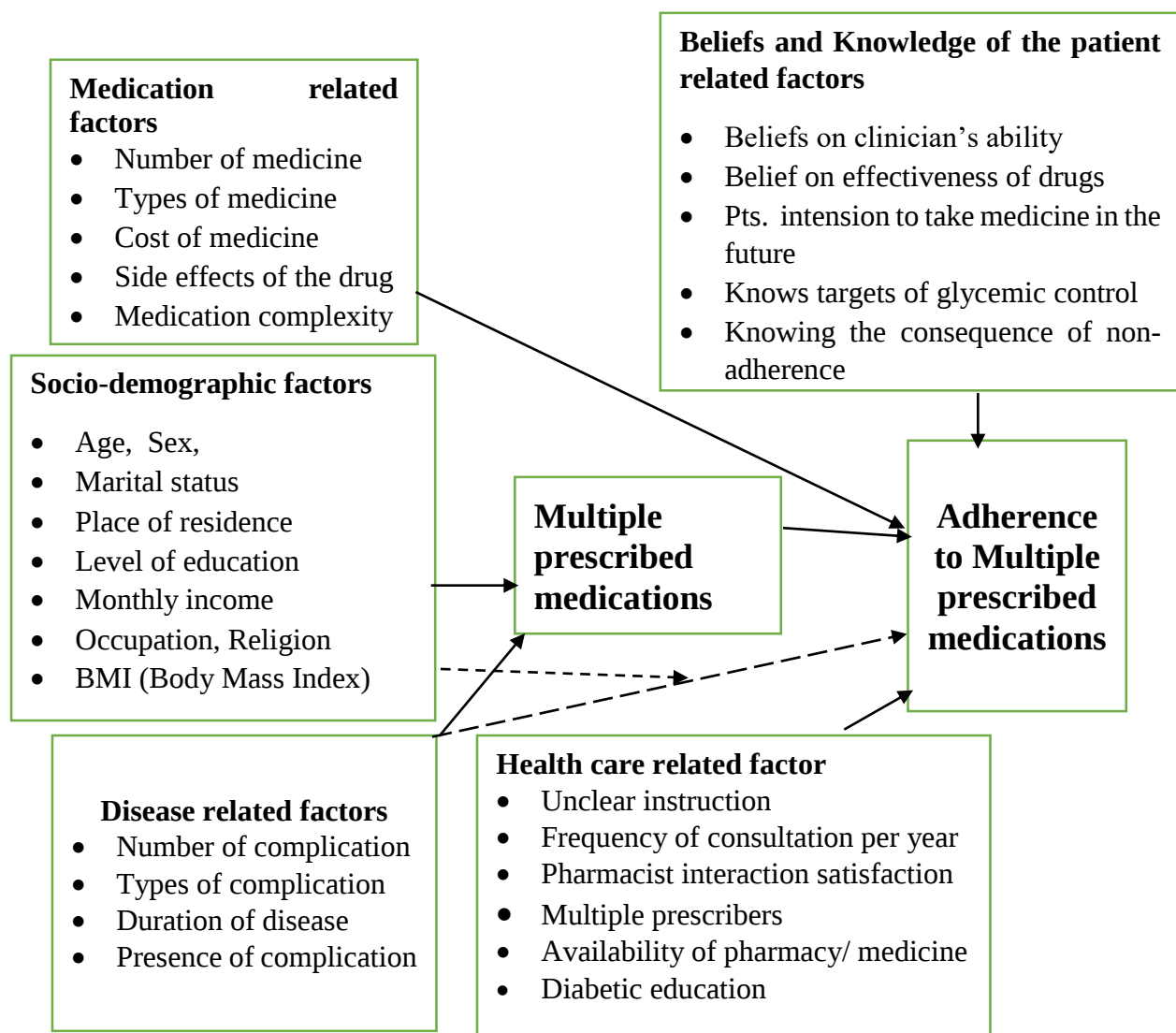


Figure 1 conceptual frame work on Adherence to Multiple Prescriptions and associated factors among Type 2 Diabetic Patients at Addis Ababa tertiary Hospitals, 2019.

3. JUSTIFICATION OF THE STUDY

The prevalence of type 2 diabetes is rising among adults with coexisting chronic complication like hypertension, dyslipidemia, coronary artery disease, depression and chronic kidney disease, which requires the use of multiple medications to treat them accordingly. This put patients at high risk of multiple prescriptions (administration or use of more medications that are clinically indicated), as inevitable choice with an estimated prevalence of multiple prescription 54%–84% (2, 13, 36, 37).

Even though, multiple medication prescription are substantially linked with improved health outcome and reduce diabetes-related morbidity and mortality, the extent of treatment beneficial aspects may be limited by a lack of treatment adherence (20, 38, 39). Having this benefits, the adherence of people with multi morbidity to multiple prescription are relatively low which ranges from 51.7%-80% (26, 37, 40, 41).

Despite high prevalence of Diabetes in Ethiopia, little is known about prevalence of multiple prescribed medicine and its adherence among T2DM visiting diabetic clinic specially in study setting to the best of my finding (33).

Assessing the magnitude of MPM and its adherence is the strategy to deal with the issue of multiple medication prescription and raise the adherence level of the patient living with T2DM taking multiple prescriptions of medications. Therefore, this study aims to assess the prevalence of multiple prescribed medicine, to identify the level of adherence to multiple medications, and its predictors among T2DM patients.

4. SIGNIFICANCE OF THE STUDY

This study was designed to assess the level of multiple prescription of medications and its adherence and associated factors among people living with type 2 diabetic visiting diabetic clinic at Tertiary Hospitals in Addis Ababa. Thus, it is expected that the result of this study will guide nurse educators, counselors, and adherence supporters in diabetic and treatment adherence related education

The findings from this study will also improve awareness of patients, pharmacists, and nurses related to multiple medications. In addition, this study will also help nurses to educate the patients on importance of multiple prescribed medicine and reduce negative myths of multiple prescribed medicines.

It is also expected that the finding from this study may be helpful in designing a future nursing educational plan for patients having multi morbidities on multiple prescriptions for professional nurses in Ethiopia. The knowledge gained from this study will also trigger Food and Drug administrative agencies to regulate and provide guidelines on strategies on how medications for comorbidities have to be prepared and administered.

The findings of this study might also help to provide base line data for researchers who want to conduct further study on a similar topic. Hopefully, this study may expand the existing literature on multiple prescribed medicine and factors associated with adherence.

5. OBJECTIVES

5.1. General Objective

To assess the prevalence and adherence to multiple prescribed medications and its predictors among Type 2 Diabetic Patients visiting Diabetic Clinic of Addis Ababa tertiary Hospitals. 2019

5.2. Specific Objectives

- To assess the prevalence of multiple prescribed medications among Type 2 Diabetic patients visiting diabetic clinic of Addis Ababa Tertiary Hospitals, 2019
- To describe predictors of multiple prescribed medications among Type 2 Diabetic patients visiting diabetic clinic of Addis Ababa Tertiary Hospitals, 2019
- To determine adherence to multiple prescribed medications among Type 2 Diabetic patients visiting diabetic clinic of Addis Ababa Tertiary Hospitals, 2019
- To identify predictors of adherence to multiple prescribed medications among Type 2 Diabetic Patients visiting diabetic clinic of Addis Ababa Tertiary Hospitals, 2019

6. METHODS AND MATERIALS

6.1. Study Area and period

The study was conducted in three tertiary Hospitals in Addis Ababa, Ethiopia. Addis Ababa is the capital city of Ethiopia which is located in the center of the country and home to nearly 7 million people. Amharic (70.8%), Afan Oromo (11%) and Tigrigna (3.6%) are the three dominantly spoken languages in the city. Addis Ababa has 51 hospitals, 84 health centers, and around 700 private clinics out of which 75 are higher clinics(61). Tikur Anbessa Specialized Hospital (TASH), Saint Paulos hospital and millennium medical college (SPHMMC) and Torhayloch specialized and comprehensive hospital (TSCH) are the three selected largest tertiary hospitals in Addis Ababa. TASH is the largest referral and teaching hospital and sees approximately 370,000 – 400,000 patients a year(62). SPHMMC is another largest hospital with an inpatient capacity of more than 700 beds and sees an average of 1200 clients from emergency and outpatient daily (63). Torhayloch specialized and comprehensive hospital is another tertiary hospital managed by defense force and is providing specialized service for patients coming from all over the country from military services(64).

These three hospitals have been providing specialized clinical services for patients as a referral center for the country. They are appropriate for the study because they have an independent diabetic clinic, which gives services to patients with diabetic and diabetic related cases as an outpatient and inpatient department. The percentage of Type 2 diabetic patients on follow up in these hospitals are approximately 90% from total diabetic patients (*HMIS of the three hospitals and observed through situational analysis*). Currently, the hospital sees on average 800, 550 and 220 type 2 diabetic patients per month at TASH, SPHMMC, TSCH respectively (*HMIS of the three hospitals*). The study was conducted from March 1- April 15/2019 at selected Addis Ababa public Hospitals.

6.2. Study Design

An institution based cross sectional study design was used to elicit the information from the study population.

6.3. Population of the Study

6.3.1. Source population of the study

All people living with Type 2 diabetes visiting diabetic clinic in the three selected tertiary hospitals in Addis Ababa.

6.3.2. Study population of the study

Sampled people living with Type 2 diabetes visiting Diabetic clinic of selected three Addis Ababa Hospitals who have follow up during data collection period and fulfill the inclusion criteria.

6.3.3. Study Units

Each people living with Type 2 diabetic attending Diabetic clinic of three selected Addis Ababa Hospitals from which actual data are collected.

6.4. Eligibility Criteria

6.4.1. Inclusion

This study were includes T2DM patients, 18 years or above, those who have follow up in the selected three hospitals diabetic clinic and taking diabetic medication for at least one year in the study setting.

6.4.2. Exclusion criteria

Critically ill patient, pregnant mothers and patients with psychiatric disorders, were excluded from the study.

6.5. Sample Size Determination

To calculate the sample size for this cross-sectional study, it is assumed 95% of confidence level, 0.05 margin of error, 0.5 proportion of adherence to MPMs since there is no study conducted in similar setting on similar topic. The sample size was calculated using single population proportion formula. Where:

$$n_i = \frac{(Z\alpha/2)^2 P(1 - P)}{d^2}$$

$$n_i = \frac{(1.96)^2 * 0.5(1-0.5)}{(0.05)^2} = \underline{384}$$

- n_i = the initial sample size required
- $P = 0.5$ assumed proportion and adherence to MPM b/se no similar study and to raise sample size.
- d = degree of accuracy (0.05)
- $Z\alpha/2$ - critical value which is assumed 95% CI

Then considering 10% non-response rate the final sample size was 422.

6.6. Sampling Technique

Systematic sampling was employed to select the study participants. The average number of patients visiting the three hospitals per months on follow up are 800, 550 and 220 at TASH, SPHMMC, and TSCH respectively. The calculated sample size were allocated proportionally for the three hospitals, and hence 215, 148, and 59 from TASH, SPHMMC, and TSCH respectively. The sample was taken based on every K's (every 4patients) by selecting random start by lottery methods and adding k's for a subsequent participant to collect data by exit interview. 422 patients was taken as an actual participant.

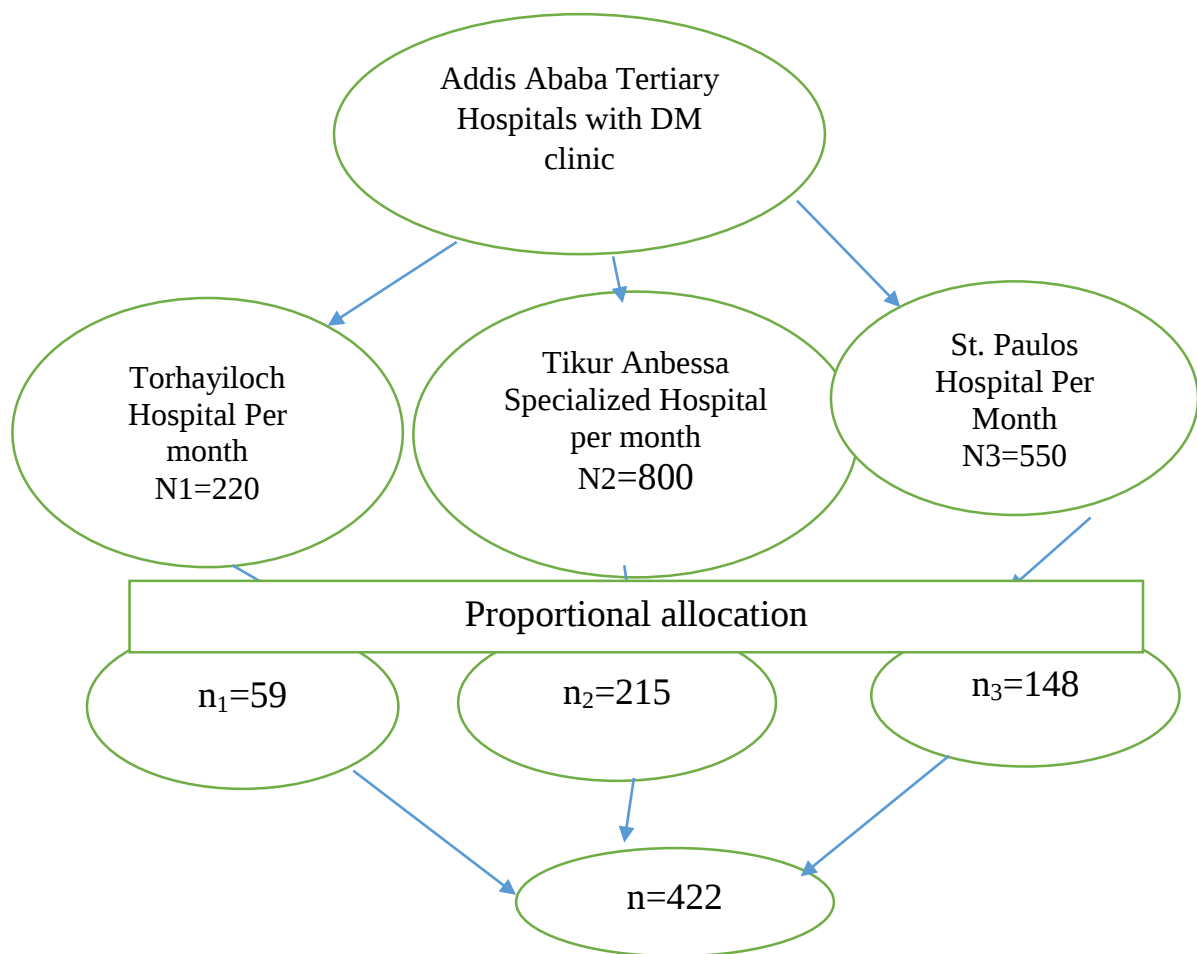


Figure 2 flow chart of sampling technique on prevalence and adherence to multiple medications among Type 2 Diabetic Patients at Addis Ababa Tertiary Hospitals, 2019

6.7. Operational Definitions

- **Multiple Prescribed Medications:** -in this study, Multiple Medication prescription is defined as the concurrent use of ≥ 4 medications regularly for at least 1 months or since last follow up (11, 14, 15).
- **Adherence to Multiple Prescribed Medication** will be calculated using Morisky 8-item medication (MMAS-8) adherence questionnaire (40, 65, 66). Adherence will be graded as
 - ✓ High when the patient correctly answered 8 Questions of MMAS-8
 - ✓ Medium when the patients correctly answered between 6 and 8 questions of MMAS-8
 - ✓ low when they correctly answer less than 6 questions of MMAS-8
- **Adhered** when the patient answers six or more MMAS-8 questions correctly and **Not Adhered** when the patient answer less than six answers for MMAS-8 questionnaire (13)

6.8. Study Variables

6.8.1. Objective one and Two

Dependent Variable

- **Prevalence of Multiple Prescribed Medications**

Independent Variables

- **Socio-demographic factors:** gender, age, place of residence, marital status, religion, occupation, monthly income, educational level, and body mass index.
- **Disease related factors:** number of disease, types of disease, duration of disease, and Presence of complication

6.8.2. Objective three and four

Dependent variable

- **Adherence to Multiple Prescribed Medication**

Independent Variables

- **Socio-demographic factors:** gender, age, place of residence, marital status, religion, occupation, monthly income, educational level, and body mass index.
- **Medication related factors:** number of medicine, types of medicine, medication complexity, cost of the medicine, Adverse drug reaction
- **Beliefs and Knowledge of the patient:** Beliefs on clinician's ability, knowing the consequence of non-adherence, Belief on effectiveness of drugs, intention to continue the medicine.
- **Health care related factor:** Unclear instruction, Frequency of consultation per year, Pharmacist interaction, Availability of pharmacy/medicine, number prescribers or units, knowledge of clinician.
- **Multiple Prescribed Medications**

6.9. Methods of Data Collection

6.9.1. Data collection Instruments/tool

The data collection instrument was a structured pretested interview-based questionnaire and check list guided document review. The questionnaire was adapted from literatures (12, 38, 42, 43, 45, 49, 50, 58, 59) and standardized Morisky Medication Adherence 8 item Scale (65, 66). The questionnaire was prepared originally in English language and then translated into Amharic language for data collection purpose by fluent Amharic and English speakers and then back to English by other translators. The questionnaire was organized into four heading as socio-demographic characteristics of the respondents, the questionnaire to extract the information from the participant's medical record regarding the medication regimen, known co-morbid or complication states, and duration of the disease, Morisky Medication Adherence Scale-8 item containing 8 questions was used to evaluate self-report of adherence to multiple prescribed medications and 20 questionnaire to interview the patients on multiple prescribed medication about health care provider related factors, medication related factors, perceived beliefs and knowledge of the patient and presence of multiple prescribed medications to obtain information related to factors associated to adherence to MPMs . MMAS-8 contains eight questions, except the 8th question all are yes/no questions with expected correct answer of “no” except question

number five in which expected correct answer is “yes”. The 8th question is likert scale from never to all the time having 1 point for never, 0.75 once at time, 0.5 some times, 0.25 for usually and 0 for all the time. Patient taking four and above medications as the standing dose were considered multiple prescription of medication users. Whereas, a score MMAS-8 of 8 indicates high adherence, a score of 6-7 indicates medium adherence whilst a score of less than 6 indicates poor adherence for Adherence measuring questionnaire and they have re categorized as Adhered (6-8) and not adhered (<6) for analysis purpose.

6.9.2. Data Collectors and Data Collection Procedure

The data was collected by a total of three data collectors who have a minimum of a diploma in nursing and who can speak Amharic language fluently. Three supervisors, of whom one with MSc in Public Health and two MSc in nursing were participated in the study.

The data was gathered using structured questionnaire, face to face every 4 patient exit interview from type 2 diabetes by selecting them systematically, after asking them for their willingness and oral informed consent was taken from each patient.

The supervisors was checked whether the questionnaires are correctly filled out during data collection period and they have collected the completed questionnaire and handover it to the principal investigator on the day data collection are conducted. Each questionnaire filled was checked for completeness of the information's by the principal investigator and was processed subsequently on a daily basis.

6.10. Data Quality Control

Data collectors and supervisors was trained intensively for one day by principal investigator on the topic of study, objectives, sampling strategies, inclusion/exclusion, informed consent, data collection strategies, handling, clarity, and completeness before actual data collection.

Pre-test was conducted on 21 (5%) of the total sample at Yekatit 12 Hospital and Medical College) 2 weeks (11/07/2011 E.C.) before the actual data collection begins for clarity, completeness, and understandability and then, necessary correction was made on the questionnaires like HgA1C (not cost effective and feasible) and ethnicity (not related to the

study). The collection of data was checked by supervisor at each data collection center and by principal investigator on daily basis for completeness and consistency and data with errors (incomplete and filling errors) were deleted from data set. Each questionnaire was identified by the ID given for it. Data validity and reliability were maintained through close supervision of data collectors by supervisors and principal investigator.

6.11. Data Processing and Analysis

All the data was checked for completeness and consistency by cross-checking and then was coded and entered into Epi Data Version 4.4.2.1 computer software package and cleaned for inconsistency. For further analysis, the data was exported to Statistical Package for Social Science (SPSS) software version 25.0.

The data was processed using both descriptive and inferential statistics. The demographic features, magnitude of MPM (using four or more medication on a regular basis), adherence to MPM was processed descriptively using frequencies percentage, mean, and median. For analysis purpose Adherence were re categorized as adhered when the patients score between [6-8] answer from 8 items and non-adhered if answer less than 6 items from 8 questionnaires.

For Analysis first, we run a bivariate analysis using the logistic regression model to identify those factors with $p < 0.25$ (to not miss important factors) for inclusion in the multivariate analysis. The multivariate analysis was conducted using the logistic regression model to identify the predictors of MPM and to measure the level of co-variation using the odds ratio. The significance of the correlation was tested by using the Wald statistics/maximum likelihood method at 95% confidence level. Those factors with $p < 0.05$ at 95% confidence level in the final model were considered as statistically significant predictors

Text, tables, graphs was used for diagrammatic presentation and summarization of the variables.

6.12. Ethical Considerations

The study was conducted after getting ethical approval and clearance from institutional review board (IRB) of school of Nursing and Midwifery, College of Health Sciences, Addis Ababa University. The supportive letter was given from Addis Ababa University to selected Addis

Ababa hospitals and letter of permission was obtained from each hospital, then after a letter of cooperation was sent to the department of a diabetic clinic.

Oral informed consent was obtained from the study participants. Study participants were provided with information about the objectives of the study, the right to withdraw at any time if they feel uncomfortable with the questionnaire and as they have had right to respond fully or partially to the questionnaire without any risks and penalty. They were also informed as the information given by the respondents was used for research purposes only, confidentiality and privacy will be maintained by omitting the names of participants during the data collection procedure. Additionally, they were also informed as the study does not cost additional expenses on the study participants except their time expense.

