Assessment of medication therapy management service among adult diabetes mellitus patients on follow up clinic at Tikur Anbessa Specialized Hospital

By:

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A Thesis Submitted to Department of Pharmacology and Clinical Pharmacy, School of Pharmacy, College of Health Sciences in Partial Fulfillment for the Requirements of Master of Pharmacy in Pharmacy Practice (MPharm)

Addis Ababa University

Addis Ababa, Ethiopia

November 2019

Addis Ababa University
School of Graduate Studies

This is to certify that the thesis prepared by Zenebe Negash entitled "Assessment of medication therapy management service among adult diabetes mellitus patients on follow up clinic at Tikur Anbessa Specialized Hospital", and submitted in partial fulfillment for the requirements of the Degree of Master of Pharmacy in Pharmacy Practice complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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November 2019

Abstract

Assessment of medication therapy management service among adult diabetes mellitus patients on follow up clinic at Tikur Anbessa Specialized Hospital

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Diabetes mellitus (DM) patients are at increased risk of developing drug therapy problems (DTPs) since they often receive multiple pharmacotherapeutic agents due to coexistence of multiple co-morbidities and complications associate with the disease. Medication therapy management (MTM) is a distinct service or group of services that optimize therapeutic outcomes for individual patients. Thus, the aim of this study was to assess impact of introduction of MTM service at DM clinic of Tikur Anbessa Specialized Hospital (TASH). A prospective hospital based interventional study was carried out at DM clinic between July 2018 and April 2019. The intervention package includes patient counseling, education, identification and resolving of DTPs for the given six months followed by four-months post- interventional assessment of DTPs, medication adherence and treatment satisfaction. Data were collected, entered and analyzed using Statistical Package for the Social Sciences (SPSS). Descriptive statistics and logistic regressions were performed for data analyses. Of 423 participants, 409 fulfilled the inclusion criteria and included in the final analysis of the study. The mean age of the patients was 52.3(SD, 15.6) years. Most of the study participants were type-II DM (78.2%). About 73.1% had comorbidity. They had mean disease duration of 13.86(SD, 8.64) years. There were decreases in hemoglobin A1c (HbA1c), fasting blood sugar (FBS) and systolic blood pressure (SBP) by 0.92%, 25.04 mg/dl and 6.62 mm Hg respectively as compared with the pre-intervention phase ($P< 0.05$). The prevalence of DTPs in the pre- and post-intervention of MTM services were found to be 72.9 %(n=298) and 26.2 %(n=107) respectively. Primary education level (AOR=2.94, 95% CI: 1.25-6.91), charging for medication from pocket (AOR= 2.27, 95%CI: 1.08-4.77), male gender (AOR=3.06, 95% CI: 1.54-6.07) were significant predictors of DTPs. About 80.4% of participants were adherent to their medications at the end of MTM intervention. Poorly controlled glycemic control (AOR=2.33, 95% CI: 1.17-4.68) and presence of three and above co-morbidities (AOR=4.76; 95% CI: 1.4-15.8) were associated with poor adherence. The

overall mean score of treatment satisfaction was 75.6(±9.7). Diabetes patients of age below 40years (77.66(SD, 8.18)), type-I DM (77.79(SD, 8.46)), treated with one medication (77.89(SD, 7.19)) and good adherence to their medication (76.17(SD, 8.89)) had higher satisfaction score ($P<0.05$). In conclusion, provision of MTM service showed a significant improvement in DTPs reduction, medication adherence, treatment satisfaction and clinical parameter relative to the pre-intervention MTM services.

Keywords: Medication therapy management; Diabetes mellitus; Drugs therapy problems, Medication adherence, Treatment satisfaction

Acknowledgement

First and foremost, my gratefulness goes to Almighty God and his mother St. Mary for courage they give me to do this work. I also like to thank Addis Ababa University, College of Health Sciences, School of Pharmacy for giving me educational opportunity and the Medication Therapy Management Thematic Research Project of Addis Ababa University for funding this research work. In particularly, my profound gratitude and deepest acknowledgments goes to my advisors Dr.Workineh Shibeshi, Mr. Alemseged Beyene and Dr. Abdurazak Ahmed for their unreserved support and provision of valuable advice and ideas in all rounds of my study. I also extend my special thanks to all the data collectors, participants, nurses and other staffs of the diabetes clinic who helped me by facilitating the research activity and all my friends for their realistic comments, helps and many of cooperative recommendations. Lastly but not least I would like to express my sincere gratitude and appreciation for my family for uncreditable contributions in my life.

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Acronyms and abbreviations

AACEs	American Association of Clinical Endocrinologists
ACEIs	Angiotensin Converting Enzyme Inhibitors
ADAs	Antidiabetic agents
ADE	adverse drug event
ADR	adverse drug reaction
ANOVA	Analysis of variance
AOR	Adjusted odds ratio
APhA	American Pharmacists Association
ARBs	Angiotensin II receptor blockers
CMR	Comprehensive medication review
COR	Crude odds ratio
DM	Diabetes mellitus
DRP	Drug-related problem
DTP	Drugs therapy problem
eGFR	estimated glomerular filtration rate
GDM	Gestational diabetes mellitus
IDF	International Diabetes Association
MAP	Medication related action plan
MDRD	Modification of diet in renal disease
MMAS	Morisky Medication Adherence Scale
MPR	Medication possession ratio
MTAC	Medication Therapy Adherence Clinic
MTM	Medication therapy management
MTMC	Medication therapy management clinic
MTR	Medication therapy review
OGLAs	Oral glucose-lowering agents
OTC	Over-the-counter
PMR	Personal medication record

SATMED-Q	Satisfaction with Medicines Questionnaire
SEMDSA	The Society for Endocrinology, Metabolism and Diabetes of South Africa
TASH	Tikur Anbessa Specialized Hospital
USD	United States dollar
WHO	World Health Organization

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1. Introduction

1.1. Background

Diabetes mellitus (DM) is a metabolic disorder with heterogeneous etiologies, characterized by chronic hyperglycemia and disturbances of carbohydrate, fat and protein metabolism due to defects in insulin secretion, insulin action or both(SEMDSA, 2017). It diagnosed by observing raised levels of glucose in the blood which lead to short and long term complications(IDF, 2015). DM can be classified based on etiopathogenisis as type 1 diabetes, type 2 diabetes(~90–95% of diabetes), gestational diabetes mellitus (GDM) and a less common types of diabetes which include monogenic diabetes and secondary diabetes. Assigning a type of diabetes to an individual often depends on the circumstances present at the time of diagnosis and many diabetic individuals do not easily fit into a single class(ADA, 2010; Aschner, 2017).

Globally, an estimated 422 million adults were living with diabetes in 2014, compared to 108 million in 1980. The global prevalence of diabetes has nearly doubled since 1980, rising from 4.7% to 8.5% in the adult population. By 2040, globally the difference is expected to widen, with 477.9 million people living in urban areas and 163.9 million in rural areas had diabetes(IDF, 2015).

Over the past decade, diabetes prevalence has risen faster in low and middle-income countries than in high-income countries(WHO, 2016). An estimated 14.2 million adults aged 20-79 have diabetes in the Africa region, representing a regional prevalence of 2.1-6.7%. According to international diabetes federation (IDF) report in Ethiopia, about 1.377 million people were with diabetes in the year 2011 and this number will be expected to rise to 2.629 million by 2030 among adults aged 20-79 years (Whiting *et al.*, 2011). Unfortunately these number were touched in Ethiopia in 2017 in which about 2.6 (1.1-3.8) million had diabetes(IDF, 2017). Its incidence and prevalence are still unknown in the general population due to lack of national data on prevalence and incidence of DM.

Global health spending to treat diabetes and prevent complications was estimated to range from United States dollar (USD) 673-1197 billion in 2015. By 2040, this number is projected to

exceed USD 802-1452billion. The more conservative estimate suggests that health spending on diabetes accounted for 11.6% of total health expenditure worldwide in 2015. In Ethiopia total annual diabetes-related healthcare expenditures (20-79 years) were between USD 80-200millions(IDF, 2015).

The management of diabetes is complex, which requires more than plasma glucose control. Comprehensive diabetes care should also comprise managing DM-specific complications and modify risk factors for DM-associated diseases(Madhu and Srivastava, 2015). It requires lifestyle modification in combination with the pharmacological agents (oral antidiabetic agents (ADAs) and insulin therapy) to address the multiple pathophysiological defects(Aziz *et al.*, 2013). Due to the complexity of management modality that required involvement of different specialist, DM management challenged by the occurrence of drug therapy problems (DTPs)(US Department of Health Human Services, 2014).

Drug therapy problems are undesirable events or circumstances experienced by a patient that involves or is suspected to involve drug therapy and interfere with the achievement of the desired goals of therapy. It can be categorized based on problem associated with medication such as indication (unnecessary treatment & need for additional treatment), effectiveness (ineffective drug & dosage too low), safety (adverse drug reactions & dosage too high) and non-adherence). DTPs can occurs at different stages starting from prescriber to patients and often deleterious and costly (Cipolle *et al.*, 2012; Ogallo and Kanter, 2016; US Department of Health Human Services, 2014).

Researches conducted in different part of the world showed that, the prevalence of DTPs were high. In study in China a mean of 0.9(SD,0.6) DTPs per patient(Wong, 2017), Indonesia an averaging of 2.88 (SD,0.23) DTPs per patient(Adnyana, 2017), India mean of 1.30(SD,1.10) DTPs per patient(Shareef *et al.*, 2015) and Malaysia an averaging of 1.94(SD,1.10) DTPs per patient(Huri and Ling, 2013) were occurred. A study carried out in Nigeria also showed that there was an averaging of 2.1(SD, 1.4) DTPs per patient(Ogbonna *et al.*, 2014).

In Ethiopia the prevalence of DTPs among diabetes patients at Hiwot Fana Specialized hospital, Harar(Ayele *et al.*, 2018) and Wolaita Soddo university teaching hospital(Koyra *et al.*, 2017)

were found to be 1.8 DTP per patient for both setups. Therefore, to counteract such problem there should be an implementation of a program that targets prevention, identification and resolution of DTP to enhance patients' quality of life.

Medication therapy management (MTM) is standard practice for assessing patient drug-related needs, identifying and resolving DTPs. It is pharmacist-provided, non-dispensing services, which involves a multifaceted approach of reviewing medications, identifying and remedying DTPs. MTM service also involve providing disease state management and self-management education, addressing medication adherence issues and considering preventative health strategies that aim to optimize drug therapy and improve clinical outcomes of patients. MTM services are the embodiment of the philosophy of pharmaceutical care(Ogallo and Kanter, 2016).

MTM service includes a comprehensive medication review (CMR) to ensure if the patient's medication-related needs have been met and all of his/her medications are appropriate, effective, safe and convenient. At the end of the review, a care plan is developed and shared with the patient and the primary care provider to resolve and prevent any DTPs by eliminating unnecessary medications, initiating appropriate medications, adjusting dosage regimens, addressing adverse reactions and increasing the patient's willingness and ability to adhere to the medication regimen(Cipolle *et al.*, 2012; Rodis *et al.*, 2017).

Different literatures showed that provision of MTM service improves different factors that contribute challenges to chronic disease management. In study targeting efforts to improve medication adherence in USA, patients' in the MTM program had good achievement in treatment goals due to improvement in medication adherence(Stuart *et al.*, 2013). In a systematic review and meta-analysis of 44 studies assessed the effect of MTM interventions in the outpatient setting for patients with chronic illnesses found that MTM implementation enhances adherence and medication appropriateness(Viswanathan *et al.*, 2015). A pragmatic randomized controlled trial(RCT) of telephonic MTM to reduce hospitalization in home health patients, the intervention group was three times less likely to be hospitalized compared with a usual care group(Zillich *et al.*, 2014). Therefore, the aim of this study was to assess the impact of introducing MTM service at DM clinic of Tikur Anbessa Specialized Hospital (TASH).

1.2. Statement of problem

Diabetes mellitus prevalence is rapidly rising all over the globe at an alarming rate. Despite the availability of effective treatment, it is still associated with substantial morbidity and mortality. Concerning its fatality issue diabetes was the direct cause of around 1.5 million deaths in 2012 with more than 80% death in low and middle-income countries(WHO, 2016). The management of diabetes is commonly intricated by the existence of comorbidity and polypharmacy, which in turn exaggerate risk of happening of DTPs(Shareef *et al.*, 2015).

DTPs are significant public health issue worldwide and have been significantly increased over the past few decades. It can occurs at all stages of the medication usage process starting from prescribing to a user. Lack of follow-ups and reassessment of therapeutic outcomes may also contribute to DTPs. It poses a challenge to the clinician, affects patient's clinical outcomes and result in morbidity or mortality and increased health care costs. Health care costs may become a burden to the patient or the government or the third parties (IDF, 2015; Shareef *et al.*, 2015).

In a study carried out at Hong Kong diabetes clinic about 417 DTPs were identified from 522 patients with 62.8% incidence of DTPs and mean of 0.9 (SD,0.6) DTPs per patient(Wong, 2017). Finding from secondary care hospital in Cimahi, Indonesia also showed that about 261 DTPs were identified with an averaging of 2.88 (SD,0.23) problems per patient among study participants(Adnyana, 2017). In interventional study in India total of 147 DTPs were identified from 111(71.1%) patients case records with mean number of 1.30(SD,1.10) DTPs per patient(Shareef *et al.*, 2015). In addition, study conducted in Malaysia, about 92% patients had at least one DTPs, averaging 1.94(SD,1.10) problems per patient(Huri and Ling, 2013). In study conducted in Nigeria also showed total of 792 DTPs were identified from 399 patients with an average of 2.1(SD,1.4) DTPs per patient(Ogbonna *et al.*, 2014).

Studies in different health facility of Ethiopia, showed that the prevalence of DTPs was high. The result of study showed that DTP per patient was at least one at Gondar university hospital(Abegaz *et al.*, 2018) and 1.65 at Jimma university specialized hospitals(Yimama *et al.*, 2018). In study conducted at TASH also showed that DTPs were 1.2(SD,0.65) per patient among study participants(Teklemariam *et al.*, 2018).

Drug associated hospital admissions have significantly raised over time. A systemic review of literature showed that drug related hospital admittances account around 5-10% of hospital admissions. The reviewer also stated that hospital admission due to DTPs were avoidable in up to 50% on an average(Nivya *et al.*, 2015). In study at University Medical Centre Ljubljana, Slovenia about 90% of ADRs were also potentially avoidable(Brvar *et al.*, 2009).

In study conducted in Spain 19.4% of admissions were the direct consequence of ADR and of which 65% were preventable. ADR associated cost was €237,377 and mean cost per admission was €4844(Menéndez-Conde *et al.*, 2011). In the US, it is estimated that adverse drug events are responsible for an estimated 3.5 million physician office visits, 1 million emergency department visits and 125,000 hospital admissions per year(Ogallo and Kanter, 2016). In study conducted in United Kingdom (UK) & Saudi Arabia (SA) showed that DTPs were occurred in more than 50% of the total study participants (58.7% in the UK and 52.6% in SA). Of the investigated DTPs, 70.9% and 41.5% led to hospitalization in the UK and SA, respectively (Al Hamid *et al.*, 2016).

DTPs are major issue to cause drug-related mortality and morbidity, which is a major public health concern. In US an estimated 100,000 deaths occur annually due to DTPs which costing the taxpayers approximately $201.4 billion in direct medical costs per year(Ombengi *et al.*, 2016). In the US, between the period 1987-2011, the treatment related cost to the patient had doubled, with prescription drug costs accounting for 55% of the increase(Zhuo *et al.*, 2015).

Due to lack of adherence to treatment and other recommendations, more than 50% of chronically treated patients do not follow the recommended lifestyle changes or do not take the prescribed pharmacotherapy(Debussche, 2014). The factors that contribute to low levels of adherence include complex treatment regimens, medication side effects, poor patient-provider communication, patient financial resources and beliefs, psychiatric disorders, memory impairment and treatment satisfaction(Nam *et al.*, 2011; Vermeire *et al.*, 2001). Among the elderly in particular and patients with a variety of chronic diseases who attend various clinics are at risk for polypharmacy and subsequent DTPs(Lochner and Cox, 2013; Wang *et al.*, 2017).