6.13. Dissemination of Results

Finding of this study will be presented in open defense and submitted to Addis Ababa University College of health science, school of nursing and midwifery, to CHS library, and to selected hospitals diabetic unit.

Effort will also be made to publish in peer reviewed journals and will be presented in different national and international conferences and seminars.

7. RESULTS

7.1. Socio-demographic characteristics of the respondents

The data was collected from 417 patients with a 98.8% response rate. Of this, more than half 223(53.5%) were male, had a mean age of 55.61±12.9 and having the median age of 56.00 years. Three fourth were married 287(68.8%). Majority 289(69.3%) were orthodox religion followers. Additionally, 133 (31.9%) completed tertiary education, nearly three fourth, 298(71.5%) were living in Addis Ababa and over half 250(60%) of the study participants had above the recommended BMI score. **Table 1.**

Table 1. Socio-demographic Characteristics of T2DM patient at tertiary hospitals in Addis Ababa, 2019.

Variables	Variable categories	Frequencies (n=417)	Percentage
Sex	Male	223	53.5
	Female	194	46.5
Age	Mean ±SD, (Median)	55.61±12.9	(56.00)
	R(min, max)	72	(22,94)
	Young adult (18-40)	57	13.7
	Middle adult (41-60)	206	49.4
	Older adult(≥ 61)	154	36.9
Marital status	Single (¥)	130	31.2
	Married	287	68.8
Religion	Orthodox	289	69.3
	Muslim	54	12.9
	Protestant	55	13.2
	Others (**)	19	4.6
Level of education	Unable read	62	14.9
	Primary(1-8)	107	25.7
	Secondary (9-12)	115	27.6
	(≥diploma)	133	31.9
Occupational status	Un employed	135	32.4
	Gov't employee	86	20.6
	Pvt. Employee	73	17.5
	Retired	94	22.5
	Merchants	21	5.0
	Student	8	1.9
Place of residence	Addis Ababa	298	71.5
	Outside AA	119	28.5
Body Mass Index (BMI)	Mean ±SD	26.32	±4.01
	≤24.9	167	40.0
	25.0-29.9	165	39.6
	≥30	85	20.4

(¥) = unmarried, divorced & widowed, **= catholic, jeova, & Wakefata,

7.2. Prevalence of Multiple Prescribed Medications

The majority 245(58.8%) of participants live with the disease between 1-10 years. Nearly three-fourth 306(73.4%) of the participants have at least one complication. The number of medication used by the study participants ranged from 1 to 13. Of all 185(44.4%) of the participants are taking from 4 to 6 medications. Metformin 281(67.4%), NPH 232(55.6%), Enalapril 179(42.8%), and Aspirin 157(37.6%) are the most frequently used medications. **Table 2.**

Table 2. Disease and disease related factors among Type 2 diabetic patients attending tertiary hospitals in Addis Ababa, 2019. (n:417)

Variables	Variable categories	frequency	Percentage
Time since diagnosis	Mean $\pm$ SD	10.83	± 7.68
	R (min, max)	44	(1,45)
	1-10	245	58.8
	11-20	139	33.3
	≥ 21	33	7.9
Presence of complication	Yes	304	72.9
	No	113	27.1
Number of complication	0	113	27.1
	1-2	233	55.9
	≥ 3	71	17.0
Number of medication	1-3	184	44.1
	4-6	185	44.4
	7-9	41	9.8
	10-12	5	1.2
	> 12	2	0.5
Most frequently prescribed medicines	Metformin	281	67.4
	NPH	232	55.6
	Enalapril	179	42.8
	Aspirin	157	37.6
	Atorvastatin	154	36.9
Key: NPH= neutral protamine hagedorn/isophane insulin)			

According to the present study, 184(44.1%) used less than four medication and the rest were used at least four medicines having prevalence of multiple prescribed medications of 233(55.9%). **Figure 3.**

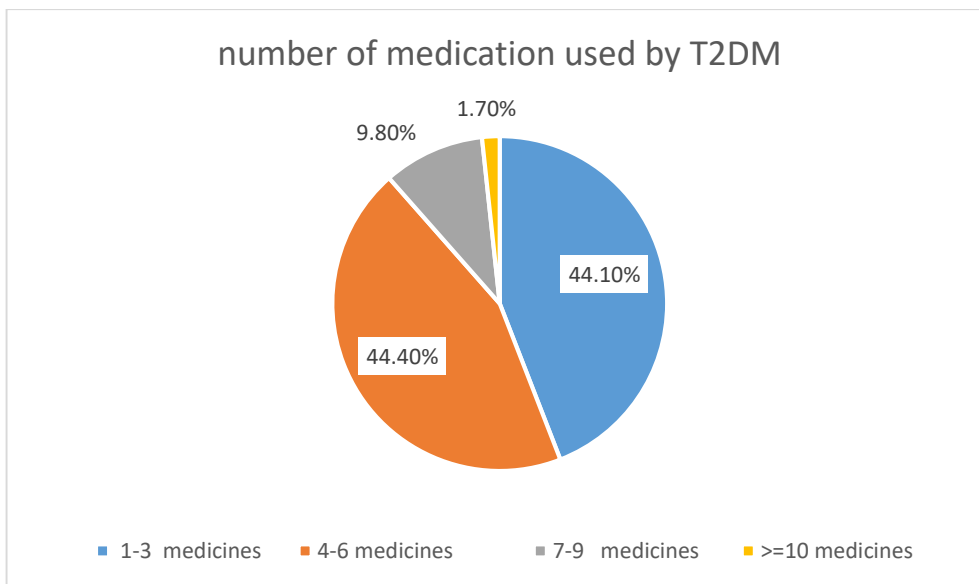


Figure 3. Number of medication used among Type 2 diabetic patients at tertiary hospitals in Addis Ababa, 2019.

From 304 participants having complications 242(79.6%), 185(60.9%), and 62(20.4%) have hypertension, dyslipidemia, and neurologic disease respectively. **Figure 4.**

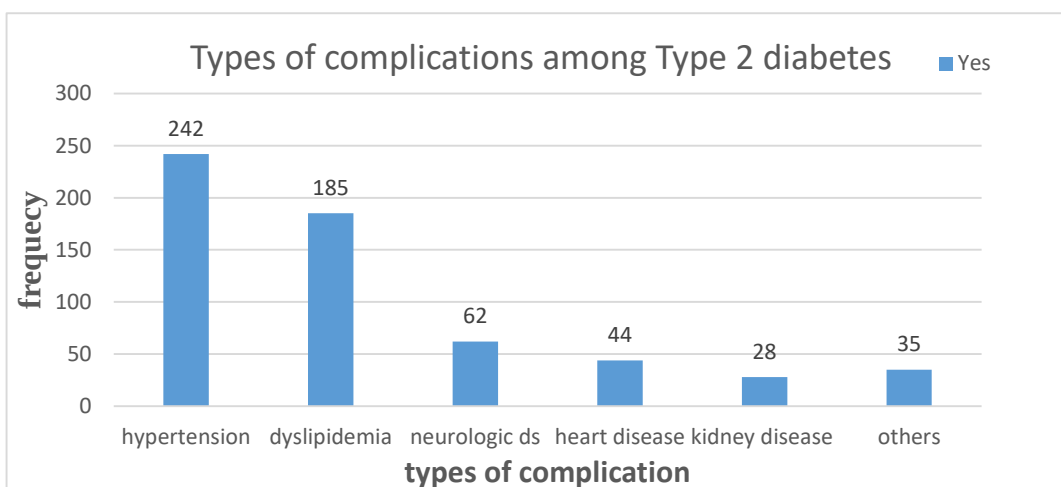


Figure 4. Types of complications among T2DM patients at tertiary hospitals in Addis Ababa, 2019.

7.3. Predictors of Multiple Prescribed Medications

Bivariate and multivariate logistic regression analyses were used to identify predictors of MPMs. All Variables were entered first in to bivariate logistic regression. Except place of residence, income and sex, all variables were related with MPMs at ($P \leq 0.25$) and hence imported to multivariate logistic regression.

Multivariate logistic regression analysis revealed that, there is significant association between BMI, level of education, and number of complication and use of multiple prescriptions among study participants. The study showed that, the odds to have multiple prescribed medications is 0.817 times lower among patients with BMI $\leq 24.9 \text{ kg/m}^2$, (AOR: 0.183 CI: 0.071-0.48, $p < 0.001$) compared to that of patients with BMI $\geq 30.0 \text{ kg/m}^2$ and as well the odds to have multiple prescription is three times higher among patients with BMI $\geq 30.0 \text{ kg/m}^2$ than those with BMI in between 25.0 to 29.9 kg/m^2 (AOR: 0.331 CI: 0.13-0.84) at $p = 0.020$. The odds of using multiple prescribed medications among patients having 1 to 2 complications is 0.978 times (AOR: 0.022 CI: 0.003-0.180) lower when compared with patients having ≥ 3 complications. The odds of using multiple prescription among secondary (9-12) educational level is 0.693 times (AOR: 0.307 CI: 0.130-0.72) lower when compared with tertiary educational level at $p = 0.007$.

Table 3.

Table 3. Predictors of multiple prescribed medications among socio-demographic characteristics and disease related factors using logistic regression.

Variables	Variable categories	Multiple Prescription of Medications status		COR (95% CI)	AOR (CI=95%)	p-value
		MPM non user	MPM users			
Sex	Male	96(23.0)	127(30.5)	1.098(0.75,1.62)		
	Female	88(21.1)	106(25.4)	1		
Age	YA 18-40	38(9.1)	19(4.6)	0.19(0.10, 0.37)	0.88(0.25, 3.04)	0.838
	MA 41-60	103(24.7)	103(24.7)	0.38(0.25, 0.61)	0.71(0.31, 1.64)	0.425
	OA ≥ 61	43(10.3)	111(26.6)	1 (*)	1	
Marital status	Married	133(31.9)	154(36.9)	.748(.490,1.14)	1.14(.56, 2.33)	0.71
	Single(¥)	51(12.2)	79(18.9)	1(*)	1	
Religion	Orthodox	129(30.9)	160(38.4)	.233(.066, .816)	.32(.03, 2.98)	0.31
	Muslim	23(5.5)	31(7.4)	.253(.066, .971)	.499(.05, 5.33)	0.57
	Protestant	29(7.0)	26(6.2)	.168(.044, .643)	.107(.01, 1.17)	0.07
	Others(**)	3(0.7)	16(3.8)	1(*)	1	
Level of education	Cant R & W	25(6.0)	37(8.9)	.863(.465, 1.60)	.65(.20, 2.11)	0.48
	1 ⁰ (1-8)	39(9.4)	68(16.3)	1.02(.60, 1.73)	.67(.72, 1.64)	0.38
	2 ⁰ (9-12)	71(17.0)	44(10.6)	.362(.216, .605)	.307(.130, .72)	.007
	Higher educn	49(11.8)	84(20.1)	1 (*)	1	
Occupational status	Un employed	58(13.9)	77(18.5)	1.42(0.64, 3.18)	.51(.129, 1.99)	0.33
	Gvt. Employe	46(11.0)	40(9.6)	0.93(0.40, 2.16)	1.00(.23, 4.41)	0.99
	Pvt. Employe	34(8.2)	39(9.4)	1.23(0.52, 2.91)	1.57(.34, 7.07)	0.56
	Retired	31(7.4)	63(15.1)	2.18(0.94, 5.07)	0.94(.21, 4.15)	0.94
	Other(***)	15(3.6)	14(3.4)	1 (*)	1	
Monthly income	<100	53(12.7)	64(15.3)	.901(.570, 1.42)		
	100-499	13(3.1)	16(3.8)	.918(.420, 2.01)		
	500-1400	30(7.2)	35(8.4)	.870(.497, 1.53)		
	>1400	88(21.1)	118(28.3)	1		
Place of residence	AA	131(31.4)	167(40.0)	1.02(.667, 1.57)		
	Outside AA	53(12.7)	66(15.8)	1		
BMI	≤24.9	103(24.7)	64(15.3)	.102(.051, .203)	.183(.071, .48)	<.00
	25.0-29.9	69(16.5)	96(23.0)	.229(.115, .453)	.331(.13, 0.84)	.020
	≥30	12(2.9)	73(17.5)	1 (*)	1	
Time since diagnosis	1-10	134(32.1)	111(26.6)	.360(.164, .789)	0.49(.14, 1.67)	0.26
	11-20	40(9.6)	99(23.7)	1.08(.470, 2.46)	.707(.19, 2.51)	0.59
	≥21	10(2.4)	23(5.5)	1 (*)	1	
Presence of complication	Yes	72(17.3)	232(55.6)	360(49, 263)	2.8(.066, 12.0)	0.59
	No	112(26.9)	1(0.2)	1 (*)	1	
No of complication	0	111(26.6)	0(0)	.00	.00(.000,-)	.994
	1-2	72(17.3)	161(38.6)	.031(.004,.228)	.022(.003, .18)	<.00
	≥3	1(0.2)	72(17.3)	1 (*)	1	

Key: (*)= variable is significant with bivariate analysis at $p \leq 0.25$, (¥) = unmarried, divorced and widowed, other (**) = catholic, jeova, and Wakefata, other (***) = merchants and students, AA= Addis Ababa, <.00= $p < 0.001$

7.4. Adherence to Multiple Prescribed Medications

Out of total 417 study participants, 233 were taking multiple prescribed medications. All have at least one complication with majority of them has 1-2 complications 161(69.1%). Over three fourth 185(79.4%) of the participants were taking 4-6 prescribed drugs and 2(0.9%) patients more than 12 prescribed medicines.

Adherence were analyzed using Morisky Medication Adherence Scale-8 (MMAS-8) which is categorized as High, Medium, and low adherence when the patient answers correctly 8, [6-8] and <6 answer from 8-MMAS questionnaire respectively. From 233 participants, 89(38.2%), 59(25.3%) and 85(36.5%) of the participants had high, medium and low adherence to prescribed drugs respectively.

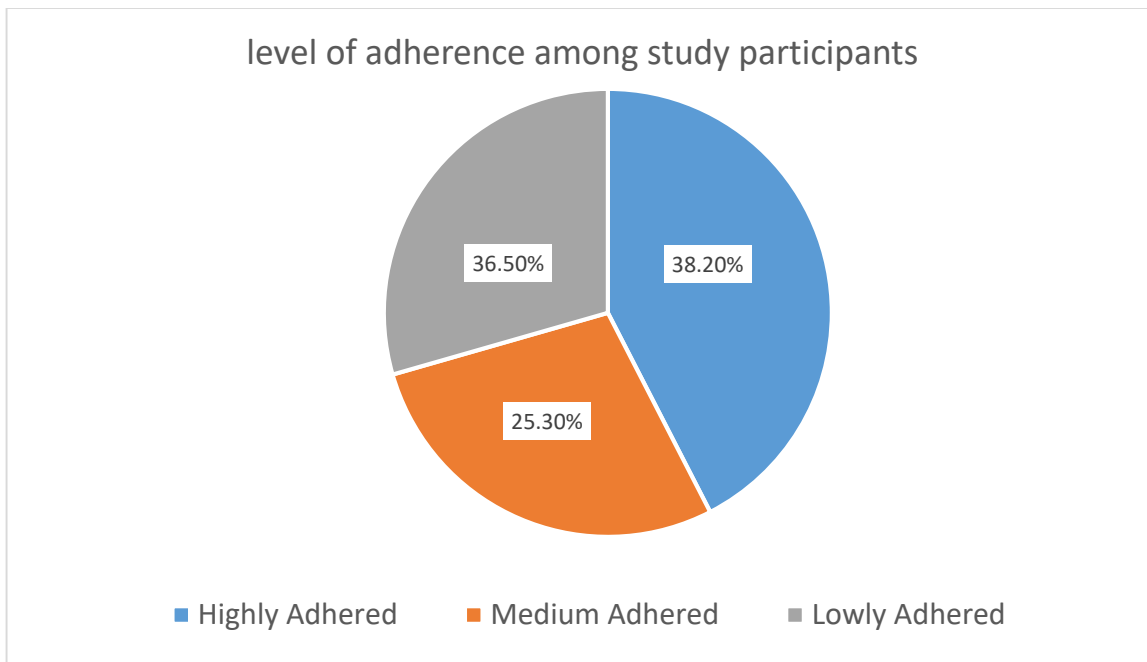


Figure 5. Level of adherence to MPMs among type 2 diabetic patients attending Tertiary hospitals in Addis Ababa, Ethiopia. 2019

7.5. Predictors of Adherence to Multiple Prescribed Medications

Bivariable and multivariable logistic regression analysis were used to determine the predictors of Adherence to MPMs and, hence variables were entered first in to bivariable logistic regression and then variables associated with Adherence to multiple prescribed medications at the p-value of <0.25 were included in final multivariable logistic regression analysis.

The results of the study revealed that; Age, time since diagnosis, the number of physicians or units patients visits, medication complexity, satisfaction with clinician service, knowing the targets of glycemic control and the number of medication were significantly associated with Adherence to MPMs at the p-value ≤ 0.05 .

The study showed that the odds of Adherence among participants in the age range of young Adult (18-40 years) is 4.9 times more compared to that of older adult (≥ 61 years) at $p=0.012$ (AOR: 4.9 CI: 1.82-12.1). The study also found that numbers of physician or units the patients visits is another significant factor associated with adherence to MPMs. Patients visiting one unit was adhered to MPMs 5.4 times more compared to patient visiting three and above units at $p=0.025$ (AOR: 5.4 CI: 1.24-23.5). Regarding knowledge about the targets of glycemic control participants knowing the targets of glycemic control is 7.4 more likely to adhered to the prescribed drugs compared with those who doesn't know the targets of glycemic controls at p-value <0.001 (AOR: 7.43 CI: 3.21-17.18). Similarly, there is significant association between adherence to MPMs and the number of medication the patient took. The odds of adherence to MPMs among patients taking 4-6 drugs are 4.8 times more likely when compared to those who took ≥ 10 medications at $p=0.047$ (AOR: 4.8 CI: 1.95, 22.76). Satisfaction with clinician service is also another variable associated with adherence to MPMs, where the odds of adherence to multiple prescribed medicines among participants satisfied with clinician service is 4.9 times (AOR: 3.92 CI: 1.5-10.25) than those who were not satisfied with clinician service at the p-value of 0.005.

The odds of adherence to multiple prescribed medicines among participants live with disease from 1 to 10 years is 79% (AOR: 0.21, CI: 0.05-0.93, $p=0.039$) less when compared with those live with disease at least for 21 years while those who lived with disease for 11-20 adhered 77% (AOR: 0.23, CI: 0.05, 0.99, $p=0.049$) less likely. Similarly, the odds of adherence to MPMs is 7.8 (AOR: 7.85, CI: 1.31-47.3, $p=0.024$) times higher among participants report cost of medications are cheap than those report cost of medications are expensive. The odds of adherence to MPMs is 62% (AOR: 0.38, CI: 0.15-0.96, $p=0.041$) less likely among participants phases medication complexity than participants not facing medication complexity. **Table 4.**

Table 4. Binary and multivariate Logistic Regression among socio-demographic characteristics, disease related factors and factors associated with adherence to MPMs.