Finding showed that medication adherence is a major challenge for diabetes patients. In a systematic review of the literature, around 25% of patients do not receive their medications after

the initial prescription, and 40% do not refill prescriptions for medications ordered for chronic conditions. These studies demonstrated that first-fill rates are highest for sulfonylureas and metformin and lowest for insulin, signifying strong necessity of follow-up and adherence support in early periods of therapy, especially for those who are prescribed insulin(Capoccia *et al.*, 2016). In study conducted in Ethiopia at TASH also showed that about 25% of study participants were non-adherent to their medication(Teklemariam *et al.*, 2018).

Failure to realize adequate treatment satisfaction may result from treatment side effects, lack of effectiveness or difficulties with treatment application. Low treatment satisfaction may in turn cause poor compliance, which further reduces effectiveness, especially among patients with chronic diseases and might ultimately lessen patients' health-related quality of life(Weaver *et al.*, 1997).

To overcome such drug therapy issue and attain targeted therapeutic outcomes implementation of MTM service is crucial. In meta-analysis of 44 studies, to assess the effectiveness of MTM services interventions in patients with chronic diseases showed that MTM improved appropriate medication prescribing, use and adherence(Viswanathan *et al.*, 2015). The long-term clinical and economic gains from MTM as depicted by the Asheville project researchers showed that more than 50% of patients presenting with reduced HbA1c and a raised number of patients with optimal HbA1c(values of below 7%) at each follow-up assessment(Cranor *et al.*, 2003). In prospective pre-post longitudinal study, at the end of 1 year, patients' HgA1c levels decreased on average by 0.27 from their baseline values while systolic and diastolic blood pressure decreased on average by 6.0 and 4.2 mmHg, respectively(Pinto *et al.*, 2014).

In study to evaluate the impact of face-to-face MTM on medication adherence among patients taking insulin, oral hypoglycemic, statins, ACEI/ARB and beta-blockers. MTM exposure was associated with an increase of medication adherence across all therapeutic classes [insulin, (10%), oral hypoglycemic (5%), statins (7.8%), ACEI (10.9%), beta-blockers (4.8%)] compare to the controls(Soliman, 2013).

There were different studies conducted on implementation of MTM service in different countries but there is no study on impact of implementing MTM service in diabetes in Ethiopia. Thus, aim of this study was to assess impact of introduction of MTM service at diabetic clinics of Tikur

Anbessa Specialized Hospital. Therefore, the finding of study helps to assess how much DTPs were reduced through MTM service. The finding may be useful as a baseline for future provision of MTM service in different setups for better improvement of health outcome. The study also provides information to hospital, regulatory body as well as policy makers to focus on MTM implementation for better improvement.

2. Literature Review

2.1. Diabetes mellitus and its impacts

Diabetes mellitus is a complex, chronic illness of multiple etiologies requiring continuous medical care with multifactorial risk-reduction strategies beyond glycemic control. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction and failure of different organs, especially the eyes, kidneys, nerves, heart, and blood vessels(Golden *et al.*, 2009). The classification of the diabetes often depends on the circumstances present at the time of diagnosis, and many diabetic individuals do not easily fit into a single class(IDF, 2015).

The major driver of diabetes costs is the treatment of the related complications. Investing in intensive blood glucose control could help to reduce the cost of diabetes complications by up to 32%(Degli Esposti *et al.*, 2013). Furthermore, in the UK alone it was estimated that improved diabetes management could lead to savings of £340 million in the first five years(Baxter *et al.*, 2016). In low-income countries, 73% of diabetes deaths occurred in people under the age of 60, which is the productive age group that have a substantial impact on economic development. Risk factors for mortality in people with diabetes include cardiovascular disease, kidney disease, depression, and high levels of HbA1c(Ogurtsova *et al.*, 2017).

2.2. Management of DM

Management of DM need coordinated treatment modalities that involves pharmacological and non-pharmacological approach to address multiple pathophysiological defects. This importantly incorporates the principles of self-management through patient education and patient self-empowerment(Aziz *et al.*, 2013). Obligating evidence also proposes that optimal vascular protection is attained through multifactorial approach (e.g., use of antiplatelet therapy, ACE

inhibitors, metformin and statins) thereby giving risk reduction in patients with risk factors(Pinchevsky *et al.*, 2017).

The management of diabetes is comprehensive care to emphasize the fact that optimal diabetes therapy requires more than plasma glucose management. It also involves detecting and managing DM-specific complications and modifying risk factors associated with diseases. The management is a multidisciplinary approach with a team consisting of a diabetologist, a certified diabetes educator, a nutritionist and when required subspecialists (including neurologists, nephrologists, and vascular surgeons with experience in DM related complications). Central to the success of this team are the patient's participation, input, and enthusiasm i.e. the therapy is now individualized and patient centered(Madhu and Srivastava, 2015).

2.3. Challenges in the management of DM

2.3.1. Drug therapy problems

Even though drug therapy enhances health-related quality of life by treating different disease condition, inappropriate use may be harmful and could evoke side effects. The management of drug therapy is challenging due to its growing complexity(Al-Azzam *et al.*, 2016). Drug therapy problems occurrence interferes with the desired therapeutic outcome. It happens in all stage of medication usage process that start from prescriber to consumer and lack of follow-ups and reassessment of therapeutic outcomes can exacerbate the condition. Even though there are no uniform systems of classification for DTPs, according to Cipolle there are four major category that can be sub categorized to seven DTPs(Cipolle *et al.*, 2012).

DTPs are a global burden that affects physical, psychological and economy of the patients and community as a whole(IDF, 2015). To avert these problems an area of an expert such as clinical pharmacy, a discipline that promotes the quality use of medicines through evidence-based medicine use is essential. A clinical pharmacist through his/her clinical accuracy checking may identify DTPs and come out with suitable solutions to resolve the problem (Adusumilli and Adepu, 2014). A rational, safe and cost effective drug treatment depends on competent diagnosing, prescribing, effective monitoring and evaluation of drug therapy, patient

understanding and compliance in relation to the prescribed medication(Adusumilli and Adepu, 2014).

2.3.2. Medication adherence

Patient medication adherence may vary on a day-to-day basis and may vary for different medications depending on the patient beliefs about the need for and efficacy of a particular medication(Parthasarathi *et al.*, 2004). Various factors are associated with non-adherence to medication in DM patients, which can be categorized as patient centered, therapy-related or healthcare system related. Patient centered contributors include socio-demographic (age, gender and educational status) factors, psychological factors such as motivation towards therapy taking, patient-prescriber relationship and patient knowledge. Therapy associated factors include route, type and duration of treatment, complexity of treatment, cost of medication and adverse effects. Healthcare system factors include availability and accessibility of health care, and the health provider-patient interactions(Almaghaslah *et al.*, 2018).

Reinforcing factors such as communication with the patient, the ability to resolve the patient's concern regarding their disease and medication, regular follow up, and quality and quantity of time spent with patient and family members, giving written instructions to the patients may improve medication adherence(Parthasarathi *et al.*, 2004). Even though adherence to medication therapy is a crucial, WHO finding shows that the average rate of non-adherence among patients in the US with one or more chronic conditions is ~50%(Chisholm-Burns and Spivey, 2012).

A study conducted in Malaysia showed that more than 50% of T2DM patients did not adhere to treatment. In that respect, one of the initiatives taken by pharmaceutical services department to increase patient adherence towards medications was the initiation of Medication Therapy Adherence Clinic (MTAC)(Bakar *et al.*, 2016). Because of their specialized knowledge of medications and access to patients, outpatient pharmacists are well positioned to coach patients in overcoming barriers to adherence. The Medication Adherence Program (MAP) study demonstrated that a brief pharmacist phone call after a missed diabetes prescription refill resulted in a significant improvement in medication possession ratio (MPR) compared with the control

group, especially among patients whose baseline MPR was below 0.80 (0.81 study group vs. 0.71 control group(Spence *et al.*, 2014).

2.3.3. Treatment satisfaction

Satisfaction is one of the elements that determines a patient's adherence to their treatment and their association is clinically intuitive. If a patient is dissatisfied with treatment, their involvement in treatment, their perception and attitude toward treatment, and intention to persist may be negatively affected. Hence, by knowing the satisfaction level and the factors affecting it, intervention to enhance patient satisfaction level for the pharmaceutical care provided in diabetes can improve adherence level (Al-Aujan *et al.*, 2012; Al Shahrani and Baraja, 2014).

In diabetes, it has been shown that increased treatment satisfaction is associated with better glycemic control suggesting that higher satisfaction is related to better clinical outcomes. Studies have measured factors that influence treatment satisfaction in diabetes patients. In the IMPROVE study conducted in seven country(Canada, China, India, Italy, Japan, Poland and Russia) showed that lower treatment satisfaction was associated with comorbidity, hypoglycemia and weight gain (Brod *et al.*, 2010). A study conducted in Italy showed that lower treatment satisfaction was associated with being female, using insulin, and having diabetes complications(Nicolucci *et al.*, 2009).

Patient satisfaction can be conceived as a pyramid where satisfaction with healthcare is placed at the base. This covers all aspects of the care received and includes patient satisfaction with access to medical care, physician behavior and technical competence, the services provided, the costs, and the treatment selected. Overall treatment satisfaction rests at an intermediate level of the pyramid and includes all associated aspects such as effectiveness, convenience, undesirable effects, follow-up, etc. Lastly, they found satisfaction with the medication received - this being the patient's evaluation of the process of administering the medication and the associated results at the top of the pyramid(Shikiar and Rentz, 2004).

In addition, cognition of the level of satisfaction with treatment may make it easier to anticipate treatment compliance and help clinicians take health-related conclusions. Therefore, this

parameter may be a useful indicator to measure in daily practice and biomedical research(Lenderking, 2005).

2.4. Medication therapy management service

Medication therapy management (MTM) is a service by which a pharmacist provides comprehensive medication therapy plan. This plan includes, but is not limited to, the review of a patient medication history (including all prescription, over the counter and nutritional or herbal supplements), medical history, available laboratory data and other pertinent available information. From this information, the pharmacist develops a medication related problem list, and along with the patient begins to build a medication-related action plan (MAP). MTM focus is on identifying and improving DTPs the patient may experience during treatment(Burns, 2008).

A randomized controlled trial of patients with poorly controlled T2DMs found that patients in the pharmacist intervention group achieved a 2.1% reduction in hemoglobin A1c (HbA1c) compared with 0.9% in the control group(Hayward *et al.*, 2005). In study performed to compare care of a clinical pharmacist on a primary care team and the usual care found that the addition of a pharmacist to a health maintenance organization primary care team decreased the mean HbA1c from 9.5% to 6.99% in the study group compared with a decrease from 9.3% to 8.4% in the control group. They also found an 18.2% reduction in LDL-Cholesterol in the study group compared with a 6.4% reduction in the control group(Ip *et al.*, 2013). MTM pilot study in Texas showed that delivering MTM services cause an average 15% reduction in HbA1c, average medication adherence score increased from 94.4 to 97.4% and 24 medication-related interventions in which all were accepted (Ndefo *et al.*, 2017).

A systematic review and meta-analysis of literature found that outpatient MTM services among patient populations with chronic illness showed improved adherence rates (approximately 4.6%), percent of patients achieving a threshold adherence level(odds ratios ranged from 0.99 to 5.98), and medication appropriateness(4.9 vs 0.9 points on the medication appropriateness index). MTM also reduced the costs of diabetes-specific hospitalization (Viswanathan *et al.*, 2015).

In the evaluation of the MTM Pilot aimed to determine the clinical and economic value of a community based MTM program among Texas Medicaid recipients results over the 18-month study period out of 498 pharmacist interventions (averaging 3.0/patient) the physician/patient acceptance rate was 82.1%. For a subset of patients who received MTM services there were significant mean total healthcare cost savings of $8,599.89/patient resulting in total cost savings of $696,591.09. This study suggested that a pharmacist-led and delivered MTM program had the potential to improve optimal diabetes management rates in a population of complex diabetes patients(Barner *et al.*, 2015).

In study of assessing the effectiveness of pharmacist-directed MTM in improving diabetes outcomes in patients with poorly controlled diabetes the results showed that a pharmacist directed MTM is positively associated with medication adherence and disease outcomes in patients with sub-optimally controlled T2DM. The results showed that prior to matching, medication adherence rates were 64.6% versus 10% compared to non-MTM and after matching, these findings persisted, with more patients in the MTM group (62%) being medication adherent than in the non-MTM group (7%)(Skinner *et al.*, 2015).

In study to evaluate whether involvement in a comprehensive MTMC could improve in clinical parameters, it showed improvements in HgA1cof 0.54% at 6 months and 0.63% at 12 months as compared with controls. At 6 months, SBP and DBP decreased in MTMC patients by 6.5mmHg and 3.8 mmHg more than controls, respectively. At 12 months, those receiving MTMC services had SBP and DBP decreases of 8.2 mmHg and 1.7 mmHg respectively compared with controls(Tilton *et al.*, 2019).

In a study done at Gondar university hospital, clinical pharmacists identify 335 DTPs from 182 patients and provide intervention through MTM service with high acceptance from patients(99.2) and physicians(68.5)(Abegaz *et al.*, 2018).

Conceptual framework

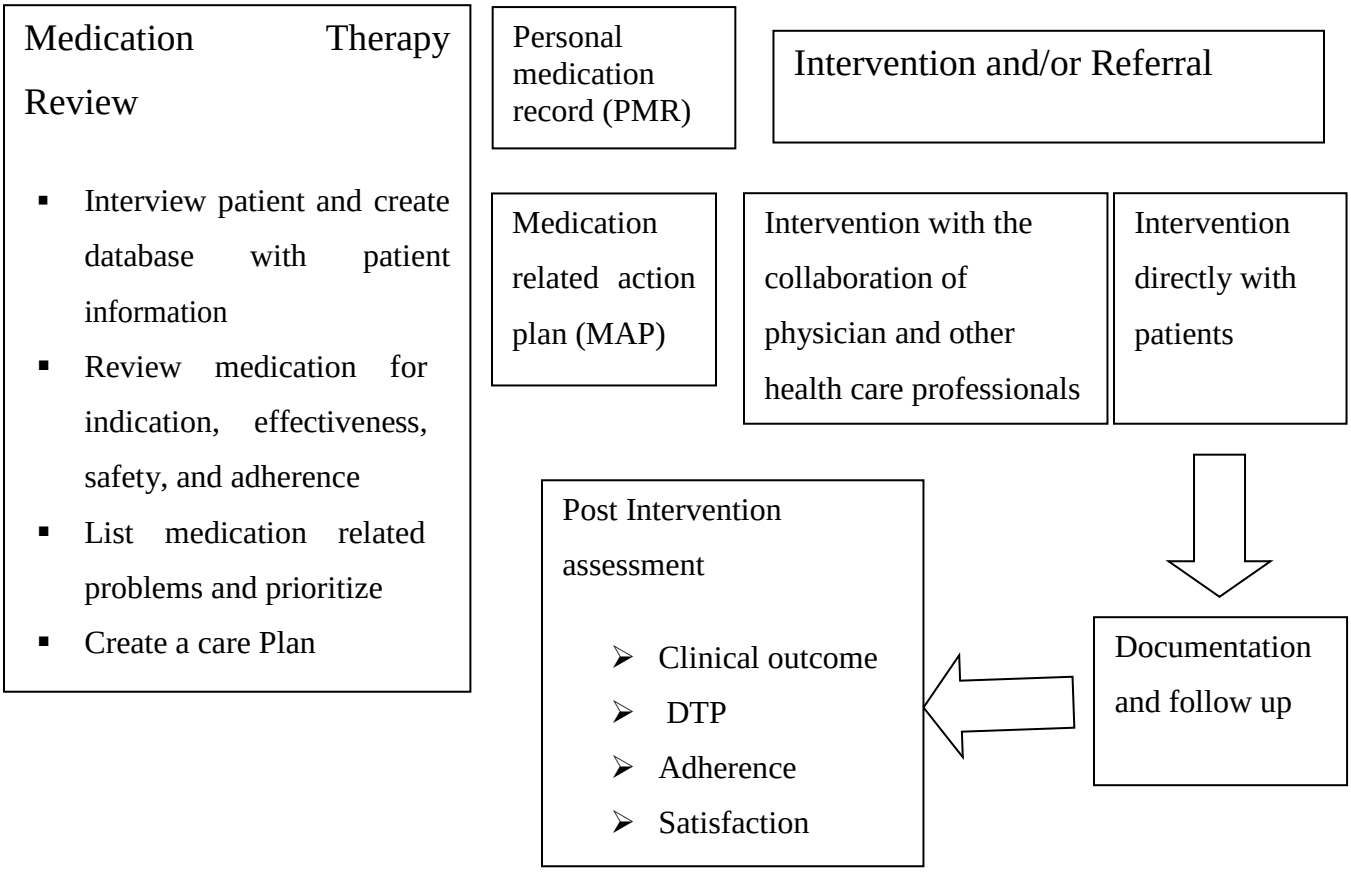

Figure 1: Conceptual framework for implementation of MTM services and post service assessment in adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

3. Objectives

3.1. General objective

The aim of this study was to assess the impact of introduction of medication therapy management services at diabetes clinic of Tikur Anbessa Specialized Hospital.