Variable	Variable categories	Adherence status to MPM		COR (95% CI)	AOR (CI=95%)	p-value
		No n(%)	Yes n(%)			
Sex	Male	50(21.5)	70(33.0)	.759(.443, 1.30)		
	Female	35(15.0)	71(30.5)	1		
Age	YA 18-40	2(0.9)	17(7.3)	8.05(1.78, 36.5)	4.9(1.82, 12.1)	0.012
	MA 41-60	29(12.4)	74(31.8)	2.42(1.37, 4.27)	1.09(0.49, 2.39)	0.84
	OA≥ 61	54(23.2)	57(24.5)	1 (*)		
Marital status	Married	43(18.5)	111(47.6)	2.93(1.67, 5.16)		
	Single(*)	42(18.0)	37(15.9)	1 (*)		
Religion	Orthodox	51(21.9)	109(46.8)	6.14(1.97, 20.8)	4.37(0.83, 22.9)	0.81
	Muslim	10(4.3)	21(9.0)	6.3(1.62, 24.53)	0.83(0.17, 5.9)	0.34
	Protestant	12(5.2)	14(6.0)	3.5(0.89, 13.76)	1.93(0.35, 7.27)	0.24
	Others	12(5.2)	4(1.7)	1 (*)		
Level of education	Can't R	20(8.6)	17(7.3)	0.32(0.14, 0.72)		
	1 ⁰ (1-8)	31(13.3)	37(15.9)	0.45(0.23, 0.89)		
	2 ⁰ (9-12)	11(4.7)	33(14.2)	1.13(0.49, 2.60)		
	Higher edu	23(9.9)	61(26.2)	1 (*)		
Occupational status	Un employed	38(16.3)	39(16.7)	0.41(0.12, 1.42)		
	Gvt. Employee	9(3.9)	31(13.3)	1.38(0.35, 5.46)		
	Pvt. Employee	15(6.4)	24(10.3)	0.64(0.17, 2.41)		
	Retired	19(8.2)	44(18.9)	0.93(0.26, 3.33)		
	Others	4(1.7)	10(4.3)	1 (*)		
Monthly income	<100	31(13.3)	33(14.2)	0.41(0.22, 0.78)		
	100-499	9(3.9)	7(3.0)	0.30(0.10, 0.88)		
	500-1400	12(5.2)	23(9.9)	0.75(0.33, 1.67)		
	>1400	33(14.2)	85(36.5)	1 (*)		
Place of residence	AA	50(21.5)	117(50.2)	2.64(1.47, 4.75)		
	OutsideAA	35(15.0)	31(13.3)	1 (*)		
BMI	≤24.9	18(7.7)	46(19.7)	2.78(1.36, 5.66)		
	25.0-29.9	29(12.4)	67(28.8)	2.51(1.33, 4.72)		
	≥30	38(16.3)	35(15.0)	1 (*)		
Time since diagnosis	1-10	39(16.7)	72(30.9)	0.51(0.18, 1.49)	0.21(0.05, 0.93)	0.039
	11-20	41(17.6)	58(24.9)	0.39(0.14, 1.14)	0.23(0.05, 0.99)	0.049
	≥21	5(2.1)	18(7.7)	1 (*)		
Number of complication	1-2	41(17.6)	120(51.5)	4.60(2.55, 8.31)		
	≥3	44(18.9)	28(12.0)	1 (*)		

Table 4. Continued

Variables	Variables categories	Adherence status		COR (95% CI)	AOR (95% CI)	p-value
		No n (%)	Yes n (%)			
Views of cost of medicine	Cheap	2(0.9)	14(6.0)	5.80(1.27, 26.6)	7.85(1.31, 47.3)	0.024
	Medium	25(10.7)	64(27.5)	2.12(1.19, 3.79)	1.94(0.86, 4.42)	0.111
	Expensive	58(24.9)	70(30.0)	1 (*)		
Medication complex	Yes	38(16.3)	18(7.7)	0.17(0.09, 0.33)	0.38(0.15, 0.96)	0.041
	No	47(20.2)	130(55.8)	1 (*)		
Presence of SE	Yes	42(18.0)	36(15.5)	0.33(0.19, 0.58)	0.46(0.20, 1.07)	0.071
	No	43(18.5)	112(48.1)	1 (*)		
Follow-up frequency	Variable	20(8.6)	39(16.7)	1.23(0.61, 2.49)		
	1-3 months	34(14.6)	60(25.8)	1.12(0.60, 2.67)		
	4-6months	31(13.3)	49(21.0)	1		
Number of Physician or units	One	40(17.2)	119(51.1)	5.45(1.9, 15.7)	5.40(1.24, 23.5)	0.025
	Two	34(14.6)	23(9.9)	1.24(0.40, 3.83)	4.22(.81, 21.9)	0.086
	Three	11(4.7)	6(2.6)	1 (*)		
open commun.	Yes	72(30.9)	139(59.7)	2.79(1.14, 6.83)		
	No	13(5.6)	9(3.9)	1 (*)		
Presence of assist	Yes	35(15.0)	100(42.9)	2.98(1.71, 5.17)		
	No	50(21.5)	48(20.6)	1 (*)		
Pharmacy available	Yes	21(9.0)	75(32.2)	3.13(1.74, 5.64)		
	No	64(27.5)	73(31.3)	1 (*)		
Instruction clear	Yes	76(32.6)	136(58.4)	1.34(0.54, 3.33)		
	No	9(3.9)	12(5.2)	1		
Satisfaction w service	Yes	51(21.9)	129(55.4)	4.52(2.37, 8.66)	3.92(1.5, 10.25)	0.005
	No	34(14.6)	19(8.2)	1 (*)		
knows physician is capable	Yes	48(20.6)	121(51.9)	4.41(2.01, 9.66)		
	No	16(6.9)	15(6.4)	1.64(0.60, 4.46)		
	don't know	21(9.0)	12(5.2)	1 (*)		
Knows impact	Yes	63(27.0)	133(57.1)	3.10(1.51, 6.370)		
	No	22(9.4)	15(6.4)	1 (*)		
Knows targets	Yes	33(14.2)	115(29.4)	5.49(3.07, 9.84)	7.43(3.21, 17.2)	0.001
	No	52(22.3)	33(14.2)	1 (*)		
Medication number	4-6	42(18.0)	134(57.4)	12.7(4.04, 40.3)	4.8(1.95, 21.88)	0.048
	7-9	27(11/6)	10(4.3)	1.48(0.40, 5.51)	0.94(0.16, 4.83)	0.92
	>=10	16(6.9)	4(1.7)	1 (*)		

(*)= variable is related with bivariate analysis at $p \leq 0.25$, (¥) = unmarried, divorced and widowed, other (**) = catholic, jeova, and Wakefata, other (***) = merchants and students

The reason for non-adherence among those who misses their medication are; forgetting 23(27.1%), having many medicine to take 20(23.5%), running out of medicine 14(16.5%), and away from homes 7(8.2%) were the top reason cited by the respondents. (Figure 5)

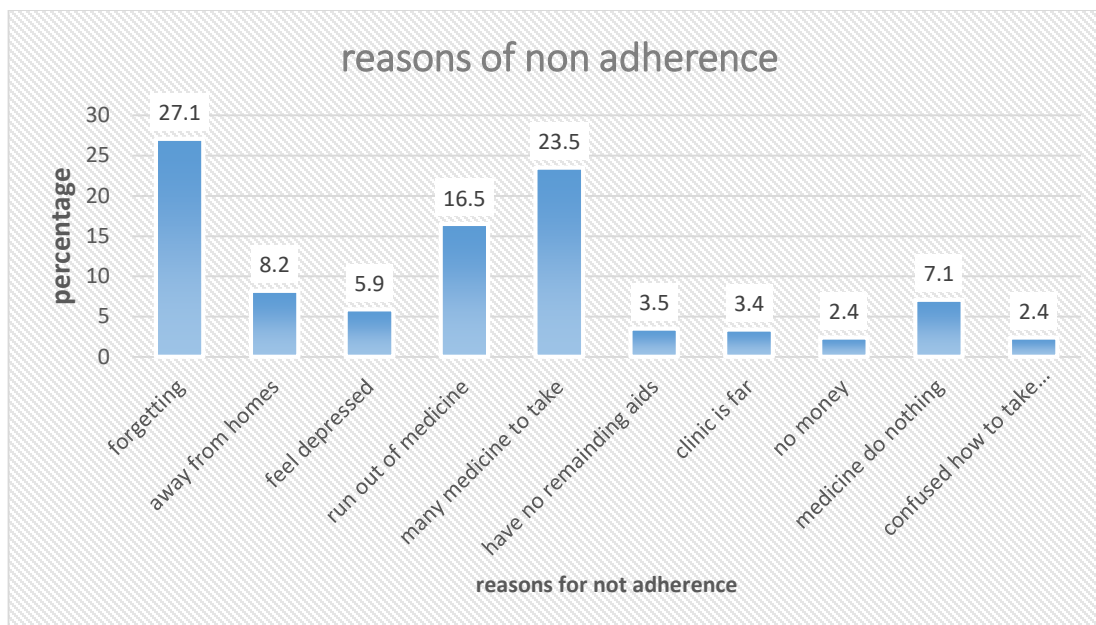


Figure 6. Reasons cited for non-adherence to MPMs among type 2 diabetic patients attending Tertiary hospitals in Addis Ababa, Ethiopia. 2019

8. DISCUSSION

The study was set out to assess the prevalence of and adherence to Multiple Prescribed Medications and its predictors among Type 2 diabetic patients at tertiary hospitals in Addis Ababa, Ethiopia.

According to this study, there was a higher rate of multiple prescription, implying the presence of high diabetes complications, poor diabetes control and inadequate management. Several prior studies have also reported the prevalence of MPMs. Among them, the result from the study conducted among adult patients in Saudi Arabia, where participants use of 4 medications are 54% (43), study conducted in Italy 57.1% (45) and study conducted in Minas Geiras (55) is comparable to our own. The proportion of MPMs in our study participants is higher than the study conducted by Geresu Y. et al. in 2017 (32.5%) (11) this may be because of the definition they used for MPMS/polypharmacy as five or more medications, but less than the study conducted by Alwhaibi M. et al. (78%) in 2018 (2) and the study conducted in south India 82.89% (53). In the current study it is found that the proportion of at least one comorbidity is 304(72.9%). It is plausible that the high rate of multiple prescribed medications in this study is potentially associated with the number of comorbidities among the study participants.

This study showed that multiple prescribed medications is common among study participants, one of the reason for such high proportion of MPMs is the patients failure to control body weight. This association could be because of obesity is associated with the common disease like hypertension and dyslipidemia which needs one or more medicines to treat each disease and it is also associated with the decrement of sensitivity of the cells and muscle that needs additional drugs. This finding is similar with the finding of the study conducted in English Longitudinal Study of Aging (ELSA) in 2018 (12) and Italy in 2016 but, unlike this study there is no significant association between MPMs and age by the current study (45).

According to our study finding, advanced education has effect on MPM, which implies as educational status increase the age will also advance hence number of diabetic complications also increase, this is differs from study found from excessive polypharmacy by Riecerts 2018 (38) which suggests being ≥ 85 years old was significantly associated with a lower risk for excessive polypharmacy. This difference may be because of the study participants took part in the study in which study participants are the older adult in their study, but, the present study

result is in line with this study in which both study found as there is an association between prevalence of MPMs and the number of diagnosis/complications. Current study confirms that number of complication the patients develops were associated with the higher occurrence of multiple prescribed medicines, this may be because complication may come from obesity, longer duration of stay with disease, increased age, and suboptimal adherence to medication which needs treatment each.

Some study reports female uses multiple medicines when compared with men (45) but, our study found that, there is no association between gender and uses of Multiple Prescribed Medications. Cross-sectional study conducted in English Longitudinal Study of Aging (ELSA) in 2018 supported the finding of the present study (12).

The study also revealed that, there is suboptimal adherence (>80% criterion) (67) to MPMs 148(63.5%) among study participants. This implies 36.5% of the patients are not taking their medicines as per prescription. This could affect the quality of life, quality of care and associated with complication and drug resistance. This can also needs additional treatments which burden with health care cost. The result of the present study is similar with study result from retrospective study conducted in Cyprus 2016 (60.9%) (58). But the finding is higher than study finding conducted in Indian Hospital 51.7% (26) and the study conducted by Sontakke 2015 (26%) (40). The difference may be related to the study participants and the gap between the years of study.

In contrast to this the result of the present study was lower than study conducted in Greece 2018 (41) and the study conducted in Boston Hospital were the means of 7-day adherence was 6.7 ± 1.1 (37). The difference could be because they use the short period of adherence measuring means (seven-day adherence) and the time frame.

Study showed that Advancing age decreases the degree of adherence to prescribed medications. This implies that, patients with advanced age uses multiple medication because of their poor adherence to prescribed medications. This could be related to being busy with work and forgetting which is increased with advanced age. The finding of our study is similar with the finding of study conducted retrospectively from 2006 to 2009 (47) and contradicts with mixed study conducted in Riyadh, Saudi Arabia (48). Similarly, there is an association between time since diagnosis and adherence to MPMs were adherence decreases when patients stay long with

the disease for the long time which contradicts with the study conducted in U.S in 2015 were new to diabetes therapy were associated with non-adherence (68)

The study also revealed that adherence decreases among multiple medication users when compared with those with relatively lower medication. This is similar with the study conducted by Jarab in 2014 (60) Austin and Rogers P. in 2006 (44) and Sweileh 2003 (46). The association may be because of, as medication increases there is a chance of missing medication, increased cost (expensiveness) and side effects of the medication, but, this contradicts the finding of a cohort study on an evaluation of polypharmacy which says “high likelihood of adherence were among cohorts with multiple medications than those with non-multiple medicine cohort” (56) this may be because of different study design selected for the two study.

Similarly, the finding of the present study revealed that cost out of pocket for medication affects adherence to MPMs by participants who reports the cost of medications are cheap were associated with high adherence to prescribed medications. This is in line with the study conducted in U. S in 2015 (68) and the study conducted by Sontakke in 2015 (40) that says lower out of pocket is associated with adherence. This finding is supported by the reasons for non-adherence in this study, which says taking multiple medicines and expensiveness of the medications as reasons for non-adherence.

According to present study result, participants who knows the targets of glycemic control is more likely adhered than those study participants who didn't know the targets of glycemic control. This association may be related to poor diabetic self-managements and absence of daily based monitoring of glucose. This is similar with proposed holistic conceptual framework on barriers to medication adherence among diabetes in 2017 (49) which suggests knowing the targets of glycemic control is indicators for adherence to multiple prescribed medicines.

The study also showed that, adherence were high among participants visiting one unit and two units when compared to those visiting three and above units. This could because of the approach of the different prescribers, repetition of similar drug classes, different follow up and pill burden that may affect the patients' adherence level. This is similar with retrospective observational study when the patient receiving medication for diabetes and hypertension from the same physician were associated with high adherence (47).

Additionally, the study also revealed that satisfaction with clinician service is predictors of adherence to multiple prescribed medications, were the participants satisfied with the clinician service were more likely adhered than those unsatisfied. The rationale may be because the acceptance to apply prescription is based on treatment satisfaction and clinician approach while educating the patients on adherence to medication and effective therapeutic relationship and diabetic education.

According to this study the most frequently cited reasons for non-adherence/missing of medications were forgetting, having many medicine to take and running out of medicine. This is similar with study finding by Sontakke in 2015 were forgetfulness and unawareness about needs of each medicine were the prevalent reasons for non-adherence (40).

In this study, hypertension and dyslipidemia are the most frequent concomitant disease with diabetes patients. The study result is similar with the study finding conducted by Indu et al. 2018 in which hyperlipidemia and hypertension (69) were prevalent concomitant complication among diabetic patients. This finding is supported by the fact that increasing BMI (obesity) which is common in this study result is the leading cause of hypertension and dyslipidemia which increase the propensity of cardiovascular disorders among diabetic patients.

Type 2 diabetic patients are prescribed with multiple medications to treat and prevent concomitant disease. In the present study, the class of drugs most commonly prescribed were those used to control blood pressure levels in addition to Anti diabetic medication. Among prescribed medications metformin, NPH, and glabiclamide are most frequently prescribed anti diabetic medications, while Enalapril, Atorvastatin, and Aspirin are the prevalent medicines prescribed as anti-hypertensive, anti-dyslipidemia and anti-platelet respectively. This implies that, there are high proportion of hypertension and dyslipidemia among type 2 diabetes mellitus patients. The study conducted in India in 2018 which suggests 'Metformin, and Atorvastatin are the drug of choice for the treatments of diabetes and dyslipidemia' supported this result (69).

9. STRENGTH AND LIMITATION OF THE STUDY

9.1. Strength

This study was conducted among type 2 diabetic patients to assess the prevalence of and Adherence to Multiple Prescribed Medications and its predictors at tertiary hospitals in Addis Ababa and have the following strength: The study has 98.8% response rate and uses face to face interview which prevent ambiguity, used for data completeness and minimize recall bias. In addition, the study used MMAS-8 to measure adherence which is suggested by many studies to study diabetes and other chronic disease adherence. Furthermore, we have used adequate sample size to minimize sampling errors. Moreover, extraction of data were from the patient, patient's medical record number and through physical assessments. Furthermore, findings from this study added to the existing literature on the prevalence and adherence to multiple prescribed medications among all age groups and identified the individuals who have a high risk for multiple medicine use and non-adherence to multiple medicines.

9.2. Limitation

Even though some attempt is taken to minimize limitation, this study have some sort of limitation. The study uses cross sectional study design in which direction of causality cannot be assessed. In addition, the study used only the concurrent prescribed medication (medication used currently) used as standing and regular dose for the last one month or since the last follow up. This exclude medication taken without prescription/ over counter drug and medication for short period of time, thus this all may underrated the prevalence of MPMs and hence can affect adherence to medication. Furthermore, Even though the study setting is tertiary hospitals which accepts all round nation patients as referral, it lacks generalizability to all patients with diabetes and we cannot exclude selection bias. Moreover, the study uses only medication adherence which doesn't include another diabetic management option like diet and exercise adherence. There is also inadequate literature, especially national literature to compare and discuss the results. Another were, Adherence measuring option is self-report, which is subject to respondents and recall bias by over rating adherence to avoid disapproval from health care provider. Finally, many study suggests HgA1c is better to see the previous adherence status which is not feasible in this due to cost ineffective.

10.CONCLUSION AND RECOMMENDATION

10.1. Conclusion

Type II DM gets complicated in many of the patients with it (as multiple prescribed medications are used to manage the complications) making proportion of multiple prescription high. This is associated with BMI, number of complications and higher educational status. Adherence to multiple prescribed medications among diabetics continues to be low. A number of important predictors to multiple prescribed medications adherence in type 2 diabetics were identified in this study. Such predictors could help develop policies for improving adherence in diabetics.

10.2. Recommendation

Based on the findings of this study the following recommendations were forwarded for Nurse Educator, adherence supporter, Patients, physicians, policy makers and future researchers.

Nurse educator

It is recommended that nurses should educate patients on the role of multiple medications in chronic disease like diabetes, Educates on targets of glycemic control for glucose self-monitoring among diabetic patients. Recommending self-glucometer if possible to assess their glucose on the daily basis and educate on exercise and diets to manage weight in ideal range to further decrease concomitant complications. They should also include the patient in decision making to facilitate active participation in controlling the disease progress from fatal incurable to chronic manageable disease.

Adherence supporter

We recommend nurses to counsel patients with diabetes on the role of adherence, benefits of multiple prescriptions in chronic disease and targets of glycemic control. It is also recommended that nurses should be cautious when dealing with older patients to take attention and give counselling how to remember taking of all medication among older patients. This will be assured by using reminding aids and persons in the family as a person who gives medicines regularly. Effort should also be made to encourage patients to stick to their medication.

Policy makers and administrators

We would like to recommend hospitals administrators to minimize the units and number of prescribers to make the instruction is fair and clear for the patient if possible or to make the record of the patients online system like “I care” especially in Defense force specialized hospitals and St. Paulo’s Millennium and Medical Hospitals in which prescribers of any units can assess the patients history and drugs to minimize double prescription and drug-drug interaction which can affect adherence. It is also recommended that it is better if policy makers works with Food and Drug Agency (FDA) to formulate Fixed Dose Combination (FDC) to decrease pill burden that affects number of prescribed medication and its adherence. We also recommends the government and hospital administrators to work on availability of medicines

and to work on how to help patients to get free medication as cost is another adherence hindering factors.

Patients

It is recommended that the patient should strictly follows the instruction of the health provider accordingly. It is also recommended that, they should work on controlling weight through diet and exercise to facilitate tissue sensitivity to insulin, to decrease concomitant complication related to obesity like hypertension and dyslipidemia. To use reminding aids to not forget their medications and glucose self-monitoring on the daily basis.

Physician

We recommend positive professional relation with the patients, to educate patients on the role of multiple indicated medications, and the consequence of non-adherence in the health of the patients. To advice on self-glucose monitoring. It is also better if they consider the medicines which is cost effective.

Future researcher

This study was institutional based cross sectional study design on tertiary hospitals. We recommended the future researchers to conduct on similar topic by using different approach like including both subjective and objective means of adherence measuring option. We also recommend them to include general hospitals patients and including different tests like HgA1C which suggests the glycemic control of long duration and to conduct exploratory works to determine causality behind the association. It is also recommended that if another research is conducted by incorporating Medications, Diet, Exercise and Glucose self-management.

11.REFERENCE

1. Salih SB, Yousuf M, Durihim H, Almodaimegh H, Tamim H. Prevalence and associated factors of polypharmacy among adult Saudi medical outpatients at a tertiary care center. *Journal of family & community medicine*. 2013;20(3):162.
2. Alwhaibi M, Balkhi B, Alhawassi TM, Alkofide H, Alduhaim N, Alabdulali R, et al. Polypharmacy among patients with diabetes: a cross-sectional retrospective study in a tertiary hospital in Saudi Arabia. *BMJ open*. 2018;8(5):e020852.
3. Williams A, Manias E, Walker R. Interventions to improve medication adherence in people with multiple chronic conditions: a systematic review. *Journal of advanced nursing*. 2008;63(2):132-43.
4. Whiting DR, Guariguata L, Weil C, Shaw J. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes research and clinical practice*. 2011;94(3):311-21.
5. Abebaw M, Messele A, Hailu M, Zewdu F. Adherence and associated factors towards antidiabetic medication among type II diabetic patients on follow-up at University of Gondar Hospital, Northwest Ethiopia. *Advances in Nursing*. 2016;2016.
6. Atlas D. International diabetes federation. Press Release, Cape Town, South Africa. 2006;4.
7. Inamdar S, Kulkarni R, Karajgi S, Manvi F, Ganachari M, Kumar BM. Medication Adherence in Diabetes Mellitus: An Overview on Pharmacist Role. *Open Journal of Advanced Drug Delivery*. 2013;1(3):238-50.
8. Marcum ZA, Gellad WF. Medication adherence to multidrug regimens. *Clinics in geriatric medicine*. 2012;28(2):287-300.
9. Williams AF, Manias E, Walker R. Adherence to multiple, prescribed medications in diabetic kidney disease: A qualitative study of consumers' and health professionals' perspectives. *International journal of nursing studies*. 2008;45(12):1742-56.
10. Duerden M, Avery T, Payne R. Polypharmacy and medicines optimisation. Making it safe and sound London: The King's Fund. 2013.
11. Geresu G, Yadesa T, Abebe B. Polypharmacy and the Contributing Factors Among Elderly Patients in Shashemene Referral Hospital, West Arsi, Oromia Region, Ethiopia. *J Bioanal Biomed*. 2017;9:277-82.
12. Slater N, White S, Venables R, Frisher M. Factors associated with polypharmacy in primary care: a cross-sectional analysis of data from The English Longitudinal Study of Ageing (ELSA). *BMJ open*. 2018;8(3):e020270.
13. Anusri Unni T. LMKaVT. IMPACT OF POLYPHARMACY ON MEDICATION ADHERENCE IN PATIENT WITH TYPE 2 DIABETES MELLITUS *WORLD JOURNAL OF PHARMACY AND PHARMACEUTICAL SCIENCES* 2017;6(11):1394-400
14. Cooper JA, Cadogan CA, Patterson SM, Kerse N, Bradley MC, Ryan C, et al. Interventions to improve the appropriate use of polypharmacy in older people: a Cochrane systematic review. *BMJ open*. 2015;5(12):e009235.
15. Patterson SM, Cadogan CA, Kerse N, Cardwell CR, Bradley MC, Ryan C, et al. Interventions to improve the appropriate use of polypharmacy for older people. *Cochrane Database Syst Rev*. 2014;10(10).
16. Priyanka T, Lekhanth A, Revanth A, Gopinath C, Babu SC. Effect of polypharmacy on medication adherence in patients with type 2 diabetes mellitus. *Indian Journal of Pharmacy Practice*. 2015;8(3):127.
17. Bauer S, Nauck M. Polypharmacy in people with Type 1 and Type 2 diabetes is justified by current guidelines—a comprehensive assessment of drug prescriptions in patients needing inpatient treatment for diabetes-associated problems. *Diabetic Medicine*. 2014;31(9):1078-85.
18. Cadogan CA, Ryan C, Francis JJ, Gormley GJ, Passmore P, Kerse N, et al. Development of an intervention to improve appropriate polypharmacy in older people in primary care using a theory-based method. *BMC health services research*. 2016;16(1):661.
19. Peron EP, Ogbonna KC, Donohoe KL. Antidiabetic medications and polypharmacy. *Clinics in geriatric medicine*. 2015;31(1):17-27.
20. Waheed S, Jamal M, Amin F. POLYPHARMACY AND MEDICATION COMPLIANCE IN PATIENTS WITH TYPE 2 DIABETES. *International Journal of Pharmaceutical Sciences and Research*. 2017;8(5):2298-301.
21. Cadogan CA, Ryan C, Hughes CM. Appropriate polypharmacy and medicine safety: when many is not too many. *Drug safety*. 2016;39(2):109-16.

22. Muth C, Blom JW, Smith SM, Johnell K, Gonzalez-Gonzalez AI, Nguyen TS, et al. Evidence supporting the best clinical management of patients with multimorbidity and polypharmacy: a systematic guideline review and expert consensus. *Journal of Internal Medicine*. 2018.
23. Sinnott C, Bradley CP. Multimorbidity or polypharmacy: two sides of the same coin? : SAGE Publications Sage UK: London, England; 2015.
24. Patton DE, Hughes CM, Cadogan CA, Ryan CA. Theory-based interventions to improve medication adherence in older adults prescribed polypharmacy: a systematic review. *Drugs & aging*. 2017;34(2):97-113.
25. Hilbink M, Lacroix J, Bremer-van der Heiden L, van Halteren A, Teichert M, van Lieshout J. Effectiveness of a medication-adherence tool: study protocol for a randomized controlled trial. *Trials*. 2016;17(1):274.
26. Mathew EM, Rajiah K. Assessment of medication adherence in type-2 diabetes patients on polypharmacy and the effect of patient counseling given to them in a multispecialty hospital. *Journal of basic and clinical pharmacy*. 2013;5(1):15.
27. Mair A, Fernandez-Llimos F, Alonso A, Harrison C, Hurding S, Kempen T, et al. Polypharmacy management by 2030: a patient safety challenge. 2017.
28. Alfian SD, Sukandar H, Lestari K, Abdulah R. Medication adherence contributes to an improved quality of life in type 2 diabetes mellitus patients: a cross-sectional study. *Diabetes Therapy*. 2016;7(4):755-64.
29. Marathe PH, Gao HX, Close KL. American Diabetes Association Standards of Medical Care in Diabetes 2017. *Journal of diabetes*. 2017;9(4):320-4.
30. Kanta Kumar SG, Karim Raza, Paramjit Gill, Rebecca Stack. Understanding adherence-related beliefs about medicine amongst patients of South Asian origin with diabetes and cardiovascular disease patients a qualitative synthesis. *BMC Endocrine disorder*. 2016;16(24).
31. Zheng Y, Ley SH, Hu FB. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. *Nature Reviews Endocrinology*. 2018;14(2):88.
32. Habte BM, Kebede T, Fenta TG, Boon H. Barriers and facilitators to adherence to anti-diabetic medications: Ethiopian patients' perspectives. *African journal of primary health care & family medicine*. 2017;9(1):1-9.
33. Abebe N, Kebede T, Addise D. Diabetes in Ethiopia 2000-2016—prevalence and related acute and chronic complications; a systematic review. *African Journal of Diabetes Medicine*. 2017;25(2).
34. Iglay K, Hannachi H, Joseph Howie P, Xu J, Li X, Engel SS, et al. Prevalence and co-prevalence of comorbidities among patients with type 2 diabetes mellitus. *Current medical research and opinion*. 2016;32(7):1243-52.
35. Lin P-J, Kent DM, Winn A, Cohen JT, Neumann PJ. Multiple chronic conditions in type 2 diabetes mellitus: prevalence and consequences. *Am J Manag Care*. 2015;21(1):e23-34.
36. Gadsby R, Galloway M, Barker P, Sinclair A. Prescribed medicines for elderly frail people with diabetes resident in nursing homes—issues of polypharmacy and medication costs. *Diabetic Medicine*. 2012;29(1):136-9.
37. Grant RW, Devita NG, Singer DE, Meigs JB. Polypharmacy and medication adherence in patients with type 2 diabetes. *Diabetes care*. 2003;26(5):1408-12.
38. Rieckert A, Trampisch US, Klaaßen-Mielke R, Drewelow E, Esmail A, Johansson T, et al. Polypharmacy in older patients with chronic diseases: a cross-sectional analysis of factors associated with excessive polypharmacy. *BMC family practice*. 2018;19(1):113.
39. Jaam M, Awaisu A, Ibrahim MIM, Kheir N. A holistic conceptual framework model to describe medication adherence in and guide interventions in diabetes mellitus. *Research in Social and Administrative Pharmacy*. 2018;14(4):391-7.
40. Sontakke S, Jadhav M, Pimpalkhute S, Jaiswal K, Bajait C. Evaluation of adherence to therapy in patients of type 2 diabetes mellitus. *Journal of Young Pharmacists*. 2015;7(4):462.
41. Geitona M, Latsou D, Toska A, Saridi M. Polypharmacy and Adherence Among Diabetic Patients in Greece. *The Consultant Pharmacist®*. 2018;33(10):562-71.
42. da Silva MRR, Diniz LM, dos Santos JBR, Reis EA, da Mata AR, de Araújo VE, et al. Drug utilization and factors associated with polypharmacy in individuals with diabetes mellitus in Minas Gerais, Brazil. *Ciência & Saúde Coletiva*. 2018;23(8):2565-75.
43. Balkhi B, Alqahtani N, Alwhaibi M, Alshammari TM, Alhawassi TM, Mahmoud MA, et al. Prevalence and factors associated with polypharmacy use among adult patients in Saudi Arabia. *Journal of patient safety*. 2018.

44. Austin RP. Polypharmacy as a risk factor in the treatment of type 2 diabetes. *Diabetes Spectrum*. 2006;19(1):13-6.
45. Noale M, Veronese N, Perin PC, Pilotto A, Tiengo A, Crepaldi G, et al. Polypharmacy in elderly patients with type 2 diabetes receiving oral antidiabetic treatment. *Acta diabetologica*. 2016;53(2):323-30.
46. Sweileh W, Aker O, Hamooz S. Effect of 'polypharmacy' and 'frequency' of drug dosing on rate of compliance among diabetic and hypertensive patients: a survey study in Palestine. *An-Najah Univ J Res*. 2003;17:155-65.
47. An J, Nichol MB. Multiple medication adherence and its effect on clinical outcomes among patients with comorbid type 2 diabetes and hypertension. *Medical care*. 2013;51(10):879-87.
48. Aloudah NM, Scott NW, Aljadhey HS, Araujo-Soares V, Alrubeaan KA, Watson MC. Medication adherence among patients with Type 2 diabetes: A mixed methods study. *PloS one*. 2018;13(12):e0207583.
49. Jaam M, Awaisu A, Ibrahim MIM, Kheir N. Factors influencing medication adherence in diabetes mellitus: Developing a holistic conceptual framework model. *Research in Social and Administrative Pharmacy*. 2017;30:1e7.
50. Jaam M, Ibrahim MIM, Kheir N, Awaisu A. Factors associated with medication adherence among patients with diabetes in the Middle East and North Africa region: a systematic mixed studies review. *Diabetes research and clinical practice*. 2017;129:1-15.
51. Kirkman MS, Rowan-Martin MT, Levin R, Fonseca VA, Schmittiel JA, Herman WH, et al. Determinants of adherence to diabetes medications: findings from a large pharmacy claims database. *Diabetes Care*. 2015;dc142098.
52. Murphy DA, Sarr M, Durako SJ, Moscicki A-B, Wilson CM, Muenz LR. Barriers to HAART adherence among human immunodeficiency virus-infected adolescents. *Archives of pediatrics & adolescent medicine*. 2003;157(3):249-55.
53. Kumaraswamy M, Chitti R, Acharya A, CH V, Dhakal K, Rayamajhi M, et al. Incidence of Polypharmacy in Type 2 Diabetic Patients in a Rural Tertiary Care Teaching Hospital in South India. *drugs*. 26:17.1.
54. Papazafiropoulou A, Koutsovasilis A, Pappas S, Bousboulas S. Rates of polypharmacy among patients with type 2 diabetes mellitus in Greece. *Arch Hellen Med*. 2014;31:750-2.
55. Rozenfeld S, Fonseca MJ, Acurcio FA. Drug utilization and polypharmacy among the elderly: a survey in Rio de Janeiro City, Brazil. *Revista Panamericana de Salud Pública*. 2008;23:34-43.
56. Chen SY. AV, Lee YC., Greene M., Oderda G. . EVALUATION OF POLYPHARMACY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AND ITS ASSOCIATION WITH MEDICATION ADHERENCE AND HEALTH CARE COSTS VALUE IN HEALTH 2013;16(-):A1-A298.
57. D Piette J, Heisler M, Harand A, Juip M. Beliefs about Prescription Medications among Patients with Diabetes: Variation Across Racial Groups and Influences on Cost-Related Medication Underuse 2010. 349-61 p.
58. Geitona M, Latsou D, Georgiou A, Panayidis N. Polypharmacy and Medication Adherence in Elderly Patients with Diabetes in Pafos General Hospital, Cyprus. *Value in Health*. 2016;19(7):A684.
59. Gunathilake G, Kottahachchi D, Siyambalapitiya S. The drug compliance among patients with diabetes in Sri Lankan setting. 2017.
60. Jarab AS, Almrayat R, Alqudah S, Thehairat E, Mukattash TL, Khmour M, et al. Predictors of non-adherence to pharmacotherapy in patients with type 2 diabetes. *International journal of clinical pharmacy*. 2014;36(4):725-33.
61. Ababa A. Addis Ababa health bureau report. 2017.
62. Hospital TAS. Tikur Anbessa Specialized hospital and nursing directorate report. . Dec 2017.
63. college SPsmhm. Saint Paulo's millennium hospital medical college (SPHMMC) report. . <https://www.sphmmc>. 2017.
64. hospita Tsac. Torayloch specialized and comprehensive hospital. matron nurse office report. 2017.
65. Plakas S, Mastrogiannis D, Mantzorou M, Adamakidou T, Fouka G, Bouziou A, et al. Validation of the 8-item Morisky Medication Adherence Scale in chronically ill ambulatory patients in rural Greece. *Open Journal of Nursing*. 2016;6(03):158.
66. Mohd MMA-H, Phung H, Sun J, Morisky DE. The predictors to medication adherence among adults with diabetes in the United Arab Emirates. *Journal of Diabetes & Metabolic Disorders*. 2015;15(1):30.

67. Basak R, McCaffrey I, David J, Bentley JP, Przybyla SM, West-Strum D, Banahan BF. Adherence to multiple medications prescribed for a chronic disease: a methodological investigation. *Journal of Managed Care Pharmacy*. 2014;20(8):815-23.
68. Kirkman MS, Rowan-Martin MT, Levin R, Fonseca VA, Schmittdiel JA, Herman WH, et al. Determinants of adherence to diabetes medications: findings from a large pharmacy claims database. *Diabetes care*. 2015;38(4):604-9.
69. Indu R, Adhikari A, Maisnam I, Basak P, Sur TK, Das AK. Polypharmacy and comorbidity status in the treatment of type 2 diabetic patients attending a tertiary care hospital: An observational and questionnaire-based study. *Perspectives in clinical research*. 2018;9(3):139.

12.ANNEX-

ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCE, SCHOOL OF NURSING AND MIDWIFERY, POST GRADUATE PROGRAM, DEPARTMENT OF ADULT HEALTH NURSING

QUESTIONNAIRES' FORMAT FOR RESPONDENTS ON MULTIPLE PRESCRIBED MEDICATION ADHERENCE AND ITS ASSOCIATED FACTORS AMONG TYPE 2 DIABETIC PATIENT VISITING DIABETIC CLINIC OF SELECTED ADDIS ABABA HOSPITALS.

Appendix I: Information Sheet

Introduction: Good morning/good afternoon! My name is _____ and I come from _____. I am working as data collectors on the study of Multiple Prescribed Medication Adherence among Type 2 Diabetic Patient Visiting Diabetic Clinic of Addis Ababa Hospitals. The study is being conducted by Mr. Aman Mamo who is an MSc student in Adult health nursing specialty at Addis Ababa University.

Objective: To determine the level of Adherence to Multiple Prescription Medication among Type 2 Diabetic Patients visiting Diabetic Clinic of Addis Ababa tertiary Hospitals. 2018/19". You are being asked to take part in this study and to respond genuinely. This questionnaire asks about demographic factors, the number of medication you took for your disease and adherence status of your medication. It will take approximately 25 minutes to complete the questionnaire.

Participation: Your participation is voluntary and you are not obligated to answer any question you do not wish to answer. If you feel discomfort with the question, it is your right to drop it any time you want without penalty.

Risks and Benefits: This study doesn't benefit you directly, however, your honest answer to these question will help us to understand better how patients are adhering to their diabetic and related treatment and factors associated with multiple prescriptions. This finding will also help to develop good strategies and to solve the problems of the future, we greatly appreciate your truthful and ken participation in responding to these questions. There is no harm or discomfort

including physical, psychological and social risks to you, except the time spent on completing the questionnaire.

Confidentiality: personal information will be identified with in the data processing only. Your name will not be needed in this form and will never be used in connection with any information you tell us. All information given by you will be kept strictly confidential. The collected data will only be used for the purpose of the study.

Person to contact: If you have questions regarding this study or would like to be informed of the results after its completion, please feel free to contact the principal investigator using the following address.

Address of the principal investigator:

Cell phone: +251966889998/ Email: amanmamo68@gmail.com

Data collector's name_____ Signature_____Date_____

THANK YOU VERY MUCH FOR YOUR COOPERATION

Are you willing to participate in the interview? Yes/No

IF NO, thank you

IF YES, Consent Form

CONSENT FORM

I have been briefly informed about the study and I clearly understood the purpose, risks, benefit, and the right to participate and withdraw at any time. I have also informed that there is no direct financial benefit for my participation. Since it doesn't affect my personal life, I don't need any remedy. Consequently, I am willing to participate in the study.

ID NO.....

Interviewer name..... Supervisor..... Date of interview.....

Appendix II: English Questionnaire

Section 1. Socio Demographic Characteristics of study participants related to diabetic and diabetic related disease.

NO	Questions	Coding categories
101	Sex	1 male 2 female
102	What is your age in years?	
103	What is your marital status?	1 unmarried 2 married 3 divorced 4 widowed
104	What is your religion?	1 Muslim 2 Orthodox 3 Catholic 4 Protestant 5 Others (specify)
105	What is your level of education?	1 unable to read and write 2 can read and write 3 grade 1-8 4 grade 9-12 5 diploma 6 degrees and above
106	What is your Current occupational status?	1 gov't employee 2 un employed 3 private employee 4 students 5 merchants 6 others specify -----
107	Your approximate Monthly income (ET Birr)?	1 < 100 2 100-499 3 500-1400 4 >1400
108	What is your place of residence?	1 Addis Ababa 2 outside Addis Ababa
Questionnaire to be filled by interviewing the patient or from the patient's medical records		
109	Weight	----- (in KG)
110	Height	----- (in meter)
111	Time since diagnosis of the disease in years	____ (in years)
112	Is there any complication of the disease (diabetes) diagnosed	1. Yes 2. No
113	If, Yes for Q114 which types of chronic disease diagnosed in addition to T2DM (list disease)	_____
114	List of medication used regularly by the patient including Anti diabetic medication in kinds	_____ _____ _____

115	Number of medication taken by the patient for the past 1 months or since last follow up.	-----
If the patient took less than four medications, Thank the patient and finish the study. If four and above proceed to the next section		

SECTION 2. Morisky Medication Adherence scale-8 items(65, 66) measurements of study participants.

Code	Morisky Medication Adherence scale-8 item questionnaire	1. Yes	2. No
201	Do you sometimes forget to take your all diabetic and diabetic related pills?		
202	Over the past two weeks, were there any days when you did not take your regular daily medicine?		
203	Have you ever cut back or stopped taking your medication without telling your doctor, because you felt worse when you took it?		
204	When you travel or leave home, do you sometimes forget to bring along your medications ?		
205	Did you take all your medicine yesterday?		
206	When you feel like your disease is under control, do you sometimes stop taking your medicine?		
207	Taking medication every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?		
208	How often do you have difficulty remembering to take all your medication?	0 never/rarely 1 ones a while 2 sometimes 3 usually 4 all the time	

SECTION 3. Questionnaire to assess factors associated with adherence to multiple prescribed medication among Type 2 diabetic patients attending diabetic clinic of Addis Ababa tertiary hospitals, 2019.

	Questions	Coding categories
Questionnaire used to assess medication related factors		
301	Do you take all your medicines regularly according to doctors order?	1. Yes 2. No 3. I don't remember
302	If your answer for Q301 is yes skip to 303 , if Q301 is no what was/were the reasons for not taking the prescribed medicines regularly? More than one answer is possible	1. I was too busy with other thing or simply forget 2. I was away from homes 3. I feel depressed 4. I ran out of medication 5. I had many medicines to take 6. I felt the drug is to toxic (side effects) 7. I have no remaining aids and supporting family in my homes 8. The clinic is far from my house 9. I have no money to go to the clinic 10. I did not think the drug is doing anything to improve my health. 11. I am confused about how to take my medicine at a time.
303	What do you think about the cost of your medications?	1. Cheap 2. Medium 3. Expensive
304	Is the medication you took is complex or confusing to take?	1. Yes 2. No

305	If Yes for Q304, what makes your medication complex to you? More than one answer is possible	1. Its color 2. Its frequency 3. Number of injection 4. Methods of administration 5. Others specify-----
306	Have you faced complication while you take your medication? If <u>no</u> to Q305 skip to Q308	1. yes 2. no
307	Which side effects do you encounter commonly? (more than one answer is possible)	-----
308	What measures do you take against the side effects/complication?	1. took until appointments 2. immediately report to professional 3. immediately stop until an appointment
Questionnaire used to assess health care related factors		
309	How frequent you visit your physician?	1. Every month 2. Every two months 3. Every three months 4. Variable 5. Others
3010	From how many physicians/units you took your medicines?	1. one 2. Two 3. Three 4. Others----
3011	Do you have open communication with health care provider treating you?	1. Yes 2. No
3012	Do you obtain education or assistance you need during your clinic visits?	1. yes 2. no
3013	Do you have access to reliable pharmacy any time you want?	1. yes 2. no
3014	Is the instruction given by Pharmacists understandable?	1. Yes 2. No
Questionnaire used to assess factors related to Perceived knowledge and beliefs of the patients		
3015	Are you satisfied with your clinician services	1. Yes

		2. No
3016	Do you feel health care provider treating you is capable?	1. Yes 2. no
3017	Do you know the consequence of non-adherence?	1. Yes 2. No
3018	Do you know the targets of your glycemic control?	1. Yes 2. No
3019	Do you think the medication you took is effective for your disease?	1. Yes 2. No
3020	Do you intend to take the prescribed medicines regularly according to the doctors order in the future?	1. Yes 2. No 3. I am not sure

Thank you for your cooperation

Appendix III: Amharic Version Questionnaire

አዲስ አበባ ዩኒቨርሲቲ፣ የጤና ሳይንስ ኮሌጅ፣ የነርቪንግ እና ሚድዋይሬሪ ትምህርት ቤት ፣ የድህረ ምረቃ ፕሮግራም፣ የአዋቂዎች የ ጤና ነርቪንግ ትምህርት ክፍል

በብዙዎቹ የሚታዘዙ መድሃኒቶች መጠንን እና ክትትልን በተመለከተ በተመረጡ የአዲስ አበባ ሆስፒታሎች ህክምናቸውን ለሚከታተሉ የዓይነት 2 ስኳር ህመማን የተዘጋጀ መጠይቅ ፡፡

አባሪ I: የመረጃ ሠንጠረዥ

መግቢያ: እንደምን አደሩ/ እንደምን ዋሉ ስሜ _____ ሲሆን የመጣሁት ከ _____ ነው ፡፡ እኔ በብዙዎቹ የሚታዘዙ መድሃኒቶች መጠንን እና ክትትልን በተመለከተ በተመረጡ የአዲስ አበባ ሆስፒታሎች ክሊኒኮች ውስጥ ህክምናቸውን በሚከታተሉ የዓይነት 2 ስኳር ህመማን ላይ በመረጃ ሰብሳቢነት በመስራት ላይ ነኝ ፡፡ ጥናቱ በአዲስ አበባ ዩኒቨርሲቲ የአዋቂዎች የጤና ነርቪንግ ትምህርት ክፍል የ2ኛ ዲግሪ ተማሪ በሆነው በአቶ አማን ማሞ እየተካሄደ ነው ፡፡

ዓላማ: የዚህ ጥናት ዓላማ በብዙዎቹ የሚታዘዙ መድሃኒቶች መጠንን እና የክትትልን ደረጃን ለማወቅ ነው፡፡ በዚህ ጥናት ውስጥ እንዲሳተፉ እና ከልብ ምላሽ እንዲሰጡ ይጠየቃሉ ፡፡ ይህ መጠይቅ ስለ ስነ ህዝብ፣ ለህመምዎ ስለሚወስዱት የመድኃኒት ብዛትና የመድኃኒት ክትትልዎን ሁኔታ ይጠይቃል ፡፡ መጠይቁን ለማጠናቀቅ ወደ 25 ደቂቃ ያህል ይወስዳል፡፡