3.2. Specific objectives

1. To identify drug therapy problems during follow up with pre-post medication therapy management service among diabetic patient
2. To determine the changing of clinical outcomes of diabetic patients during pre-post medication therapy management service
3. To assess patient medication adherence after the implementation of medication therapy management service
4. To assess treatment satisfaction after the implementation of medication therapy management service

4. Methods

4.1. Study setting

The study was conducted at DM clinic of Tikur Anbessa Specialized Hospital (TASH), Addis Ababa, Ethiopia. TASH, the largest referral hospital in the country, which was established in 1972; and now serving as the main teaching hospital for health science students and rendered a clinical service to the whole nation. It offer comprehensive health care service for 500,000 patients per year through 20 specialty clinics and 5 main inpatient service departments. It has over 600 beds and 3088 professional and support staffs in inpatient, outpatient, emergency units and administrative.

One of these specialty clinics is the diabetes clinic, which is a DM center; provide an outpatient service for different endocrine condition in different schedule. The clinic had 6 consultants/endocrinologists, one fellow, 7 internal medicine residents who were assigned for attachment in the clinic, 6 nurse and 3 dispensing pharmacist. Adult patients with type 1 and 2

diabetes scheduled to visit the clinic on every Monday and Wednesday morning as well as diabetes foot ulcers on Friday morning. On average about 6000 patients were attending diabetes clinic annually with an average of about 250 diabetes patients per week.

4.2. Study design and period

A pre-post interventional study design was carried out in the time period range from July 2018 to April 2019 for a total of 10 months. This study period had two consecutive phases that include 6-month intervention and 4-month post assessment.

4.3. Source and study population

The source population includes all diabetic patients who were on follow up at DM clinic of TASH. The study population involved all patients visiting TASH during the study period for management of DM and also who fulfill the inclusion criteria.

4.4. Eligibility criteria

4.4.1. Inclusion criteria

- All adult patients attending diabetes follow up clinics and diagnosed as DM for at least three months and had prescribed drugs (minimum three-month disease duration since diagnosed and prescribed with drugs) were included.
- Age >18years

4.4.2. Exclusion criteria

- Gestational DM patients
- Patients planning to change the follow up clinic to other setups, and patients who were not willing to participate in the study

4.5. Sample size and sampling technique

Sample size computed based on single proportion formula assuming a prevalence (p) of 50%, as there was no research conducted on this topic in Ethiopia and neighboring countries. A z-value of 1.96 was used at 95% CI and d of 5%. (n= sample size, p= prevalence, d= margin of error).

$$n = \frac{Z^2\ p\ (1-p)}{d^2} = \frac{(1.96)^2 x\ (0.5)\ (0.5)}{(0.05)^2} \quad = 384.16$$

Therefore, with adjustment for 10% contingency, the total sample size were 423.

During the recruitment periods patients who had an appointment were make the sampling frame and the sampling fraction was calculated. The average weekly attender (~250 patients) were used for calculation of constant (k). The predetermined sample of participants per day were calculated by using total sample size (423) divided by the number of days scheduled per three months(24 days) of the recruitment period. Based on this calculation about 18 patients were sampled each day. This was made for the purpose of participant distribution throughout the year for better representativeness.

A systematic random sampling technique was used based on list of patients' appointment record by calculating sampling interval as K=N/n (where N (125) average number of patients per day; n (18) is sample to be taken per day). Then participant's medical card number (ID) were taken every seventh interval for comprehensive chart review. A colored sticker was posted on the patient chart to identify easily during follow up. Chart reviewed and some activities were performed a day before the appointment date. At the day of appointment, recruited participants were interviewed for additional information and provided with MTM services after they got usual physician services. During intervention period, already recruited patients were excluded from making sample of new recruitment. All patients recruited for the intervention were used for post MTM assessment study.

4.6. Intervention development and implementation

The intervention began by comprehensive chart review for the recruited patients who were attending the clinic on appointment date. During the first visit, the patients get their usual medical care from physician and then transferred to the MTM pharmacist, where the participants' basic clinical information were documented and medication therapy review was completed. The information included such as a brief explanation of the self-reported disease states, medications, potential adverse drug events as well as their medication adherence issue. The number of medications taken by patients including all active over-the-counter (OTC) medications, supplements, herbal products, medications used to treat acute conditions or used for a limited time period (e.g., antibiotics, analgesics) and medications prescribed for chronic conditions (e.g., antihypertensive medications, antidepressant agents) were documented.

Based on the standard guideline the pharmacist reviewed the patient's medication regimen and render verbal education and training on medication delivery and best administration sites and education on health-promoting behaviors (diet, exercise, alcohol use and smoking cessation) with the goal of optimizing medication therapy to improve outcomes. The intervention were provided for both new recruited and for those on MTM follow up based on the therapeutic need of patients. In addition to intervention provided at the day of recruitment, each patients had got at least one MTM service during the intervention period. Pharmacists use currently updated guidelines and textbooks (ADA, 2018; Garber *et al.*, 2018; Joseph DiPiro, 2017; IDF, 2017) for provision of intervention.

The interventions reflected the published literature on MTM service and focused on potentially inappropriate medications. These included identifying DTPs, such as medication duplications, drug interactions, dosing for renal and liver impairment, suspected ADR, therapeutic drug monitoring and inappropriate non-pharmacological managements (dietary and lifestyle modification).

The pharmacists also provide the brochure that was written in Amharic language as intervention package to increase patients' awareness about their disease condition and lifestyle modification. The package also included personal medication data book that include personal information,

personal medication record (MAR), medication action plan (MAP), investigation recorder (BP, FBS, RBS and HgA1c) and additional information about hypoglycemia symptoms and its management.

Upon completion of the review, the pharmacist discussed recommendations regarding the current DTPs with the treating physician and respective patients at that moment. So that the pharmacist could review any changes made to the patient's therapy. The pharmacist then documented any interventions made during the visit. After the initial visit, the pharmacist also followed the patients by telephone calls and also remembered for their appointment date not to missed. If an intervention was required during the follow-up via calls, the pharmacist made an intervention in collaboration/consultation with physicians who were working in diabetic clinics.

During each visit, patients were interviewed for any new DTP, educated on their disease state and medications use. Unresolved issues from the prior sessions were also discussed. The pharmacist carried out an assessment of the treatment care plan to monitor the patient's adherence to the medication action plan and to establish new therapy goals when required. Abnormal lab values, potential medication-related interventions and other updates on the patients' progress were reported back to the patients' physician.

All MTM activities were documented using a manually prepared patient information documentation tool. Baseline data were recorded from patient and medical chart during the first involvement in MTM that include HbA1c, weight, height, previous and current medical and medication history. The time spent for each patient was 15-20 min for patient interview as well as medication review with patient and/or caregiver and 15-20 min for intervention, patient medication record and documentation.

Drug therapy problems identification

Drug therapy problems were identified and classified using the Cipolle's(Cipolle *et al.*, 2012) tools which were classified into 4 major categories; indication, effectiveness, safety, and compliance and 7 subcategories. The identification of DTP was based on a review of patients' medical and medication records, assessment of laboratory investigations, patient's interview

about medication experience and physical observation. Specific information about medication therapies, such as the recommended drug of choice, recommended dosages, frequency of administration, duration of therapy, drug-interactions and ADR were compared based on details from the standard pharmacotherapy textbooks and DM treatment guidelines(ADA, 2018; Joseph DiPiro, 2017).