ተሳትፎ: ተሳትፎዎ በፈቃደኝነት ስለሆነ ለመመለስ የማይፈልጉትን ማንኛውም ጥያቄ ለመመለስ አይገደዱም ፡፡ በጥያቄዎቹ ምሽት ካልተሰማዎት በፈለጉ ጊዜ ያለምንም ቅጣት ማቋረጥ መብትዎ ነው ፡፡

አደገኛ ሁኔታዎችና ጥቅማ ጥቅሞች: ይህ ጥናት በቀጥታ እርስዎን ላይጠቅምዎ ይችላል፤ ነገር ግን ትክክለኛ ምላሽዎ ታካሚዎች ለስኳር በሽታ እና ለተያያዙ ሕክምናዎቻቸው እና በብዙዎቹ ከሚታዘዙ መድሃኒቶች ጋር የተያያዙ ነገሮችን እንዴት እንደሚረዱ የበለጠ ለመረዳት ይረዳናል ፡፡ ይህ ግኝት መልካም ስልቶችን ለማዳበር እና የወደፊቱን ችግሮች ለመፍታት ይረዳናል ፡፡ ለነዚህ ጥያቄዎች ምላሽ በመስጠት እውነተኛና ቅን ተሳትፎ ስለሚያደርጉ በጣም እናደንቃለን፡፡ መጠይቁን ለማጠናቀቅ ከሚወስድበዎ ጊዜ በስተቀር አካላዊ፣ ስነ-ልቦናዊ እና ማህበራዊ አደጋዎች ጨምሮ ምንም የሚደርስብዎት ጉዳት ወይም ምሽት የለም ፡፡

ሚስጢራዊነት፡ ለርስዎ ምስጢራዊነት ሲባል የግል መረጃ በመረጃ አያያዝ ሂደት ላይ ብቻ ይገለጻል፡፡ በዚህ ቅጽ ስምዎ አስፈላጊ አይሆንም፤ እርስዎ ከሚነግሩን መረጃ ጋር በተያያዘም ፈጽሞ ጥቅም ላይ አይውልም ፡፡ በርስዎ የተሰጡ ሁሉም መረጃዎች በጥብቅ ምስጢራዊነት ይያዛሉ ፡፡ የተሰበሰበው መረጃ ለጥናት ዓላማ ብቻ ጥቅም ላይ ይውላል፡፡

የመረጃ ሰጪ አድራሻ፡ ይህንን ጥናት አስመልክቶ ጥያቄዎች ካሉዎት ወይም ከተጠናቀቁ በኋላ ስለ ውጤቶቹ መረጃ እንዲሰጥዎት ከፈለጉ፣ እባክዎ ዋናውን መርማሪ ያነጋግሩ፡፡

የዋና ተቆጣጣሪው አድራሻ፡

የተንቀሳቃሽስልክ +251966889998 / ኢሜል amanmamo68@gmail.com

የመረጃ ሰብሳቢ ስም _____ ፊርማ _____ ቀን _____

ለትብብርዎ በጣም አመሰግናለሁ ፡፡

በቃለ መጠይቁ ለመሳተፍ ፈቃደኛ ነዎት? አዎ/አይ

መልስዎ አዎ ከሆነ፣ ወደ የፍቃደኝነት ማረጋገጫ ቅፅ

የፍቃደኝነት ማረጋገጫ ቅፅ

ስለ ጥናቱ በአጭር ጊዜ ተረድቼያለሁ ፡፡ በተጨማሪም ዓላማውን፣ ስጋቶችን፣ ጥቅሞችን፣ እና በማንኛውም ጊዜ የመሳተፍ እና የማቋረጥ መብትን በግልጽ ተረድቼያለሁ፡፡ ለተሳትፎዬ ምንም ቀጥተኛ የገንዘብ ጥቅም እንዳሌለም ተነግሮኛል፡፡ በግል ሕይወቴ ላይ ተጽዕኖ ስለሌለው ካሳ አያስፈልገኝም፡፡ ስለዚህ፣ በጥናቱ ለመሳተፍ ፈቃደኛ ነኝ፡፡

የመታወቂያ ያቀጥር

የመረጃ ሰብሳቢ ስም.....የተቆጣጣሪ ስም..... ቀን.....

መጠይቅ

ክፍል 1. ከስኳር እና ከስኳር ተያያዥ በሽታ ጋር የተዛመዱ የጥናቱ ተሳታፊዎች

ማህበረ-ኢኮኖሚ ላይ ያሉት፡፡

መ. ቁ	ጥያቄዎች	የመለያ ምድቦች
101	ጾታ	1 ወንድ 2 ሴት
102	ዕድሜዎ ስንት ነው? (በዓመት)	
103	የየጋብቻ ዎህኔታ ምንድን ነው?	1 ያላገቡ 2 ያገቡ 3 የተፋታ/ች 4 የሞተበት/የሞተችበት
104	ሃይማኖት ምንድን ነው?	1 ሙስሊም 2 ኦርቶዶክስ 3 ካቶሊክ 4 ፕሮቴስታንት 5 ሌሎች (ይግለጹ)
105	የትምህርት ደረጃዎ ምንድን ነው?	1 ማንበብና መጻፍ የማይችል 2 ማንበብ እና መጻፍ የሚችል 3 ከ1-8ኛ ክፍል 4 ከ9-12ኛ ክፍል 5 ዲፕሎማ 6 ዲግሪ እና ከዚያ በላይ
106	አሁን ያለዎት የሥራ ሁኔታ ምንድን ነው?	1 የመንግስት ሰራተኛ 2 ያልተቀጠረ 3 የግል ተቀጣሪ 4 ተማሪ 5 ነጋዴ 6 ሌሎች ዘርዘር-
107	ግምታዊ ወርሃዊ ገቢዎ (በብር)?	1 <100 2 100-499 3 500-1400 4 > 1400
108	የመኖሪያ አድራሻዎ የት ነው?	1 አዲስ አበባ 2 ከአዲስ አበባ ውጪ

ከህመምተኛው ወይም ከህመምተኛው ሰነዶች የሚሞላ መጠይቅ

109	ክብደት	----- (በኬጂ)
110	ቁመት	----- (በሜትር)
111	በሽታው ከታወቀበት ጊዜ አንስቶ ያለው ጊዜ በዓመታት	_____ (በዓመታት)
112	በ ዓይነት 2 ስኳር ህመም ጋር የተያያዙ ተጨማሪ በሽታዎች አለብዎት ?	1 አዎ 2 አይ

113	ለጥያቄ ቁጥር 114 መልስዎ አዎ ከሆነ፣ ከዓይነት 2 ስኳር ህመም በተጨማሪ ሌሎች የተለዩ ስር የሰደዱ በሽታ ዓይነት የትኛው ነው (ይዘርዘር)	-----
114	በሽታኛው የስኳር ህመም መድኃኒቶችን ጨምሮ በመደበኛነት የሚጠቀማቸው መድኃኒቶች በዓይነት	-----
115	ባለፈው 1 ወር በታካሚው በቋሚነት/በመደበኛነት የተወሰዱ መድኃኒቶች ብዛት	-----
ታካሚው የወሰደው ከአራት ያነሱ መድኃኒቶች ከሆነ፣ ታካሚውን አመሰግነህ ጥናቱን አጠናቀው፡፡ አራት እና ከዚያ በላይ ከሆነ ወደ ቀጣዩ ክፍል እለፍ ፡፡		

ክፍል 2. Morisky የመድኃኒት ልኬት- 8 አይነቶች (64:65) የጥናት ተሳታፊዎችን ልኬት.

መ.ቁ	Morisky የመድኃኒት ክትትል ደረጃ -8 ዓይነት መጠይቅ	አዎ	አይ
201	አንዳንዴ ሁሉንም የስኳር እና ስኳር ተያያዥ መድኃኒቶችን መውሰድ ያስረዳሉ?		
202	ባለፉት ሁለት ዓመታት፣ የየዕለቱን መደበኛ መድኃኒት ልወሰዱበት ቀናት ነበሩ?		
203	ህመምዎ ስለሚብስብዎት ለሐኪምዎ ሳይገልጹ መድኃኒቱን መውሰድ ትተው ወይም አቋርጠው ያውቃሉ?		
204	አንዳንዴ ሲጓዙ ምሆን ከቤት ሲወጡ፣ መድኃኒትዎን ያዘው መውጣትን ያስረዳሉ?		
205	ትላንትና ሁሉንም መድኃኒትዎን ወስደው ታልወይ?		
206	በሽታዎ በቁጥጥር ስር እንደወለ ሲሰማዎ አንዳንዴ መድኃኒቱን መውሰድ ያቋርጣሉ?		
207	በየቀኑ መድኃኒት መውሰድ ለአንዳንድ ሰዎች አስቸጋሪ ሁኔታ ነው ፡፡ ከሐኪምና ዕቅድዎ ጋር ለመጓዝ ይቸገራሉ?		

208	ሁሉንም መድሃኒትዎን መውሰድዎን ለማስታወስ ምን ያህል ጊዜ ይቸገራሉ?	0 በጭራሽ / በጣም በጥቂቱ 1 አንድ ጊዜ 2 አንዳንድ ጊዜ 3 በአብዛኛው 4 ሁልጊዜም
-----	---	--

ክፍል 3. በአዲስ አበባ ከፍተኛ ትምህርት ሆስፒታሎች የዓይነት 2 ስኳር ህሙማን ክሊኒክ ህክምናቸውን በሚከታተሉ ህሙማን ላይ በብዙዮሽ የሚታዘዙ መድሃኒቶች ክትትል ጋር የሚዛመዱትን ሁኔታዎች ለመገምገም የተዘጋጀ መጠይቅ፡፡

	ጥያቄዎች	የመለያ ምድቦች
ከመድሃኒቶቹ ጋር ተዛማጅነት ያላቸውን ሁኔታዎች ለመገምገም የሚያገለግሉ መጠይቆች		
301	መድሃኒቶቹን በየጊዜው በዶክተሮች ትእዛዝ ይወስዳሉ?	1. አዎ 2. አይ 3. አላስታውስም
302	የጥያቄ ቁጥር 301 መልስ አዎን ከሆነ ወደ ጥያቄቁጥር 303፣ አይ ከሆነ የታዘዘውን መድሃኒት በየጊዜው የማይወስዱበት ምክንያቱ/ቶቹ ምንድነው/ ናቸው? ከአንድ በላይ መልስ ይሰጣል	1. በሌሎች ነገሮች ተጠምጄ ወይም በቀላሉ ረስቼ 2. ከቤት ርቆ ነበር 3. ጭንቀት/ድብርት ተሰምቶኝ 4. መድኃኒት አጥቼ ነበር 5. ብዙ የምወስዳቸው መድኃኒቶች ነበሩኝ 6. መድሃኒቱ መርዛማ እንደሆነ (የጎንዮሽ ጉዳዮች እንዳለው) ይሰማኛል 7. በቤቴ ውስጥ ምንም የሚያስታውሱኝ እገዛዎች እና ቤተሰቦች የሉኝም 8. ክሊኒኩ ከቤቴ ርቆ ይገኛል 9. ወደ ክሊኒኩ ለመሄድ ምንም ገንዘብ የለኝም 10. መድሃኒቱ ጤንነቱን ለማሻሻል ማንኛውንም ነገር እያደረገ ነው ብዬ አላሰብኩም.

		11.በአንድወቅት መድኃኒቱን እንዴት መውሰድ እንዳለብኝ ግራ ገብቶኝ ነበር.
303	ስለመድሃኒት ወጪዎ ምን ያስባሉ?	1. ርካሽ 2. መካከለኛ 3. ውድ
304	የወሰዱት መድሃኒት/ቶች ውስብስብ ወይም ግራ የሚያጋባ ነው/ናቸው?	1. አዎ 2. አይ
305	ለጥያቄ ቁጥር 304 መልስዎ አዎ ከሆነ፣ የመድሃኒትዎን ውስብስብ ያደረገው ምንድን ነው? ከአንድ በላይ መልስ ይቻላል	1. ቀለሙ 2. የእሱ ድግግሞሽ 3. የመርፌ ቁጥር 4. የአወሳሰድ ሁኔታ 5. ሌሎች ይለዩ -----
306	መድሃኒትዎን በሚወስዱበት ጊዜ ችግሮች አጋጥመውዎት ያውቃል? አይ ከሆነ ወደ ጥያቄ ቁጥር 308	1. አዎ 2. አይ
307	በተደጋጋሚ የሚያጋጥምዎ የጎንዮሽ ጉዳት ምንድነው? (ከአንድ በላይ መልስ ይቻላል)	-----
308	የጎንዮሽ ጉዳቶችን / ችግሮችን ለመከላከል ምን እርምጃዎችን ይወስዳሉ?	1. ቀጠሮ እስኪደርስ መድኃኒቱን መቀጠል 2. ወዲያውኑ ለባለሙያ/ሪፖርት ማድረግ 3. ቀጠሮው እስኪደርስ ወዲያውኑ መድኃኒቱን ማቆም
ከጤና እንክብካቤ ጋር የተዛመዱ ሁኔታዎችን ለመገምገም የሚያገለግሉ መጠይቆች		
309	ሐኪምዎን በየስንት ጊዜ ይጎበኛሉ?	1. በየወሩ 2. በየሁለት ወሩ 3. በየሶስት ወሩ 4. ተለዋዋጭ 5. ሌሎች----
3010	መድሃኒትዎን ከስንት ሃኪሞች/ክፍሎች ታዋሎት ያውቃል ወይም ይወስዳሉ?	1. ከአንድ 2. ከሁለት 3. ከሶስት 4. ሌሎች ----

3011	ከጤና ባለሙያ ጋር ለሚያደርጉት ግንኙነት ግልጽ የሆነ ግንኙነት አለዎት?	1. አዎ 2. አይ
3012	በክሊኒክ ጉብኝትዎ ወቅት የሚያስፈልግዎት ትምህርት ወይም እርዳታ ያገኛሉ?	1. አዎ 2. አይ
3013	በሚፈልጉበት ጊዜ አስተማማኝ የፋርማሲ ያጋኛሉ?	1. አዎ 2. አይ
3014	በፋርማሲ ባለሙያ የሚሰጠዎት ትዕዛዝ ግልጽ ነው?	1. አዎ 2. አይ
ከታካሚው እውቀትና እምነት ጋር የተያያዙ ሁኔታወችን ለማጥናት የተዘጋጀ መጠይቅ		
3015	በጤና ባለሙያዎ አገልግሎት እርዳታ አለዎት?	1. አዎ 2. አይ
3016	የጤና አገልግሎት ሰጪዎችዎ ብቃት እንዳላቸው ይሰማዎታል?	1. አዎ 2. አይ
3017	መድኃኒቶችን አለመከታተል የሚያስከትለውን ውጤት ያውቃሉ?	1. አዎ 2. አይ
3018	የደም ስኳር መጠን መቆጣጠሪያ ግብ/ኢላማዎን ያውቃሉ?	1. አዎ 2. አይ
3019	የሚወስዷቸው መድኃኒቶች ለበሽታዎ ውጤታማ ናቸው ብለው ያስባሉ?	1. አዎ 2. አይ አላውቅም
3020	የታዘዘልዎን መድኃኒቶች በመደበኛነት በህኪም ትዕዛዝ መሰረት ለመውሰድ ቁርጠኛ ነዎት?	1. አዎ 2. አይ 3. እርግጠኛ አይደለሁም

ለተሳትፎዎ እናመሰግናለን

**ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF NURSING AND MIDWIFERY
DEPARTMENT OF ADULT HEALTH NURSING**



**PREVALENCE AND ADHERENCE TO MULTIPLE PRESCRIBED
MEDICATIONS AND ITS PREDICTORS AMONG TYPE 2 DIABETIC
PATIENTS ATTENDING TERTIARY HOSPITALS IN ADDIS ABABA,
ETHIOPIA, 2019**

PRINCIPAL INVESTIGATOR: -AMAN MAMO (BSc)

**A RESEARCH PROPOSAL TO BE SUBMITTED TO NURSING
DEPARTMENT, SCHOOL OF NURSING AND MIDWIFERY, COLLEGE
OF HEALTH SCIENCES, ADDIS ABABA UNIVERSITY IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE MASTER OF
SCIENCE DEGREE IN ADULT HEALTH NURSING.**

**FEBRUARY, 2019
ADDIS ABABA**

ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF NURSING AND MIDWIFERY
DEPARTMENT OF ADULT HEALTH NURSING

PRINCIPAL INVESTIGATOR	AMAN MAMO (BSC)
TITLE OF THE PROPOSAL	Prevalence, and Adherence to Multiple Prescribed Medication and Its Predictors Among Type 2 Diabetic Patients attending Tertiary Hospitals in Addis Ababa, Ethiopia, 2019
NAME OF ADVISOR	DR. GETAHUN TAREKEGN (CONSULTANT INTERNIST, ENDOCRINOLOGIST) DR. AMSALE C. (PHD, ASSOCIATE PROFESOR) MR. WUDMA A. (BSC, MSC, PHD FELLOW)
DURATION OF THE STUDY	DECEMBER 2018 TO JUNE 2019
STUDY AREA	ADDIS ABABA, ETHIOPIA
TOTAL COST OF THE PROJECT	31947.30 ETB
SOURCE(S) OF FUNDING	ADDIS ABABA UNIVERSITY
ADDRESS OF THE INVESTIGATOR	TEL: +251966889998, Email- amanmamo68@gmail.com

ACKNOWLEDGEMENT

First of all, I would like to thank Addis Ababa University, college of Health Sciences, school of nursing and midwifery, department of Nursing for giving me this opportunity.

Next, I extend my heartfelt thanks to my advisors Dr. Amsale Cherie (PhD, Associate professor) Dr. Getahun Tarekegn (Consultant Internist, Endocrinologist), and Mr. Wudma Alemu (MSc, PhD fellow) for their constructive advice and genuine comments that helped me during the development of this research proposal.

Lastly, I would like to thank all my lovely family and friends those helped me by support and sharing their important experiences. for their continuous support, motivation and guidance throughout the tenure of this work in spite of hectic schedule who truly remain driving spirit and their experience gave me light in this work and helped me in clarifying he abstruse concepts, requiring knowledge and perception, handling critical situations and understanding objective of this work.

ABBREVIATION AND ACRONYMS

ADA	American Diabetic Association
AOR	Adjusted Odds Ratio
COR	Crude Odds Ratio
DC	Data Collector
DEC	Data Entry Clerk,
DM	Diabetes Mellitus
IDF	International Diabetic Federation
IHRERC	Institutional Health Research Ethical Review Committee,
MCC	Multiple Chronic Comorbidities
MMA	Multiple Medication Adherence
MMAS-8	Morisky Medication Adherence Scale 8-item medication
MPM	Multiple Prescribed Medication
PI	Principal Investigator
PLWD	People Living With Diabetes
SPHMMC	Saint Paulos hospital and millennium medical college
SPSS	Statistical Package of Social Science
TASH	Tikur Anbessa Specialized Hospital
TSCH	Torhayloch specialized and comprehensive hospital

SUMMARY

Background: -Prevalence of Diabetes Mellitus is raising throughout the world. Patients with diabetes often have a coexisting chronic complication which puts patients at high risk of multiple prescription of medication as an inevitable choice to improve health outcome and reduce diabetes-related morbidity and mortality. Non adherence to multiple medication prescriptions is a public health issue which determines the treatment outcomes of the patient and responsible for death of up to 80% of people with diabetes. **Objectives:** -The aim of the study is to assess prevalence and Adherence to multiple prescription of medications and its predictors among Type 2 Diabetic Patients visiting Diabetic Clinic of Addis Ababa tertiary Hospitals, 2019. **Methods:** Institutional based cross-sectional study design will be employed in three Tertiary Hospitals in Addis Ababa. A total of 422 Type 2 Diabetes patients will be selected, using systematic sampling. Data will be collected by using pre-tested interview based structured questionnaire and checklist guided document review. The collected data will be entered into Epi-info and transported into SPSS software version 21 and analyzed using Adjusted Odds Ratio, logistic regression, and the result will be presented by graph, figure, and tables. **Work plan and budget:** - the study will be conducted from September, 2018 to July, 2019 with estimated total expense of 31947.30 ETB

Key words: Multiple Prescribed Medication, Adherence, Type 2 Diabetes, Morisky Medication Adherence-8 item scale .

13.INTRODUCTION

13.1. Back Ground

One of the greatest challenges facing health systems globally in the 21st century is the increasing burden of chronic diseases like diabetes mellitus (1). The adult population with multiple chronic diseases especially, diabetes mellitus (DM) has led to a rising prescription of medications due to acute, chronic complication and to slow progression of the disease (2, 3). Diabetes Mellitus is a common chronic metabolic disorder that affects nearly 8.8% of the total world population (4). Prevalence of DM is increasing worldwide and is more in developing countries which are already suffering from communicable diseases with expected 70% of them reside in developing countries by the year 2030 (5).

In Africa, an estimated 2.8 billion USA dollar was spent on healthcare expenditure because of diabetes in 2011. This report forecasts the expenditure will rise by 61% in the year 2030; meanwhile, the prevalence of diabetes is expected to almost double in the same time period(6, 7).

Multiple prescribed medications (MPM) and medication adherence taken together present a unique challenge for the patient, their caregiver(s), and the healthcare team. Evidence from systemic review suggests there is mixed relation between multiple prescribed Medicine and medication adherence due to the connection with patient, health-system, and provider factors as a mediators of the association between multiple prescription of medication and medication non adherence (8, 9).

Multiple prescription of medications which is similar with prescribed polypharmacy is concurrent use of multiple medication items by one individual which is considered something to be avoided in the past. But, currently, it is accepted in many circumstances as it is therapeutically beneficial, especially in patients with a chronic condition like diabetes (10). Its definition varies according to the literature, and hence there is no consensus definition of multiple medication prescription, prescribed polypharmacy and appropriate polypharmacy. But, for this study MPM and polypharmacy will be used interchangeably, which ranges from the concurrent use of two or more to ten or more prescription drugs(1, 8, 10-12) . However, for this study it is defined as the concurrent use of four or more prescription drugs (11, 13).

People with Type 2 Diabetic often have multi morbidity (co-occurrence of two or more chronic condition in one patient) like macro vascular complication, micro vascular complication, and neuropathic complication. For this reason, the patient needs multiple medications to treat hyperglycemia, comorbidity regularly and slow the progression of disease. Therefore, multiple medication prescription is unavoidable, given that multiple drug therapy has become the standard of care in these chronic conditions (14-16).

Although, reduction of MPM is salutary according to some study (2, 17, 18) by being too occupied with reduction approach one might fail to consider inappropriate prescribing in its entirety. Means, Inappropriate prescribing does not only incorporate over-prescribing (more drugs than clinically necessary) and mis-prescribing (incorrect prescribing of a necessary drug), it also includes under-prescribing (failure to prescribe a clinically indicated drug) (19-22).

Medication adherence (multiple medication adherence in case) is defined as the extent to which a patient medication taking behavior coincides with the intention of the health advice he or she has been given (7, 23). It is the most important factors that determine therapeutic outcome, especially in a patient suffering from a chronic illness like diabetes mellitus (7). But, non-adherence to this multiple prescribed medicine is another public health issue that can determine the quality of life, treatment outcome, mental status which is responsible for therapeutic failure and vital organ damage that increases the risk of death by 80% in a diabetic patient (24-27).

Even though adherence to medications leads to beneficial outcomes, it is often poor especially in patients with chronic disease who are taking multiple drugs (12, 18, 28), even some study reports patients perceive increased number of prescribed medicine will increase side effects, toxicities and risks of death, although the truth is far from the myth (29). Therefore, it is crucial to study about the prevalence and adherence to multiple Prescribed medications and its predictors among Type 2 Diabetic patients attending diabetic clinic.

13.2. Statements of the Problem

Diabetes is estimated the ninth among the top 10 causes of morbidity and mortality worldwide and its numbers are increased by four times from 1980 to 2014(2, 30). About 1 in 11 adults worldwide now have diabetes mellitus, 90% of whom have type 2 diabetes mellitus(30).

In African region approximately around 14.2 million peoples have diabetes of which 1.3 million people live in Ethiopia that makes the country among top four countries with the burden of adult diabetes from Sub Saharan African countries. These figures are expected to quickly increase along with an increase in urbanization and life expectancy. It has been associated with rapid economic development, increasing urbanization, aging populations, reduced physical activity, and unhealthy diets especially in type 2 Diabetes mellitus(31, 32).

Patients with Multiple Chronic Comorbidities (MCCs) constitute a majority of the diabetes population. For instance, from 1,389,016 eligible patients, 97.5% of patients had at least one comorbid condition in addition to T2DM and 88.5% had at least two comorbidities. The most common comorbid conditions include hypertension (HTN) in 82.1%; overweight/obesity in 78.2%; hyperlipidemia in 77.2%; chronic kidney disease (CKD) in 24.1%; and cardiovascular disease (CVD) in 21.6% of the patients (33, 34).

Presence of complication like hypertension, dyslipidemia, coronary artery disease, depression and chronic kidney disease, requires the use of multiple medications to treat the conditions. this put patients with diabetes at high risk of multiple prescription (administration or use of more medications that are clinically indicated), as inevitable choice with an estimated prevalence of 54%–84% of patients with diabetes using five or more medications in countries like Saudi Arabia, USA, and Italy (2, 13, 35, 36).

Even though, these required medication (clinically indicated multiple medication) substantially linked with improved health outcome, health care cost and reduce diabetes-related morbidity and mortality, the extent of treatment beneficial aspects may be limited by a lack of treatment adherence (18, 37, 38). Having this benefits, the adherence of people with multi morbidity to multiple prescription are relatively low which ranges from 51.7%-80% (25, 36, 39, 40).

Studies report factors affecting MPMs among patients with diabetes is sex, age, obesity, presence of comorbidities, types of comorbidities average time of diagnosis, consultation per year, adverse drug reaction and educational level (41-44). While factors associated with Adherence to MPMs were complex and multifaceted which include factors like: age, sex, number of medication, appointment schedule, unavailability of transport, forgetfulness, poor communication between physician and patient, adverse outcomes such as weight gain and hypoglycemia, lack of education and understanding of the long term benefits of treatment, cost of medication, knowledge of the patient about medications, follow up frequencies, beliefs about medicine, income, health care provider interaction at (prescription, at filling and adherence supporter), duration of disease, asymptomatic nature of the disease, and availability of pharmacy (13, 18, 39, 45-50)

According to some studies, methods of improving adherence to multiple medications can be grouped into four general categories: Patient education; improved dosing schedules; increased hours when the clinic is working (including duty time) and therefore shorter wait times; and improved/clear communication between physicians and patients(13, 25, 51)

To date, no studies have examined the prevalence and adherence to multiple medication prescriptions among adults with Type 2 diabetes living in Addis Ababa and assessed the specific factors associated with adherence to multiple medication.

Identifying prevalence and adherence to multiple prescriptions of medication and its predictors among type 2 diabetic patients will facilitate effective interventions for optimal blood glucose control and pharmacovigilance efforts in clinical practice setting to improve microvascular, cardiovascular outcomes, prevent hyperglycemia and its related complication.

Therefore, the primary objective of this study is to determine prevalence and adherence to multiple prescribed medications and its predictors among adults with type 2 diabetes in Addis Ababa Hospital.

14.LITERATURE REVIEW

14.1. Introduction

The literature review of this study was made on articles related to multiple prescriptions of medication/polypharmacy in diabetic, in chronic disease and in adults, adherence to multiple prescribed medications/Polypharmacy, factors associated with multiple prescribed medications and adherence to diabetic medication among Type 2 diabetic mellitus visiting diabetic clinic since 2002-to present, because of limited availability of articles. We use the literatures for this study on article titled as Multiple prescribed medications, multiple medication prescriptions, polypharmacy and multiple regimen since they used interchangeably by this and some other studies. To search those literature different printed materials and computer data-bases like; AAU library data base, HINARI, Google scholar, Pub Med, CINAHL and reports of study setting for study sample have been used.

The findings of these literature is being searched, analyzed, categorized and presented into five subsections: prevalence of MPMs among diabetes, factors associated with MPMs, Adherence to MPMs among diabetes, predictors of adherence to MPM among diabetes and diabetic related problems and conceptual frame work of the study to conceptualize the summery of the literatures.

14.2. Prevalence of Multiple Prescribed Medications Among Diabetic Patient

A cross sectional study conducted in Saudi Arabia on 8932 adults with diabetes, 78% had multiple medications which was more likely among women as compared with men and more likely among older adults (age ≥ 60 years) as compared with the adults. Also, multiple medication was two times as likely among patients with coexisting cardiovascular conditions (AOR=2.89; 95% CI 2.54 to 3.29), respiratory disease (AOR=2.42; 95% CI 1.92 to 3.03) and mental health conditions (AOR=2.19; 95% CI 1.74 to 2.76), and three times as likely among patients with coexisting musculoskeletal disease (AOR=3.16; 95% CI 2.31 to 4.30) as compared with those without these coexisting chronic conditions categories(2).

Multicenter cross-sectional survey conducted in Italy reveals, the percentage of the study sample receiving five or more drugs was 57.1% with more proportion of multiple dugs among elderly

(73.7 ± 5.6 years vs 72.7 ± 5.3 , $p = 0.0020$), on long duration in Diabetic treatment (10 vs 8 years, $p < 0.0001$), higher body mass index (BMI) (29.4 ± 5.0 kg/m² vs 28.5 ± 4.7 , $p = 0.0014$) place of residence north Italian (60.1 vs 47.7 %, $p < 0.0001$) and on those with complication of diabetes (15.8 vs 6.9 %, $p < 0.0001$) (44).

The incidence of multiple prescriptions of medication (using ≥ 5 drugs) among type 2 diabetes patient admitted to general medicine attending rural tertiary care teaching hospital in south India were 82.89%. Multiple prescriptions of medication were common among smokers, alcohol users, hypertensive with dyslipidemia and hypertensive with thyroid disorders according to this study (52). Other report in medical outpatient of Saudi hospital reveals out of 766 patients included in the study, 683 (89%) participant have had multiple medications. The mean number of prescribed medications, oral pills and doses was 8.8, 9.6 and 12.1, respectively among the study participants (1). The mean rates of medicines among patients with T2DM in Greece for >5 drugs and >7 drugs were 79% and 54.1%, respectively (53).

A household survey in 63 municipal areas of Minas Gerais reports out of 2619 respondents with diabetes, 56.5% were on multiple medicine which is associated with age, comorbidities and increased access to health services (54). Similarly, according to a multicenter cross-sectional survey conducted in Italy from 1342 participants with type 2 diabetes 2.8 % participants took one drug to 0.3 % of them took ten or more drugs. The percentage of the study population receiving five or more drugs was 57.1 % (44).

According to evaluation of polypharmacy in patients with type 2 diabetes mellitus and its association with medication adherence and health care costs conducted in, 13,365 total sample population 22.4% had non-multiple medication, 39.3% had minor, 25.3% had moderate, and 13.0% had major multiple medication where, patients with no multiple medication (≤ 2 drugs), minor (3-5 drugs), moderate (6-8 drugs), and major (≥ 9 drugs) took the cumulative drugs respectively (55). Additionally, According to study conducted on drug utilization and factors associated with polypharmacy in 2018, the average number of prescribed medication were 5.2 ± 2.9 with 0-17 amplitude of medication administered (41).

14.3. Factors associated with Multiple Prescribed Medications Among Diabetic patients

Bivariate study conducted by Snater et al, 2018 reveals that there is significant association between low wealth condition, obesity, increasing age, and presence of chronic health condition (12). According to Italian, a multivariable logistic model reveals, there is significant association between Multiple prescribed medication and the female gender, living in Northern Italian regions, diabetes duration longer than 4 years, and having a body mass index of $>30 \text{ kg/m}^2$ (44).

A study conducted on “Drug utilization and factors associated with polypharmacy in individuals with diabetes mellitus in Minas Gerais, Brazil” indicated that factors like: age above 40 years, bad or very bad self-perceived health, presence of five or more comorbidities, average time of diagnosis above 10 years, four or more medical consultations in the last year, absence of regular physical activity, interruption of normal activities in the last 15 days, and access to a private health plan are significantly associated to the occurrence of prescription of multiple medication in DM patients (41). Similarly, according to study conducted by Austin and Rogers P. the predictors of multiple medication prescriptions are multiple prescribers, aging population, complex drug therapies, psychosocial contributions, and adverse drug reactions that may be interpreted as new medical conditions. According to this study presence of multiple drugs can also affect adherence to medication and quality of life of the patient (43).

A cross-sectional analysis of factors associated with excessive polypharmacy on 3904 patients with chronic disease, there is no association between excessive MPM and female sex, low educational level, and smoking. But, there is associated with multiple diagnosis, and age >85 years (37). Other, retrospective cross sectional study conducted on adult Saudi Arabian patients reports multiple prescribed medicines were high among older patients (OR=2.68, 95% CI=2.51-2.87), women (OR= 1.69, 95% CI= 1.59-1.80), married, and among patient with chronic condition like COPD, osteoporosis, ischemic heart disease and heart failure (42).

14.4. Adherence to Multiple Prescribed Medication Among Diabetic Patients

Treatment guide lines of DM encourage the effort promote the medication adherence and appropriate intensification of medication to achieve therapeutically effective dose. But

unfortunately, adherence among many patients are poor (56). A cross sectional study conducted in Greece suggests from 644 outpatients participated in the study 47.8% of patients had been receiving anti-diabetic medication monotherapy, 38.2% combination therapy with two anti-diabetic drugs, 11.8% with three drugs, and 2.2% with four drugs. Additionally, 44.4% of patients with comorbidities exhibited MMP, compared with 4.8% of patients who were diagnosed only with diabetes ($P = 0.001$)(40). A study on polypharmacy and medication compliance in patients with type 2 diabetes reports only 18% the patients took one drug with average drugs of four medications. From the study subject 92% of the patient were compliant to medications(18).

Retrospective study conducted in Cyprus suggests level of prescribed MPM was 87.6% of patients, whom 46.7% received more than 12 medications ($p \leq 0.001$). From those with MPM only 60.9% of the patient were adhered to their medication as per prescription. Moreover, 28.9% of patients often/very often missed taking their medications because they feel better and 22.7% increased drug dosage in order to feel better (57). Whereas, study conducted on 910 Boston Hospitals Reveals Patients were taking a mean of $4.1 (\pm 1.9)$ diabetes-related medicines with the average 7-day adherence of 6.7 ± 1.1 days. According to this study, total number of medicines prescribed was not correlated with medication adherence. But adherence was significantly lower for medicines not felt to be improving current or future health(36).

Study conducted on Evaluation of Adherence to Therapy in Patients with diabetes reports Average number of medicines taken by each patient daily were 4.75 ± 1.73 (mean + SD). 70% patients reported non-adherence to medication schedule. According to this prospective cross sectional study Morisky medication adherence questionnaire 0%, 26% and 74% of patients where highly, moderately and lowly adhered to prescribed medicine, respectively. Unawareness about need of each medicine (55.66%), forgetfulness (50.66%) and high cost (43.33%) were the common causes of non-adherence(39).

A study conducted on Assessment of medication adherence in type-2 diabetes patients on poly pharmacy and the effect of patient counseling given to them in a multispecialty hospital in Indian hospitals, on 240 patients, 51.7% of them where adhered to their prescribed medicines (25). Another survey study conducted on the effect of polypharmacy on drug compliance among diabetic and hypertensive patient reveals from 321 patient surveyed more than half (58.3%) of

them are either not partially compliant or totally non-compliant to their prescribed medication (45).

14.5. Predictors of Adherence to Multiple Prescribed Medications

Questionnaire based interview conducted in Sri Lankan reports out of 247 patient interviewed a good compliance to medication were seen in 38.4% of patients with large number of tablets that they need to swallow, fear of side effects with long-term drug intake and unclear instructions as the main reasons for poor drug compliance(58).

A retrospective observational study conducted from 2006-2009 reveals Age, number of index medications, and physician-related factors like receiving medication for Diabetes and Hypertension from the same physician were significantly associated with Multiple Medication Adherence (MMA). But the proportion of multiple prescribers (when the patient followed different units regularly and prescribed medicine from different physician) was not significantly associated with MMA (46). Another study reveals variable independently associated with medication non adherence were increased number of medication, increased daily dose, concerns of side effects, taking metformin and presence of one or more microvascular complication (59).

A cohort study on Evaluation of Polypharmacy in Patients with Type 2 Diabetes Mellitus and Its Association with Medication Adherence and Health Care Costs reports higher level of multiple medicine was associated with a higher likelihood of adherence than the non-multiple medicine cohort (minor: OR=2.18, 95% CI=1.99-2.40; moderate: OR=3.58, 95% CI=3.20-3.99; major: OR=4.70, 95% CI=4.07-5.43) (55). Similarly, according to study conducted by Austin and Rogers P. the presence of multiple medicine by itself are determinants of adherence to medication and quality of life of the patient(43). A survey study conducted in Palestine reveals that, there is significant difference in the degree of adherence with respect to the number of medications taken by diabetic patients where, good adherence decreases and the total of poor plus the non-adherence increases with increasing the number of medications (45).

Mixed study conducted in University Diabetic Center of Riyadh, Saudi Arabia factors associated with adherence to anti diabetic medication were observed with increasing age (OR, 1.084; 95% CI, 1.056– 1.112), taking fewer non-diabetic medications (OR, 0.848; 95% CI, 0.728–0.986). But, reports has no evidence that gender, marital status, education level, income and diabetes

duration) were associated with OHA adherence (47). Another study conducted in 2017 in Middle East and North Africa shows adherence to medication were Positively associated with knowledge about the disease and medications, regular follow-up visits, and patients' positive beliefs about effectiveness and motivations about medications, while negatively associated with factors like forgetfulness, side effects, and polypharmacy(49).

A Cohort study conducted in 2015, at U. S describes Adherence was independently associated with older age, male sex, higher education, higher income, 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(50). A prospective questionnaire based cross sectional study reveals, not buying all medicines (58.66%), not taking prescribed dose of medicines (34%), taking additional non-prescribed medicines (30%) and not taking medicines for required duration (25.33%) were common types of non-adherence and unawareness about need of each medicine (55.66%), forgetfulness (50.66%) and high cost (43.33%) were the common causes of non-adherence(39).

A Proposed Holistic Conceptual Framework for Barriers to Medication Adherence in Diabetes in 2017, conceptualize barriers related to medication adherence as patient related (Sociodemographic factors, Beliefs on clinician's ability, Availability of pharmacy, Knowledge of the patient, Belief on effectiveness of drugs) , medication related like medication complexity (in terms of frequency, timing of medicine, number of injection per day and methods of administration) and Adverse drug reaction, disease related (duration and complication, asymptomatic), provider related (patient provider interaction, knowledge of the provider)- , system related (financial and accessibility)-, and societal (support, stigma and discrimination) related factors that can affect the Adherence to medication(48).

14.6. Conceptual Framework

The conceptual frame work of this study is conceptualized by the principal investigator based on the literature review mainly focusing on the factors related typically with adherence to Multiple Prescribed Medication which is extracted from study conducted by (12, 37, 39, 41, 42, 44, 48-50, 58).

The concept is headed by five main factors as sociodemographic related factors, disease related factors, health care related factors, medication related factors and presence of multiple prescribed medication which can affect adherence to Multiple Prescribed Medications.

Medication related factors

- Number of medicine
- Types of medicine

10

Beliefs and Knowledge of the patient related factors

- Beliefs on clinician's ability
- Belief on effectiveness of drugs

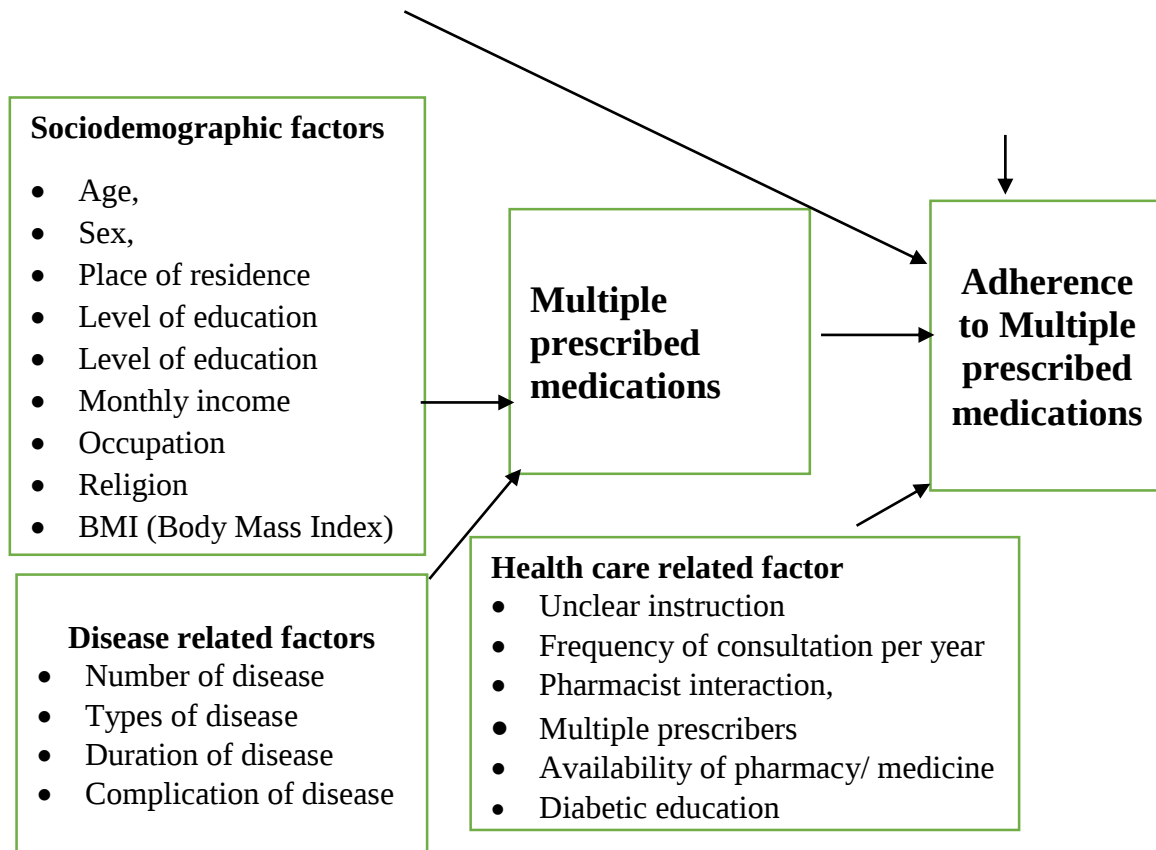


Figure 7 conceptual frame work for the study on Adherence to Multiple Medication Prescription and associated factors among Type 2 Diabetic Patients at Addis Ababa tertiary Hospitals, 2019.

15.JUSTIFICATION OF THE STUDY

The prevalence of type 2 diabetes is rising among adults with coexisting chronic complication like hypertension, dyslipidemia, coronary artery disease, depression and chronic kidney disease, which requires the use of multiple medications to treat them accordingly. This put patients at high risk of multiple prescriptions (administration or use of more medications that are clinically indicated), as inevitable choice with an estimated prevalence of multiple prescription 54%–84% (2, 13, 35, 36).