In DTPs identification the participant‘s age, comorbid conditions and diabetes complications, glycemic control, drug safety profile and the proper drug selection, dosage titration, indication for therapy, untreated indication, clinical characteristic, organ function test etc were considered. For both pre-post MTM assessment, a recent HgA1c and an average consecutive FBS were considered. For patients who needed, estimated glomerular filtration rate (eGFR) was calculated using Modification of Diet in Renal Disease (MDRD) = 186× (creatinine/88.4) −1.154 ×age − 0.203× (0.742 if female) × (1.21 if black). Where, the result was expressed in ml/min/1.73 m^2(Michels *et al.*, 2010). Upon completing identification of DTP the discussion were undergone with concerned bodies (physician, nurse, dispenser pharmacist and patient).

Anthropometric measurements

Anthropometric measurements were weight, height and waist circumference (WC) (inch). Height was measured in meters (m) using a height scale while the subject was standing upright and with normal straight posture. Weight was measured in kilogram (kg) using a weight scale. Body Mass Index (BMI) was calculated as the ratio of weight (kg) to the square of height (m). Waist circumference (inch) was measured by non-elastic meters.

Medication adherence

Modified Morisky Medication Adherence Scale (MMAS 8) assessment questionnaires were implemented to assess the adherence after the intervention was given to see the impact of MTM intervention. It is an eight item self-report measure of adherence. The single composite measure was scored according to the developers’ instructions so that lower scores indicate higher adherence. Individuals have identified several issues regarding their medication taking behavior. Each question was based on their personal experience with the medication taking behavior. The

first seven questions are scored with “yes = 1” and “No = 0.” Question eight concerning the difficulty to remember taking medications is scored as Never = zero, and one for the remaining response (rarely once in a while, sometimes, usually and all the time). During calculation the value were exchanged according to the tool and classified as sum of all value <6 low adherence; 6-8 middle adherence; 8 high adherence (Bener *et al.*, 2014).

Treatment satisfaction

A self-administered Treatment Satisfaction with Medicines Questionnaire (SATMED-Q) 17 questionnaire was used to measure patients’ treatment satisfaction. It is a brief, feasible and easy to self-administer multidimensional generic questionnaire with good metric properties of reliability and validity. The SATMED-Q is designed to assess treatment satisfaction in persons with any chronic disease treated with medicines. The SATMED-Q has 17 items, assessing six treatment satisfaction domains; undesirable side effects (3 items), treatment effectiveness (3 items), convenience of use (3 items), impact on daily activities (3 items), medical care (2 items) and global satisfaction (3 items) each of which is computed as a score. In addition, a total satisfaction score is computed. Each item in the scale uses a five point Likert scale; overall and domain scores range from zero to 68 or zero to 100(after transformation), with higher scores indicating greater levels of treatment satisfaction(Rejas *et al.*, 2011; Ruiz *et al.*, 2008).

4.7. Study variables

4.7.1. Dependent variables

- Drug therapy problem
- Change in clinical outcome
- Adherence
- Satisfaction

4.7.2. Independent variables

- Age, sex, marital status, education, residence, occupation status, disease type, type of medications(prescription and non-prescription), duration with the disease, comorbid disease & complication, source of medication, lifestyle, family history, physical activity.

4.8. Data collection and management

4.8.1. Data collection instruments

We used pre-tested data abstraction tool and Cipolle DTP identification tools for pre-post MTM assessment. In addition, during post MTM assessment we used Morisky 8 adherence assessment questionnaires and SATMED-Q for treatment satisfaction assessment as a data collection instruments. We also used electronic instrument (online source) such as Micromedex, Launch Lexi-Interact™ and Standard textbooks for DTP identification. Weight measuring balance, height measuring upright positioned meter, meter for waist circumference measuring and BP apparatus were also used.

4.8.2. Recruitment and training of intervention providers and data collectors

For this interventional study, two clinical pharmacists and two nurses were selected for facilitating, data collection and intervention provisions. They provided with a 2-days intensive theoretical and practical based training. The training was provided by senior clinical pharmacists about the procedure followed during intervention, how the intervention package implemented and how challenge resolved. Principal and co-investigators did supervision during the training. After completion of the training, they were assigned.

After completion of intervention phase for post MTM service assessment two nurse and two pharmacist were recruited for data collection. They also attended one-day training to familiarize them with the data collection instrument as well as how to solve potential problems encountered during data collection. The recruitment processes was based on their interest and full commitment to the MTM project.

Throughout study periods the role of pharmacist were providing intervention package and identifying drug related need of patients while nurses were involved in facilitating and coordinating of activities during intervention and data collection process.

4.8.3. Data quality management

Pre-test was done on 5% of the sample at the diabetes clinic of TASH for completeness of variables before the baseline data collection started. Based on the results obtained from pre-test, amendment was made on the assessment tools and ways of assessment. Training was given for the data collectors. Orientation was also given by the principal investigator(PI) and the supervisor as needed. The PI was closely supervising the data collection on a daily bases. At the end of each data collection days, the principal investigator checked the completeness of filled questionnaire and recorded information to ensure its quality. After data collection completed the PI carefully cleaned and entered the data into SPSS. The data analysis was performed under the supervision of biostatistician.

4.9. Data analysis

Completeness of the data was checked, cleaned, entered and analyzed using SPSS version 25. Descriptive analysis was computed as frequency, percent, mean and standard deviation (SD) for continuous and categorical variables data. To examine the influences of different variables on DTPs and adherence and controlling for potential confounders, both binary and multiple logistic analyses were performed. Independent variables having p-value <0.20 in the bivariate logistic regression analysis were entered into multivariable logistic regression analysis in order to control confounding effect.

Paired sample t-test was used to ascertain the significance of differences between the mean baseline data during the initiation of the service and end result of MTM follow up. Relationship between treatment satisfaction (mean scores of SATMED-Q) and sociodemographic and clinical characteristics of patient were also examined. Statistical significance of treatment satisfaction was determined using independent t-test for mean values of two continuous variables and the one-way analysis of variance (ANOVA) with post hoc analysis for mean values of more than

two continuous variables. A multivariate linear regression model was performed in order to identify independent variables associated with treatment satisfaction. A 95% CI and p-value of <0.05 was considered statistically significant for all data analysis. Tables, charts and graphs were used to present results.

4.10. Ethical considerations

The study was conducted after ethical approval was obtained from the College of Health Sciences of Addis Ababa University Institution Review Board (Ref. No.: 002/17/SPharma). Written informed consent was obtained from participants before collecting the required data. The study result did not intend to include participants' identifiers. The raw data was not made available to anyone, other than the research team.

4.11. Operational definitions

- **Adverse drug reaction (ADR)**: Any response to a drug which is noxious and unintended, and which occurs at doses normally used in man for prophylaxis, diagnosis, or therapy of disease, or for the modification of physiological function(Adusumilli and Adepu, 2014).
- **Drug-therapy problem**: any undesirable event experienced by the patient that involves or is suspected to involve drug therapy and that actually or potentially interferes with desired health outcomes(Cipolle *et al.*, 2012).
- **Medication adherence**: The extent to which a person's behavior in taking medicines corresponds with the agreed recommendations from a health care provider.
- **Treatment satisfaction:** any report coming from patients about a health condition and its treatment (i.e good glycemic control, better understanding about their disease condition and factor exacerbates)
- **Medicine therapy review (MTR):** a systematic process of collecting patient specific information, assessing medicine therapies to identify medicine-related problems, developing a prioritized list of medicine-related problems, and creating a plan to resolve them.
- **Patient medicine record (PMR):** a comprehensive record of the patient's medicines (prescription and nonprescription medicines, herbal products, and other dietary supplements)

- **Medicine action plan (MAP):** a patient centric document containing a list of actions for the patient to use in tracking progress for self-management.
- **Comorbidity:** the presence of one or more additional diseases co-occurring with diabetes mellitus.
- **Body mass index(BMI):** mass divided by the height square ($BMI=Wt(kg)/Ht(m)^2$)
- **Waist circumference (WC):** measured at the midpoint between the bottom of the ribs and the top of the pelvis.
- **Informal education**- a person not certified with any grade level of education.
- **Alcohol use**- drinks any alcoholic beverage for women, more than one drink per day; for men, more than two drinks per day(one drink is equal to a 12-oz beer(350ml), 5-oz glass of wine(150ml), or 1.5-oz distilled spirits(45ml))(ADA, 2018).
- **Physical activity**: all movement that increases energy use by the individual- including activities undertaken while working, playing, carrying out household chores, travelling and engaging in recreational pursuits(ADA, 2018).
- **Exercise** is physical activity for at least 30 minutes per day for 5 days per week that is planned, structured, repetitive, and designed to improve or maintain physical fitness, physical performance, or health(Health and Services, 2018).
- **Unemployed**: Participants who do not have a job that provides money.
- **Hyperglycemia**: an average FBG level of above 130 mg/dl for patients between 18 and 60 years old with no comorbid with disease duration of below 8years and values above 150 mg/dl for those above 60 years of age and patients with multiple comorbid and also those with disease duration more than 8 years(SEMDSA, 2017).
- **Controlled hypertension**: if patient diagnosed as hypertension and initiated with medication or lifestyle modification achieve therapeutic goal of SBP/DBP< 130-140/90 mmHg
- **Controlled lipid profile:** if dyslipidemic patients achieve lipid profile of HDL-C >40 mg/dL**,** LDL-C <100 mg/dL, TG <150 mg/dL, and TC <200mg/dL
- **Poly-pharmacy**: The daily consumption of 5 or more medications (Fulton and Riley Allen, 2005).