Even though, multiple medication prescription are substantially linked with improved health outcome and reduce diabetes-related morbidity and mortality, the extent of treatment beneficial aspects may be limited by a lack of treatment adherence (18, 37, 38). Having this benefits, the adherence of people with multi morbidity to multiple prescription are relatively low which ranges from 51.7%-80% (25, 36, 39, 40).

Despite high prevalence of Diabetes in Ethiopia, little is known about prevalence of multiple prescribed medicine and its adherence among T2DM visiting diabetic clinic specially in study setting to the best of my finding (32).

Assessing the magnitude of MPM and its adherence is the strategy to deal with the issue of multiple medication prescription and raise the adherence level of the patient living with T2DM taking multiple medication prescription. Therefore, this study aims to assess the prevalence of multiple prescribed medicine, to identify the level of adherence to multiple medications, and its predictors among T2DM patients.

16.SIGNIFICANCE OF THE STUDY

This study was designed to assess the level of multiple prescription of medications adherence and associated factors among people living with type 2 diabetic visiting diabetic clinic at Addis Ababa Tertiary Hospitals. Thus, it is expected that the result of this study will guide nurse educators, counselors, and adherence supporters in diabetic and treatment adherence related education

The findings from this study will also improve awareness of patients, pharmacists, and nurses related to multiple medications. In addition, this study will also help nurses to educate the patients on importance of multiple prescribed medicine and reduce negative myths of multiple prescribed medicine.

It is also expected that the finding from this study may be helpful in designing a future nursing educational plan for patients having multi morbidities on multiple prescriptions for professional nurses in Ethiopia. The knowledge gained from this study will also trigger Food and Drug administrative agencies to regulate and provide guidelines on strategies on how medications for comorbidities have to be prepared and administered.

The findings of this study might also help to provide base line data for researchers who want to conduct further study on a similar topic. Hopefully, this study may expand the existing literature on multiple prescribed medicine and factors associated with adherence.

17.OBJECTIVES

17.1. General Objective

To assess Prevalence and Adherence to Multiple Prescribed Medications and its predictors among Type 2 Diabetic Patients visiting Diabetic Clinic of Addis Ababa tertiary Hospitals. 2019

17.2. Specific Objectives

- To assess the prevalence of Multiple Prescribed Medications among Type 2 Diabetic patients visiting Diabetic Clinic of Addis Ababa Tertiary Hospitals, 2019
- To describe factors associated with Multiple Prescribed Medications among Type 2 Diabetic patients visiting Diabetic Clinic of Addis Ababa Tertiary Hospitals, 2019

- To determine adherence to Multiple Prescribed Medications among Type 2 Diabetic patients visiting Diabetic Clinic of Addis Ababa Tertiary Hospitals, 2019
- To identify predictors of adherence to multiple prescribed medications among Type 2 Diabetic Patients visiting Diabetic Clinic of Addis Ababa Tertiary Hospitals, 2019

18.METHODS AND MATERIALS

18.1. Study Area and period

The study will be conducted in selected Hospitals in Addis Ababa, Ethiopia. Addis Ababa is the capital city of Ethiopia which is located in the center of the country and home to nearly 7 million people. The four major ethnic groups living in the city are Amhara (47%), Oromo (19.5%), Tigre (6.2%), Gurage (1.6%) and Amharic (70.8%), Afan Oromo (11%) and Tigrigna (3.6%) are the three dominantly spoken languages in the city. Addis Ababa has 51 hospitals, 84 health centers, and around 700 private clinics out of which 75 are higher clinics(60). Tikur Anbessa Specialized Hospital (TASH), Saint Paulos hospital and millennium medical college (SPHMMC) and Torhayloch specialized and comprehensive hospital (TSCH) are the three largest and tertiary hospitals in Addis Ababa. TASH is the largest referral and teaching hospital

and sees approximately 370,000 – 400,000 patients a year(61). SPHMMC is another largest hospital with an inpatient capacity of more than 700 beds and sees an average of 1200 clients from emergency and outpatient daily (62). Torhayloch specialized and comprehensive hospital is another tertiary hospital managed by defense force and is providing specialized service for patients coming from all over the country from military services(63).

These three hospitals have been providing specialized clinical services for patients as a referral center for the country. They are appropriate for the study because they have an independent diabetic clinic, which gives services to patients with diabetic and diabetic related cases as an outpatient and inpatient department. The percentage of Type 2 diabetic patients on follow up in these hospitals are approximately 90% from total diabetic patients (*HMIS of the three hospitals and observed through situational analysis*). Currently, the hospital sees on average 800, 550 and 220 type 2 diabetic patients per month at TASH, SPHMMC, TSCH respectively (*HMIS of the three hospitals*). The study will be conducted from March 1- April 1/2019 at selected Addis Ababa public Hospitals.

18.2. Study Design

An Institutional based cross sectional study design will be used to elicit the information from the study population.

18.3. Population of the Study

18.3.1. Source population of the study

All people living with Type 2 diabetes visiting diabetic clinic in the three selected Addis Ababa hospitals.

18.3.2. Study population of the study

All people living with Type 2 diabetes visiting Diabetic clinic of selected three Addis Ababa Hospitals who have follow up during data collection period and fulfill the inclusion criteria.

18.3.3. Study Units

Each people living with Type 2 diabetic attending Diabetic clinic of three selected Addis Ababa Hospitals from which actual data are collected.

18.4. Eligibility Criteria

18.4.1. Inclusion

This study will include T2DM patients, 18 years or above, those who have follow up in the selected three hospitals diabetic clinic and taking diabetic medication for at least three months in the study setting.

18.4.2. Exclusion criteria

Critically ill patient, patients with psychiatric disorders, and unwilling to participate will be excluded from the study.

18.5. Sample Size Determination

To calculate the sample size for this cross-sectional study, it is assumed 95% of confidence level, 0.05 margin of error, 0.5 proportion of adherence to MPMs since there is no study conducted in similar setting on similar topic. The sample size will be calculated using single population proportion formula.

Where:

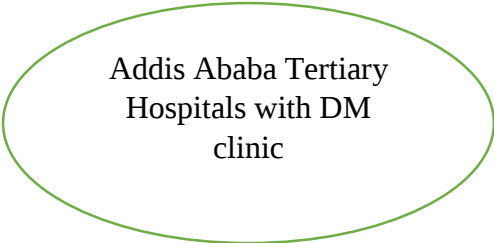
$$n_i = \frac{(1.96)^2 \cdot 0.5(1-0.5)}{(0.05)^2} = 384$$

- n_i = the initial sample size required
- $P = 0.5$ assumed adherence to MPM
- $d =$ degree of accuracy (0.05)
- $Z_{\alpha/2}$ - critical value which is assumed 95% CI

Then considering 10% non-response rate the final sample size will be 422.

18.6. Sampling Technique

Systematic sampling will be employed to select the study participants. The average number of patients visiting the three hospitals per months on follow up are 800, 550 and 220 at TASH, SPHMMC, and TSCH respectively. The calculated sample size will be allocated proportionally for the three hospitals, and hence 215, 148, and 59 from TASH, SPHMMC, and TSCH respectively. The sample will be taken based on every K's (every 4 patients) by selecting random start by lottery methods and adding k's for a subsequent participant to collect data by exit interview. 422 patients will be taken as an actual participant.



Addis Ababa Tertiary
Hospitals with DM
clinic

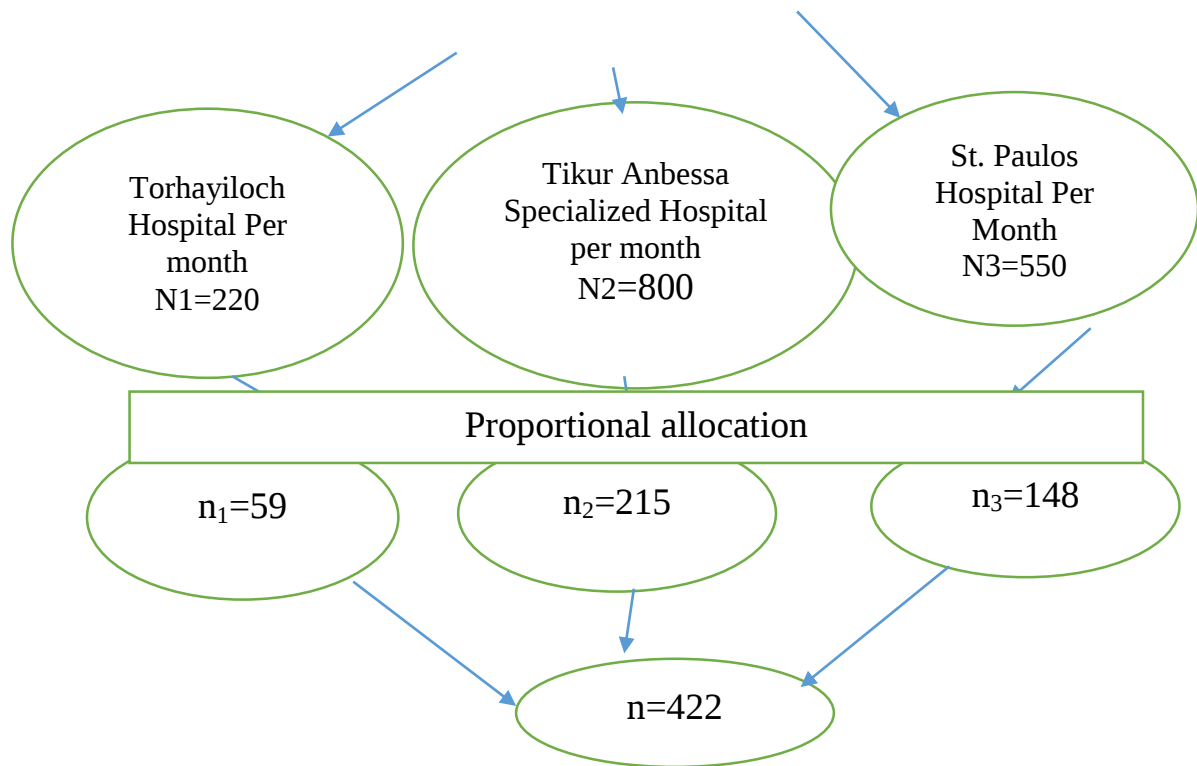


Figure 8 schematic representation of sampling technique for study conducted on prevalence and adherence to multiple medications and associated factors among Type 2 Diabetic Patients visiting Diabetic Clinic of Addis Ababa tertiary Hospitals, 2019

18.7. Operational Definitions

- **Multiple Prescribed Medications:** -in this study, Multiple Medication prescription is defined as the concurrent use of ≥ 4 medications regularly for at least 1 months or since last follow up (11).
- **Adherence to Multiple Prescribed Medication** will be calculated using Morisky 8-item medication (MMAS-8) adherence questionnaire(39, 64, 65). Adherence will be graded as
 - ✓ High when the patient correctly answered 8 Questions of MMAS-8
 - ✓ Medium when the patients correctly answered between 6 and 8 questions of MMAS-8

✓ low when they correctly answer less than 6 questions of MMAS-8

- **Diabetic and diabetic related** medication is a medication taken by the patient orally, inhalational, parenterally, or by drops regularly at least for the last 1 month or since last follow up will be recorded for each patient (53).
- **Medication complexity:** is the complexity of the regimens in terms of frequency, timing of medicine, number of injection per day and methods of administration (48).
- **Knowledge of the patient:** is the knowledge questions related to knowledge about disease, about medication, ability to read the label, knowledge about the targets of the glycemic control and knowledge about the consequence of non-adherence (48).
- **Beliefs of the patient:** is the perception of the patient on effectiveness of the drug, on intention of future adherence, ability of the physician and others (48).
- **Multiple prescribers:** is occurs when patient followed different units and prescribed medicine from different physician (46).

18.8. Study Variables

18.8.1. Objective one and Two

Dependent Variable

- **Prevalence of Multiple Prescribed Medications**

Independent Variables

- **Sociodemographic factors:** gender, age, place of residence, marital status, ethnicity, religion, occupation, monthly income, educational level, and body mass index.
- **Disease related factors:** number of disease, types of disease, duration of disease, and Presence of complication

18.8.2. Objective three and four

Dependent variable

- **Adherence to Multiple Prescribed Medication**

Independent Variables

- **Sociodemographic factors:** gender, age, place of residence, marital status, ethnicity, religion, occupation, monthly income, educational level, and body mass index.
- **Medication related factors:** number of medicine, types of medicine, medication complexity, cost of the medicine, Adverse drug reaction
- **Beliefs and Knowledge of the patient:** Beliefs on clinician's ability, Knowledge of the patient on consequence of non-adherence, Belief on effectiveness of drugs, intention to continue the medicine and knowledge of the consequence of non-adherence.
- **Health care related factor:** Unclear instruction, Frequency of consultation per year, Pharmacist interaction, Availability of pharmacy/medicine, Multiple prescribers, knowledge of clinician.
- **Multiple Prescribed Medications**

18.9. Methods of Data Collection

18.9.1. Data collection Instruments/tool

The data collection instrument is a structured pretested interview-based questionnaire and check list guided document review. The questionnaire was adapted from literatures (12, 37, 41, 42, 44, 48, 49, 57, 58) and standardized Morisky Medication Adherence 8 item Scale (64, 65). The questionnaire was prepared originally in English language and then translated into Amharic language for data collection purpose by fluent Amharic and English speakers and then back to English by other translators. The questionnaire was organized into four heading as sociodemographic characteristics of the respondents, the questionnaire to extract the information from the participant's medical record regarding the medication regimen, known comorbid or complication states and glycated hemoglobin (hbA1c) and duration of the disease, Morisky Medication Adherence Scale-8 item containing 8 questions will be used to evaluate self-report of adherence to multiple prescribed medications, and 20 questionnaire to interview the patients on multiple prescribed medication about health care provider related factors, medication related factors, perceived beliefs and knowledge of the patient and presence of multiple prescribed medications to obtain information related to factors associated to adherence

to MPMs . Patient taking four and above medications as the standing dose will be considered multiple prescription of medication users. Whereas, a score MMAS-8 of 8 indicates high adherence, a score of 6-7 indicates medium adherence whilst a score of less than 6 indicates poor adherence for Adherence measuring questionnaire.

18.9.2. Data Collectors and Data Collection Procedure

The data will be collected by a total of three data collectors who have a minimum of a diploma in nursing and who can speak Amharic language fluently. Three supervisors with MSc in either Public Health or nursing will be selected.

The data will be gathered using structured questionnaire, face to face exit interview from type 2 diabetes by selecting them systematically, after asking them for their willingness and oral informed consent.

The responsibility of the supervisors is to check whether the questionnaires are correctly filled out during data collection period. Supervisors will collect the completed questionnaire and handover it to the principal investigator on the day data collection are conducted. Each questionnaire filled will be checked for completeness of the information's by the principal investigator and will be processed subsequently on a daily basis.

18.10. Data Quality Control

Data collectors and supervisors will be trained intensively for one day by principal investigator on the topic of study, objectives, sampling strategies, inclusion/exclusion, informed consent, data collection strategies, handling, clarity, and completeness.

Pre-testing will be conducted on 5% of the total sample teaching hospital (Yekatit 12 Hospital and Medical College) 2 weeks before the actual data collection begins for clarity, completeness, and understandability and then, necessary correction will be made on the questionnaires. The collection of data will be checked by supervisor at each data collection center and by principal investigator on daily basis for any incompleteness and /or inconsistency and data with filling errors will be deleted from data set. Each questionnaire will be identified by the ID given for it.

Data validity and reliability will be maintained through close supervision of data collectors by supervisors and principal investigator.

18.11. Data Processing and Analysis

All the data will be checked for completeness and consistency by cross-checking and then will be coded and double entered into Epi Data Version 3.1 computer software package and cleaned for inconsistency. For further analysis, the data will be exported to Statistical Package for Social Science (SPSS) software version 21.0.

The data will be processed using both descriptive and inferential statistics. The demographic features, magnitude of MPM, adherence to MPM will be processed descriptively using mean, median, rate, and ratio. During analysis Adherence will be re categorized as adhered when score when the patients score between [6-8) answer from 8 items and non-adhered if answer less than 6 items from 8 questionnaires.

For Analysis first, we run a bivariate analysis using the logistic regression model to identify those factors with $p < 0.25$ for inclusion in the multivariate analysis. The multivariate analysis will be conducted using the logistic regression model to identify the predictors of MPM and to measure the level of covariation using the odds ratio. The significance of the correlation will be tested by using the Wald statistics/maximum likelihood method at 95% confidence level. Those factors with $p < 0.05$ at 95% confidence level in the final model will be considered as statistically significant predictors

Text, tables, graphs will be used for diagrammatic presentation and summarization of the variables.

18.12. Ethical Considerations

The study will be conducted after getting ethical approval and clearance from institutional review board (IRB) of school of Nursing and Midwifery, College of Health Sciences, Addis Ababa University. The supportive letter will be given from Addis Ababa University to selected Addis Ababa hospitals and letter of permission will be obtained from each hospital, then after a letter of cooperation will be sent to the department of a diabetic clinic.

Oral informed consent will be obtained from the study participants. Study participants will be provided with information about the objectives of the study, the right to withdraw at any time if they feel uncomfortable with the questionnaire and as they have had right to respond fully or partially to the questionnaire without any risks and penalty. They will also be informed as the information given by the respondents will be used for research purposes only, as confidentiality and privacy will be maintained by omitting the names of participants during the data collection procedure. Additionally, they will also be informed that the study does not cost additional expenses on the study participants except their time expense.

18.13. Dissemination of Results

Finding of this study will be presented in open defense and submitted to Addis Ababa University college of health science, school of nursing and midwifery, to CHS library, and to selected hospitals diabetic unit.

Effort will also be made to publish in peer reviewed journals and will be presented in different national and international conferences and seminars.

19.WORK PLAN

Table 5 Work plan for study of Adherence to Multiple Prescribed Medication among Type 2 diabetic patients, Addis Ababa, Ethiopia 2018.

s/n	Activities	Res. Body	Time in months									
			Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	may.	Jun.
1	Topic selection	PI										
2	Proposal finalization	PI										
3	Budget approval and ethical clearance	IHRERC										
4	Prepare for field work	PI										
5	Selection & training of DC and supervisors	PI										
6	Pre-test	PI+DC+ Sup.										
7	Data collection and entry	DC+PI+ Sup. + DEC										

8	Data analysis and thesis write up	PI										
9	Submission of draft to advisor and final thesis draft to department	PI										
10	Mock and Final defense	PI										
11	Submitting final thesis draft	PI										
12	Monitoring overall activities	PI										

Key: DC = Data Collector, DEC = Data Entry Clerk, IHRERC = Institutional Health Research Ethical Review Committee, PI = Principal Investigator, Sup. = supervisor

20.BUDGET BREAK DOWN

Table 6. tentative budget breakdown for study on adherence to multiple prescribed medication among Type 2 Diabetic patients. Addis Ababa, Ethiopia, 2019

A/ STATIONARY

S/N	ITEM DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL PRICE
1	Duplicating paper	Pads	2	80	160
2	Printing questionnaires	Price	4(422)	1	1688
3	Printing document	Price	2x45 + 4x70	1	370
4	Pen and pencil	Price	16 +8 pencil	5	120
5	Computer typing	Price	1	500	500
	Subtotal				2838

B/ PERSONAL COST

S/N	BODY REQUIRED	NUMBER OF PERSON	OCCUPATION	COST PER DAY	NUMBER OF TOTAL DAY	TOTAL
1	Secretarial	1	At least level III	100	3	300
2	Translators	2	Msc	179	2	716

3	Training of data collectors	6	All the same	179(6)	1	1074
4	Trainers	1	MSc candidate	179	1	179
5	Investigator	1	MSc candidate	179	22	3938
6	Super visor	3	MSc nurse/public health	179	22	11814
7	Data collectors	3	Diploma	124	22	8184
	Subtotal					26205

C/ CONTINGENCY10%.

BUDGET SUMMERY: -

A/ STATIONARY2838

B/PERSONAL COST.....26205

C/CONTINGENCY.....2904.3

GROUND TOTAL (A+B+C)31947.30 E.B

21.REFERENCE

1. Salih SB, Yousuf M, Durihim H, Almodaimagh H, Tamim H. Prevalence and associated factors of polypharmacy among adult Saudi medical outpatients at a tertiary care center. *Journal of family & community medicine*. 2013;20(3):162.
2. Alwhaibi M, Balkhi B, Alhawassi TM, Alkofide H, Alduhaim N, Alabdulali R, et al. Polypharmacy among patients with diabetes: a cross-sectional retrospective study in a tertiary hospital in Saudi Arabia. *BMJ open*. 2018;8(5):e020852.
3. Williams A, Manias E, Walker R. Interventions to improve medication adherence in people with multiple chronic conditions: a systematic review. *Journal of advanced nursing*. 2008;63(2):132-43.
4. Whiting DR, Guariguata L, Weil C, Shaw J. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes research and clinical practice*. 2011;94(3):311-21.
5. Abebaw M, Messele A, Hailu M, Zewdu F. Adherence and associated factors towards antidiabetic medication among type II diabetic patients on follow-up at University of Gondar Hospital, Northwest Ethiopia. *Advances in Nursing*. 2016;2016.
6. Atlas D. International diabetes federation. Press Release, Cape Town, South Africa. 2006;4.
7. Inamdar S, Kulkarni R, Karajgi S, Manvi F, Ganachari M, Kumar BM. Medication Adherence in Diabetes Mellitus: An Overview on Pharmacist Role. *Open Journal of Advanced Drug Delivery*. 2013;1(3):238-50.
8. Marcum ZA, Gellad WF. Medication adherence to multidrug regimens. *Clinics in geriatric medicine*. 2012;28(2):287-300.
9. Williams AF, Manias E, Walker R. Adherence to multiple, prescribed medications in diabetic kidney disease: A qualitative study of consumers' and health professionals' perspectives. *International journal of nursing studies*. 2008;45(12):1742-56.
10. Duerden M, Avery T, Payne R. Polypharmacy and medicines optimisation. Making it safe and sound London: The King's Fund. 2013.
11. Geresu G, Yadesa T, Abebe B. Polypharmacy and the Contributing Factors Among Elderly Patients in Shashemene Referral Hospital, West Arsi, Oromia Region, Ethiopia. *J Bioanal Biomed*. 2017;9:277-82.
12. Slater N, White S, Venables R, Frisher M. Factors associated with polypharmacy in primary care: a cross-sectional analysis of data from The English Longitudinal Study of Ageing (ELSA). *BMJ open*. 2018;8(3):e020270.

13. Anusri Unni T. LMKaVT. IMPACT OF POLYPHARMACY ON MEDICATION ADHERENCE IN PATIENT WITH TYPE 2 DIABETES MELLITUS WORLD JOURNAL OF PHARMACY AND PHARMACEUTICAL SCIENCES 2017;6(11):1394-400
14. Priyanka T, Lekhanth A, Revanth A, Gopinath C, Babu SC. Effect of polypharmacy on medication adherence in patients with type 2 diabetes mellitus. Indian Journal of Pharmacy Practice. 2015;8(3):127.
15. Bauer S, Nauck M. Polypharmacy in people with Type 1 and Type 2 diabetes is justified by current guidelines—a comprehensive assessment of drug prescriptions in patients needing inpatient treatment for diabetes-associated problems. Diabetic Medicine. 2014;31(9):1078-85.
16. Cadogan CA, Ryan C, Francis JJ, Gormley GJ, Passmore P, Kerse N, et al. Development of an intervention to improve appropriate polypharmacy in older people in primary care using a theory-based method. BMC health services research. 2016;16(1):661.
17. Peron EP, Ogbonna KC, Donohoe KL. Antidiabetic medications and polypharmacy. Clinics in geriatric medicine. 2015;31(1):17-27.
18. Waheed S, Jamal M, Amin F. POLYPHARMACY AND MEDICATION COMPLIANCE IN PATIENTS WITH TYPE 2 DIABETES. International Journal of Pharmaceutical Sciences and Research. 2017;8(5):2298-301.
19. Cadogan CA, Ryan C, Hughes CM. Appropriate polypharmacy and medicine safety: when many is not too many. Drug safety. 2016;39(2):109-16.
20. Cooper JA, Cadogan CA, Patterson SM, Kerse N, Bradley MC, Ryan C, et al. Interventions to improve the appropriate use of polypharmacy in older people: a Cochrane systematic review. BMJ open. 2015;5(12):e009235.
21. Muth C, Blom JW, Smith SM, Johnell K, Gonzalez-Gonzalez AI, Nguyen TS, et al. Evidence supporting the best clinical management of patients with multimorbidity and polypharmacy: a systematic guideline review and expert consensus. Journal of Internal Medicine. 2018.
22. Sinnott C, Bradley CP. Multimorbidity or polypharmacy: two sides of the same coin? : SAGE Publications Sage UK: London, England; 2015.
23. Patton DE, Hughes CM, Cadogan CA, Ryan CA. Theory-based interventions to improve medication adherence in older adults prescribed polypharmacy: a systematic review. Drugs & aging. 2017;34(2):97-113.
24. Hilbink M, Lacroix J, Bremer-van der Heiden L, van Halteren A, Teichert M, van Lieshout J. Effectiveness of a medication-adherence tool: study protocol for a randomized controlled trial. Trials. 2016;17(1):274.
25. Mathew EM, Rajiah K. Assessment of medication adherence in type-2 diabetes patients on poly pharmacy and the effect of patient counseling given to them in a multispecialty hospital. Journal of basic and clinical pharmacy. 2013;5(1):15.
26. Mair A, Fernandez-Llimos F, Alonso A, Harrison C, Hurding S, Kempen T, et al. Polypharmacy management by 2030: a patient safety challenge. 2017.
27. Alfian SD, Sukandar H, Lestari K, Abdulah R. Medication adherence contributes to an improved quality of life in type 2 diabetes mellitus patients: a cross-sectional study. Diabetes Therapy. 2016;7(4):755-64.
28. Marathe PH, Gao HX, Close KL. American Diabetes Association Standards of Medical Care in Diabetes 2017. Journal of diabetes. 2017;9(4):320-4.
29. Kanta Kumar SG, Karim Raza, Paramjit Gill, Rebecca Stack. Understanding adherence-related beliefs about medicine amongst patients of South Asian origin with diabetes and cardiovascular disease patients a qualitative synthesis. BMC Endocrine disorder. 2016;16(24).
30. Zheng Y, Ley SH, Hu FB. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. Nature Reviews Endocrinology. 2018;14(2):88.
31. Habte BM, Kebede T, Fenta TG, Boon H. Barriers and facilitators to adherence to anti-diabetic medications: Ethiopian patients' perspectives. African journal of primary health care & family medicine. 2017;9(1):1-9.
32. Abebe N, Kebede T, Addise D. Diabetes in Ethiopia 2000-2016—prevalence and related acute and chronic complications; a systematic review. African Journal of Diabetes Medicine. 2017;25(2).
33. Iglay K, Hannachi H, Joseph Howie P, Xu J, Li X, Engel SS, et al. Prevalence and co-prevalence of comorbidities among patients with type 2 diabetes mellitus. Current medical research and opinion. 2016;32(7):1243-52.
34. Lin P-J, Kent DM, Winn A, Cohen JT, Neumann PJ. Multiple chronic conditions in type 2 diabetes mellitus: prevalence and consequences. Am J Manag Care. 2015;21(1):e23-34.

35. Gadsby R, Galloway M, Barker P, Sinclair A. Prescribed medicines for elderly frail people with diabetes resident in nursing homes—issues of polypharmacy and medication costs. *Diabetic Medicine*. 2012;29(1):136-9.
36. Grant RW, Devita NG, Singer DE, Meigs JB. Polypharmacy and medication adherence in patients with type 2 diabetes. *Diabetes care*. 2003;26(5):1408-12.
37. Rieckert A, Trampisch US, Klaaßen-Mielke R, Drewelow E, Esmail A, Johansson T, et al. Polypharmacy in older patients with chronic diseases: a cross-sectional analysis of factors associated with excessive polypharmacy. *BMC family practice*. 2018;19(1):113.
38. Jaam M, Awaisu A, Ibrahim MIM, Kheir N. A holistic conceptual framework model to describe medication adherence in and guide interventions in diabetes mellitus. *Research in Social and Administrative Pharmacy*. 2018;14(4):391-7.
39. Sontakke S, Jadhav M, Pimpalkhute S, Jaiswal K, Bajait C. Evaluation of adherence to therapy in patients of type 2 diabetes mellitus. *Journal of Young Pharmacists*. 2015;7(4):462.
40. Geitona M, Latsou D, Toska A, Saridi M. Polypharmacy and Adherence Among Diabetic Patients in Greece. *The Consultant Pharmacist®*. 2018;33(10):562-71.
41. da Silva MRR, Diniz LM, dos Santos JBR, Reis EA, da Mata AR, de Araújo VE, et al. Drug utilization and factors associated with polypharmacy in individuals with diabetes mellitus in Minas Gerais, Brazil. *Ciência & Saúde Coletiva*. 2018;23(8):2565-75.
42. Balkhi B, Alqahtani N, Alwhaibi M, Alshammari TM, Alhawassi TM, Mahmoud MA, et al. Prevalence and factors associated with polypharmacy use among adult patients in Saudi Arabia. *Journal of patient safety*. 2018.
43. Austin RP. Polypharmacy as a risk factor in the treatment of type 2 diabetes. *Diabetes Spectrum*. 2006;19(1):13-6.
44. Noale M, Veronese N, Perin PC, Pilotto A, Tiengo A, Crepaldi G, et al. Polypharmacy in elderly patients with type 2 diabetes receiving oral antidiabetic treatment. *Acta diabetologica*. 2016;53(2):323-30.
45. Sweileh W, Aker O, Hamouz S. Effect of 'polypharmacy' and 'frequency' of drug dosing on rate of compliance among diabetic and hypertensive patients: a survey study in Palestine. *An-Najah Univ J Res*. 2003;17:155-65.
46. An J, Nichol MB. Multiple medication adherence and its effect on clinical outcomes among patients with comorbid type 2 diabetes and hypertension. *Medical care*. 2013;51(10):879-87.
47. Aloudah NM, Scott NW, Aljadhey HS, Araujo-Soares V, Alrubeaan KA, Watson MC. Medication adherence among patients with Type 2 diabetes: A mixed methods study. *PloS one*. 2018;13(12):e0207583.
48. Jaam M, Awaisu A, Ibrahim MIM, Kheir N. Factors influencing medication adherence in diabetes mellitus: Developing a holistic conceptual framework model. *Research in Social and Administrative Pharmacy*. 2017;30:1e7.
49. Jaam M, Ibrahim MIM, Kheir N, Awaisu A. Factors associated with medication adherence among patients with diabetes in the Middle East and North Africa region: a systematic mixed studies review. *Diabetes research and clinical practice*. 2017;129:1-15.
50. Kirkman MS, Rowan-Martin MT, Levin R, Fonseca VA, Schmittdiel JA, Herman WH, et al. Determinants of adherence to diabetes medications: findings from a large pharmacy claims database. *Diabetes Care*. 2015;dc142098.
51. Murphy DA, Sarr M, Durako SJ, Moscicki A-B, Wilson CM, Muenz LR. Barriers to HAART adherence among human immunodeficiency virus-infected adolescents. *Archives of pediatrics & adolescent medicine*. 2003;157(3):249-55.
52. Kumaraswamy M, Chitti R, Acharya A, CH V, Dhakal K, Rayamajhi M, et al. Incidence of Polypharmacy in Type 2 Diabetic Patients in a Rural Tertiary Care Teaching Hospital in South India. *drugs*. 26:17.1.
53. Papazafiropoulou A, Koutsovasilis A, Pappas S, Bousboulas S. Rates of polypharmacy among patients with type 2 diabetes mellitus in Greece. *Arch Hellen Med*. 2014;31:750-2.
54. Rozenfeld S, Fonseca MJ, Acurcio FA. Drug utilization and polypharmacy among the elderly: a survey in Rio de Janeiro City, Brazil. *Revista Panamericana de Salud Pública*. 2008;23:34-43.
55. Chen SY, AV, Lee YC, Greene M., Oderda G. . EVALUATION OF POLYPHARMACY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AND ITS ASSOCIATION WITH MEDICATION ADHERENCE AND HEALTH CARE COSTS VALUE IN HEALTH 2013;16(-):A1-A298.
56. D Piette J, Heisler M, Harand A, Juip M. Beliefs about Prescription Medications among Patients with Diabetes: Variation Across Racial Groups and Influences on Cost-Related Medication Underuse 2010. 349-61 p.

57. Geitona M, Latsou D, Georgiou A, Panayidis N. Polypharmacy and Medication Adherence in Elderly Patients with Diabetes in Pafos General Hospital, Cyprus. *Value in Health*. 2016;19(7):A684.
58. Gunathilake G, Kottahachchi D, Siyambalapitiya S. The drug compliance among patients with diabetes in Sri Lankan setting. 2017.
59. Jarab AS, Almrayat R, Alqudah S, Thehairat E, Mukattash TL, Khmour M, et al. Predictors of non-adherence to pharmacotherapy in patients with type 2 diabetes. *International journal of clinical pharmacy*. 2014;36(4):725-33.
60. Ababa A. Addis Ababa health bureau report. 2017.
61. Hospital TAS. Tikur Anbessa Specialized hospital and nursing directorate report. . Dec 2017.
62. college SPsmhm. Saint Paulo's millennium hospital medical college (SPHMMC) report. . <https://www.sphmmc>. 2017.
63. hospita Tsac. Torayloch specialized and comprehensive hospital. matron nurse office report. 2017.
64. Plakas S, Mastrogiannis D, Mantzourou M, Adamakidou T, Fouka G, Bouziou A, et al. Validation of the 8-item Morisky Medication Adherence Scale in chronically ill ambulatory patients in rural Greece. *Open Journal of Nursing*. 2016;6(03):158.
65. Mohd MMA-H, Phung H, Sun J, Morisky DE. The predictors to medication adherence among adults with diabetes in the United Arab Emirates. *Journal of Diabetes & Metabolic Disorders*. 2015;15(1):30.

22.ANNEX-

ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCE, SCHOOL OF NURSING AND MIDWIFERY, POST GRADUATE PROGRAM, DEPARTMENT OF ADULT HEALTH NURSING

QUESTIONNAIRES' FORMAT FOR RESPONDENTS ON MULTIPLE PRESCRIBED MEDICATION ADHERENCE AND ITS ASSOCIATED FACTORS AMONG TYPE 2 DIABETIC PATIENT VISITING DIABETIC CLINIC OF SELECTED ADDIS ABABA HOSPITALS.

Appendix I: Information Sheet

Introduction: Good morning/good afternoon! My name is _____ and I come from _____. I am working as data collectors on the study of Multiple Prescribed Medication Adherence Among Type 2 Diabetic Patient Visiting Diabetic Clinic of Addis Ababa Hospitals. The study is being conducted by Mr. Aman Mamo who is an MSc student in Adult health nursing specialty at Addis Ababa University.

Objective: To determine the level of Adherence to Multiple Prescription Medication Among Type 2 Diabetic Patients visiting Diabetic Clinic of Addis Ababa tertiary Hospitals. 2018/19". You are being asked to take part in this study and to respond genuinely. This questionnaire asks about demographic factors, the number of medication you took for your disease and adherence status of your medication. It will take approximately 25 minutes to complete the questionnaire.

Participation: Your participation is voluntary and you are not obligated to answer any question you do not wish to answer. If you feel discomfort with the question, it is your right to drop it any time you want without penalty.

Risks and Benefits: This study doesn't benefit you directly, however, your honest answer to these question will help us to understand better how patients are adhering to their diabetic and related treatment and factors associated with multiple prescriptions. This finding will also help to develop good strategies and to solve the problems of the future, we greatly appreciate your truthful and ken participation in responding to these questions. There is no harm or discomfort including physical, psychological and social risks to you, except the time spent on completing the questionnaire.

Confidentiality: personal information will be identified with in the data processing only. Your name will not be needed in this form and will never be used in connection with any information you tell us. All information given by you will be kept strictly confidential. The collected data will only be used for the purpose of the study.

Person to contact: If you have questions regarding this study or would like to be informed of the results after its completion, please feel free to contact the principal investigator using the following address.

Address of the principal investigator:

Cell phone: +251966889998/ Email: amanmamo68@gmail.com

Data collector's name _____ Signature _____ Date _____

THANK YOU VERY MUCH FOR YOUR COOPERATION

Are you willing to participate in the interview? Yes/No

IF NO, thank you

IF YES, Consent Form

CONSENT FORM

I have been briefly informed about the study and I clearly understood the purpose, risks, benefit, and the right to participate and withdraw at any time. I have also informed that there is no direct financial benefit for my participation. Since it doesn't affect my personal life, I don't need any remedy. Consequently, I am willing to participate in the study.

ID NO.....

Interviewer name..... Supervisor..... Date of interview.....

Appendix II: English Questionnaire

Section 1. Socio Demographic Characteristics of study participants related to diabetic and diabetic related disease.

NO	Questions	Coding categories
116	Sex	1 male 2 female
117	What is your age in years?	
118	Which Ethnic group you belong to?	1 Amhara 2 Oromo 3 Tigre 4 Gurage 5 Other specify
119	What is your marital status?	1 unmarried 2 married 3 divorced 4 widowed
120	What is your religion?	1 Muslim 2 Orthodox 3 Catholic 4 Protestant 5 Others (specify)

121	What is your level of education?	1 unable to read and write 2 can read and write 3 grade 1-8 4 grade 9-12 5 diploma 6 degrees and above
122	What is your Current occupational status?	1 gov't employee 2 un employed 3 private employee 4 students 5 merchants 6 others specify -----
123	Your approximate Monthly income (ET Birr)?	1 < 100 2 100-499 3 500-1400 4 >1400
124	What is your place of residence?	1 Addis Ababa 2 outside Addis Ababa
Questionnaire to be filled by interviewing the patient or from the patient's medical records		
125	Weight	----- (in KG)
126	Height	----- (in meter)
127	Glycated hemoglobin (HbA1c)	----- (%)
128	Time since diagnosis of the disease in years	____ (in years)
129	Is there any complication of the disease (diabetes) diagnosed	3. Yes 4. No
130	If, Yes for Q114 which types of chronic disease diagnosed in addition to T2DM (list disease)	_____ _____
131	List of medication used regularly by the patient including Anti diabetic medication in kinds	_____ _____ _____
132	Number of medication taken by the patient for the past 1 months or since last follow up.	-----
If the patient took less than four medications, Thank the patient and finish the study. If four and above proceed to the next section		

SECTION 2. Morisky Medication Adherence scale-8 items(64, 65) measurements of study participants.

You indicated that you are taking medication for your diabetic and diabetic related disease. Individuals have identified several issues regarding their medication-taking behavior and we are interested in your experiences. There is no right or wrong answer. Please answer each question based on your personal experiences with your diabetic and related problems medication. Please answer the following question by saying yes or no. use Likert scale for question number 208.

Code	Morisky Medication Adherence scale-8 item questionnaire	1. Yes	2. No
209	Do you sometimes forget to take your all diabetic and diabetic related pills?		
2010	Over the past two weeks, were there any days when you did not take your regular daily medicine?		
2011	Have you ever cut back or stopped taking your medication without telling your doctor, because you felt worse when you took it?		
2012	When you travel or leave home, do you sometimes forget to bring along your medications ?		
2013	Did you take all your medicine yesterday?		
2014	When you feel like your disease is under control, do you sometimes stop taking your medicine?		
2015	Taking medication every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?		
2016	How often do you have difficulty remembering to take all your medication?	0 never/rarely 1 ones a while 2 sometimes 3 usually 4 all the time	

SECTION 3. Questionnaire to assess factors associated with adherence to multiple prescribed medication among Type 2 diabetic patients attending diabetic clinic of Addis Ababa tertiary hospitals, 2019.

	Questions	Coding categories
Questionnaire used to assess medication related factors		
3021	Do you take all your medicines regularly according to doctors order?	4. Yes 5. No 6. I don't remember
3022	If your answer for Q301 is yes skip to 303 , if Q301 is no what was/were the reasons for not taking the prescribed medicines regularly? More than one answer is possible	12. I was too busy with other thing or simply forget 13. I was away from homes 14. I feel depressed 15. I ran out of medication 16. I had many medicines to take 17. I felt the drug is to toxic (side effects) 18. I have no remaining aids and supporting family in my homes 19. The clinic is far from my house 20. I have no money to go to the clinic 21. I did not think the drug is doing anything to improve my health. 22. I am confused about how to take my medicine at a time.
3023	What do you think about the cost of your medications?	4. Cheap 5. Medium 6. expensive
3024	Is the medication you took is complex or confusing to take?	3. Yes 4. No

3025	If Yes for Q304, what makes your medication complex to you? More than one answer is possible	6. Its color 7. Its frequency 8. Number of injection 9. Methods of administration 10. Others specify-----
3026	Have you faced complication while you take your medication? If <u>no</u> to Q305 skip to Q308	3. yes 4. no
3027	which side effects do you encounter commonly? (more than one answer is possible)	-----
3028	what measures do you take against the side effects/complication?	4. took until appointments 5. immediately report to professional 6. immediately stop until an appointment
Questionnaire used to assess health care related factors		
3029	How frequent you visit your physician?	6. Every month 7. Every two months 8. Every three months 9. Variable 10. Others
3030	From how many physicians/units you took your medicines ?	5. one 6. Two 7. Three 8. Others----
3031	Do you have open communication with health care provider treating you?	3. Yes 4. No
3032	Do you obtain education or assistance you need during your clinic visits?	3. yes 4. no
3033	Do you have access to reliable pharmacy any time you want?	3. yes 4. no
3034	Is the instruction given by Pharmacists understandable?	3. Yes 4. No
Questionnaire used to assess factors related to Perceived knowledge and beliefs of the patients		
3035	Are you satisfied with your clinician services	3. Yes

		4. No
3036	Do you feel health care provider treating you is capable?	3. Yes 4. no
3037	Do you know the consequence of non-adherence?	3. Yes 4. No
3038	Do you know the targets of your glycemic control?	3. Yes 4. No
3039	Do you think the medication you took is effective for your disease?	3. Yes 4. No
3040	Do you intend to take the prescribed medicines regularly according to the doctors order in the future?	4. Yes 5. No 6. I am not sure

Thank you for your cooperation

DECLARATION AND APPROVAL SHEET

ADDIS ABABA UNIVERSITY ADVISORS AND EXAMINER APPROVAL SHEET

By my signature below I declare and affirm that this proposal is my own work, I have followed all ethical principles of scholarship in preparation of this proposal. All scholarly matters included in the proposal has been given recognition through citation. I affirm that every effort has been made to avoid plagiarism in preparation of this proposal entitled on “**Prevalence and Adherence to Multiple Prescribed Medications and its predictors Among Type 2 Diabetic Patients Attending Tertiary Hospitals in Addis Ababa, Ethiopia 2019**”

PRINCIPAL INVESTIGATOR:

AMAN MAMO (BSc) _____

Name of student

Signature

Date

The research proposal entitled above has been carried out under our supervision. Therefore, we approve that the student has fulfilled the requirements and hence he can submit the proposal to the department.

APPROVED BY:

NAME OF RESEARCH ADVISOR

1. Dr. AMSALE C. (PhD, Associate professor)

Name of Major Advisor

Signature

Date

2. Mr. WUDMA A. (MSc, PhD Fellow)

Name of Co-Advisor

Signature

Date

NAME OF EXAMINER

1. DANIEL M. (MSc, PhD Fellow)

Name of examiner

Signature

Date