5. Result

Out of 423 participant joined MTM service during intervention phase, 409 fulfilled the inclusion criteria and included in the final analysis of the study results.

Flow chart of participants

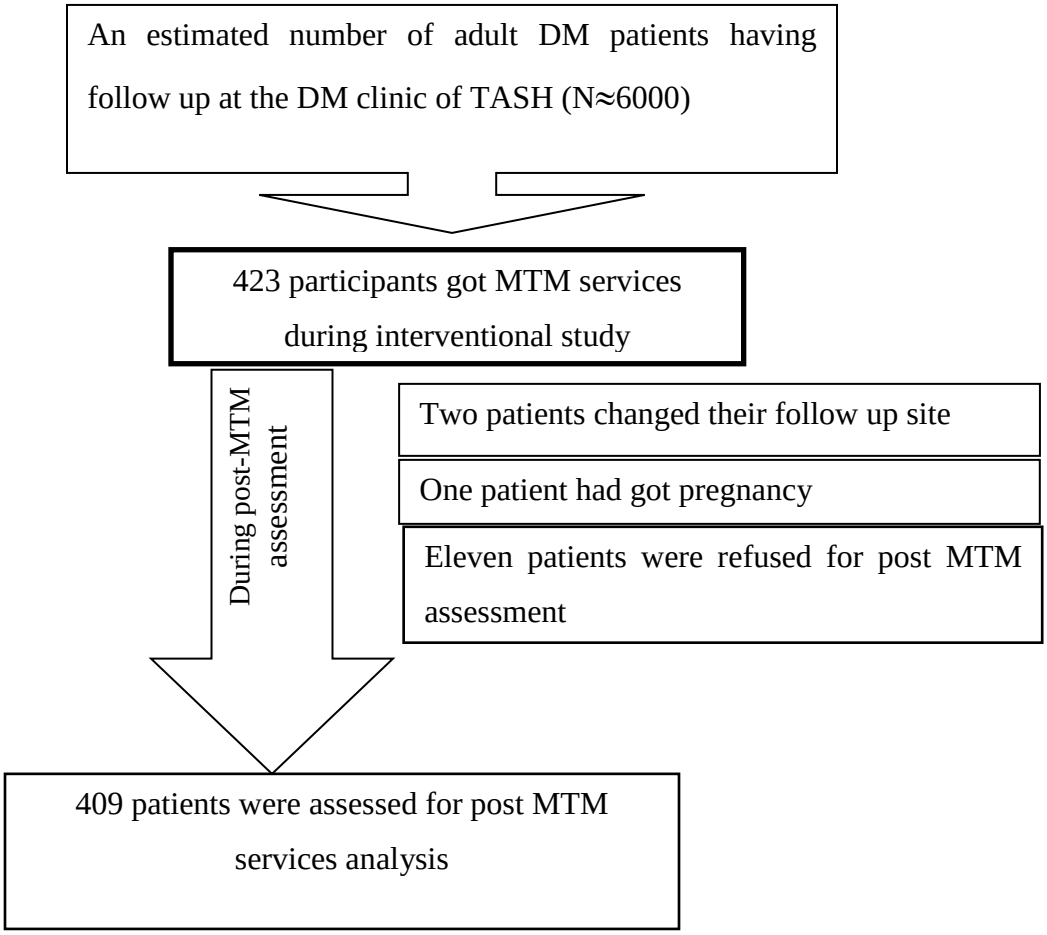

Figure 2: Flow chart of participants' sample size involved in the analysis among ambulatory patients with adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

5.1. Socio-demographic characteristics

The study participants had a mean (SD) age of 52.3 (SD, 15.6) years with most falls in age range of 40-60years (42.5%). Most of the study participants were females (54.5%) and married (71.4%). About 84.4% of the participants were the resident of Addis Ababa (Table 1).

Table 1: Socio-demographic characteristics of adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Variables	**Categories**	**N (%)**
Age(Years)	Mean ± SD	52.3 ±15.6
	<=40	99(24.2)
	40-60	174(42.5)
	>60	136(33.3)
Sex	Male	186(45.5)
	Female	223(54.5)
Marital status	Married	292(71.4)
	Single	69(16.9)
	Divorced	19(4.6)
	Widowed	29(7.1)
Education	Unable to write & read	28(6.8)
	Informal education	25(6.1)
	Primary school	74(18.1)
	Secondary school	131(32.0)
	Diploma and above	151(36.9)
Residence	Addis Ababa	345(84.4)
	Out of Addis Ababa	64(15.6)
Occupational status	Employed	115(28.1)
	Unemployed	82(20.1)
	self-employed	59(14.4)
	Others♠	153(37.4)
Source of medication	Buying	78(19.1)
	Free	331(80.9)
Allergy to any medication	Known	29(7.1)
	No/Not known	380(92.9)
Social drug use	X-smoker	4(1.0)
	Smoker	6(1.5)
	Alcohol consumption	59(14.4)
	Caffeine intake	280(68.5)
	Khat chewing	10(2.4)
Type of physical activity	No	56(13.7)
	Walking	193(47.2)

(Continued)

	Exercise	31(7.6)
	Daily activity	129(31.5)
Family history	No/Unknown/ Other♠♠	349(85.3)
	Mother/Father	24(5.9)
	Sister/Brother	18(4.4)
	Mother/Father/Sister/Brother	18(4.4)

♠Retired ♠♠Grandparents, Relative

5.2. Change in clinical outcomes

In this study to express basic descriptive statistics and difference between paired means, paired t-test was applied. As seen from the measured variables there were reduction in HgA1c, FBS, BP, WC, BMI as well as number of DTPs. The difference was statistically significant ($p<0.05$) for reduction in SBP, HgA1c, FBS and number of patient with DTPs (Tables 2).

Table 2: Clinical measures for mean scores and paired samples t-test for clinical outcome measures among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Variables	**Descriptive Statistics**		**Paired Differences**			**t**	**p-value**
	Pre-Post MTM (N)	**Mean ± SD**	**Mean±SD**	**95% CI of the Difference**			
				Lower	**Upper**		
BMI	308	25.0±4.3	0.13±1.6	-0.03	0.28	1.61	0.108
	289	24.7±4.3					
WC	93	36.8±5.7	-1.53±10.55	-2.56	-0.51	-2.94	0.003
	112	35.7±6.7					
SBP	212	141.2±18.7	2.39±20.85	0.37	4.42	2.32	0.021
	212	80.9±10.5					
DBP	215	134.5±15.9	-5.02±16.78	-6.65	-3.39	-6.05	0.000
	215	79.3±9.3					
HgA1c	93	9.3±1.7	0.92±3.04	0.63	1.22	6.13	0.000
	38	8.2±1.6					
FBS	404	167.0±61.4	25.04±62.93	18.93	31.16	8.05	0.000
	407	141.7±47.5					
Number of patients with DTPs	298	1.9±1.1	2.80±1.96	2.61	2.99	28.78	0.000
	107	1.2±0.5					

Key: MTM: Medication therapy management; BMI: Body mass index; WC: Waist circumference; SBP: Systolic blood pressure; DBP: Diastolic blood pressure;HgA1c: Hemoglobin A1c; FBS: fasting blood sugar; DTPs: Drug therapy problems; SD: Standard deviation of mean

5.3. Clinical characteristics (Pre-Post MTM)

In current finding majority of study participants were type-II DM (78.2%). About 73.1% and 36.9% had one or more comorbidity and complication respectively. Out of these, HTN (56.2%) and neuropathy (30.1%) were the predominant comorbid and complication of the diabetes, respectively. The study participants had an average fourteen years of disease duration since diagnosed and initiated with medication. The clinical characteristics (BMI, WC, BP, HgA1c and FBS) of the study participants showed improvement (Table 3). The majority (77%) of study participants had one to two MTM pharmacist visits and about 23% had three or more visits.

Table 3: Clinical characteristics of adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Variables		**Pre- intervention**	**Post MTM**
		N (%)	**N (%)**
BMI	Mean ± SD	25.01± 4.34	24.71±4.34
	Under weight	10(2.4)	10(2.4)
	Normal	157(38.4)	157(38.4)
	Over weight	103(25.2)	94(23.0)
	Obese	38(9.3)	28(6.8)
WC	Mean ± SD	37.78±11.18	35.71±6.73
SBP/DBP	Mean± SD	141.3±18.7/81.2±10.8	134.2±16.5/79.3±9.3
	Uncontrolled	102(24.9)	67(16.4)
	Controlled	110(26.9)	150(36.7)
HbA1c	Mean ± SD	9.28±1.72	8.16±1.65
FBS	Mean ± SD	166.95±61.43	141.66±47.54
Hyperglycemic		278(68.0)	165(40.3)
Hypoglycemic		75(18.3)	23(5.6)
Lipid control	Poorly controlled	21(5.1)	5(1.2)
	Controlled/unknown	388(94.9)	404(98.8)
Number of MTM visit	Mean ± SD	2.13 ± 0.73	
	One		62(15.2)
	Two		253(61.9)
	Three and above		94(23.0)
Type DM	Type I	89(21.8)	
	Type II	320(78.2)	
Number of comorbidities	NO	110(26.9)	
	1-2	240(58.7)	
	>=3	59(14.4)	

(Continued)

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Types of comorbidity	Hypertension	230(56.2)
	Dyslipidemia	96(23.5)
	IHD	52(12.7)
	CKD	26(6.4)
	RVI	15(3.7)
	Asthma	9(2.2)
	Others*	105(25.7)
Number of complications	NO	258(63.1)
	1-2	141(34.5)
	>=3	10(2.4)
Types of complications	Neuropathy	123(30.1)
	Nephropathy	30(7.3)
	Retinopathy	29(7.1)
	Diabetic foot ulcer	5(1.2)
	Others**	14(3.4)
Number of Medications	Mean ± SD	4.27±2.36
	One	76(18.6)
	Two-Four	137(33.5)
	Five and above	195(47.7)
Duration of diabetes (Years)	Mean ± SD	13.86± 8.64
	<5	41(10.0)
	5-10	59(14.4)
	10-15	69(16.9)
	>=15	129(31.5)

* Thyroid disorders, osteoarthritis, psychotic disorder, infection, cancer, seizure, obesity** Peripheral arterial disease, autonomic gastroparesis; BMI: body mass index(kg/m^2); WC: waist circumference(inch); SBP/DBP: systolic/ diastolic blood pressure(mmHg); HbA1c: hemoglobin A1c (%); FBS: fasting blood glucose(mg/dl); SrCr: serum creatinine(mg/dl); eGFR: estimated glomerular filtration rate(mL/min/1.73m^2); IHD: ischemic heart disease; CKD: chronic kidney disease; RVI: retroviral infection

In current study patients were prescribed with an average of 1.49 antidiabetic medications (oral glucose-lowering agents (OGLAs) and insulin) per patient. From these medications, insulin (41.3%) was the most prescribed agent followed by Metformin + Insulin (29.6%). In addition, other than anti-diabetic medications, antihypertensive (53.8%) medications were predominantly prescribed. Full description of medications used by study participants were presented in figure 3. Among the total study participants 18.6 %, 33.5 % and 47.7% of them used one, two-four and more than five drugs respectively.

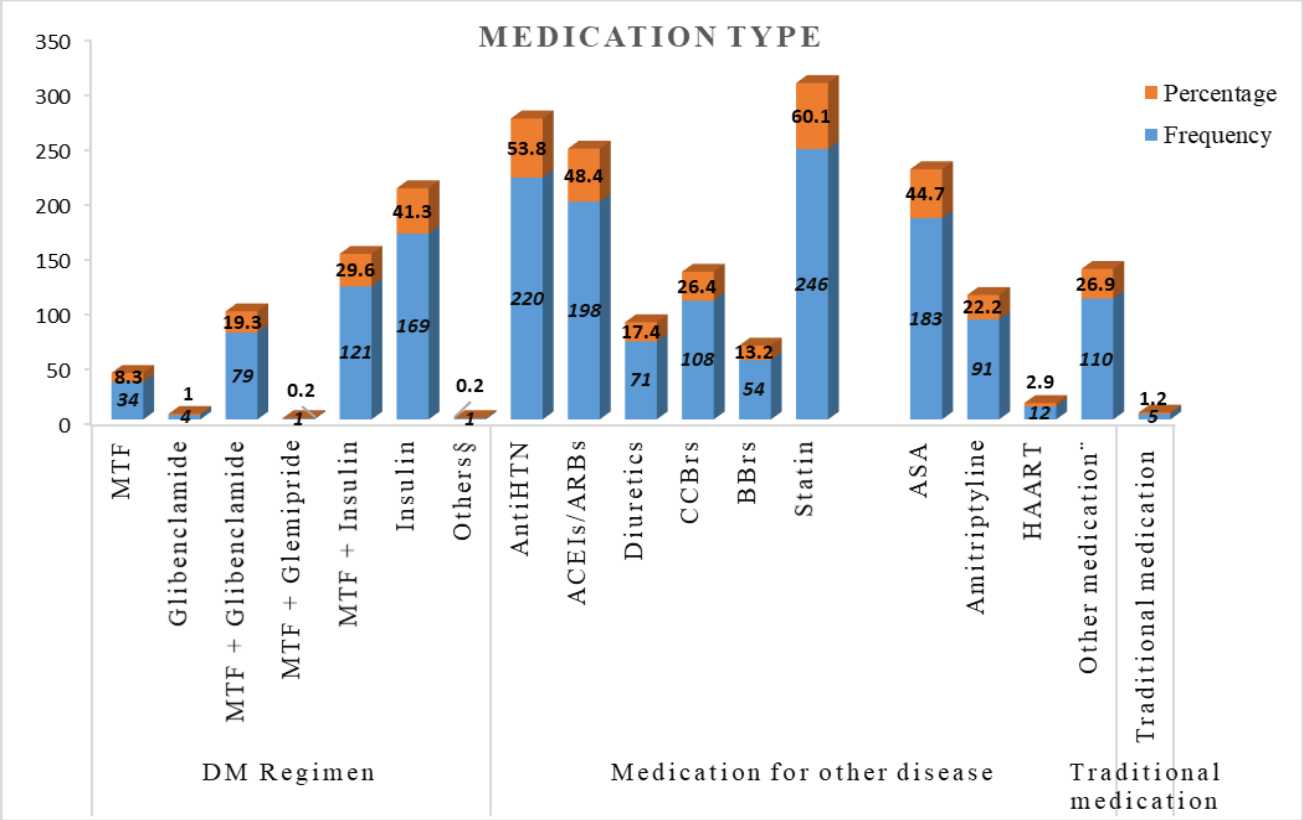

Figure 3: Prescribed medications among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Key:-Others medication: metformin + sitaglyptin, Proton pump inhibitors (omeprazole, pantoprazole), amitriptyline, carbamazepine, gabapentin, tramadol, proplythiouracil, antiTB, NSAIDs: Non-steroidal anti-inflammatory drugs; ACEIs: Angiotensin Converting Enzyme Inhibitors, ARBs: Angiotensin II receptor blockers, CCBs: Calcium channel blockers, BBs: Beta blockers, HAART: Highly active antiretroviral therapy; MTF: Metformin

5.4. Drug therapy problems (Pre-Post MTM)

5.4.1. Prevalence of DTPs

In current study during provision of MTM service about 578 DTPs were identified in about 72.9% of participants with average 1.92(SD, 0.98) DTP per participant. Out of this one DTP occurred in about 31.8 %(n=130) and two DTP in 22.5 %(n=92) (Figure 4). The DTP was reduced to 128, which was identified in 26.2 % at the end of MTM intervention follow up.

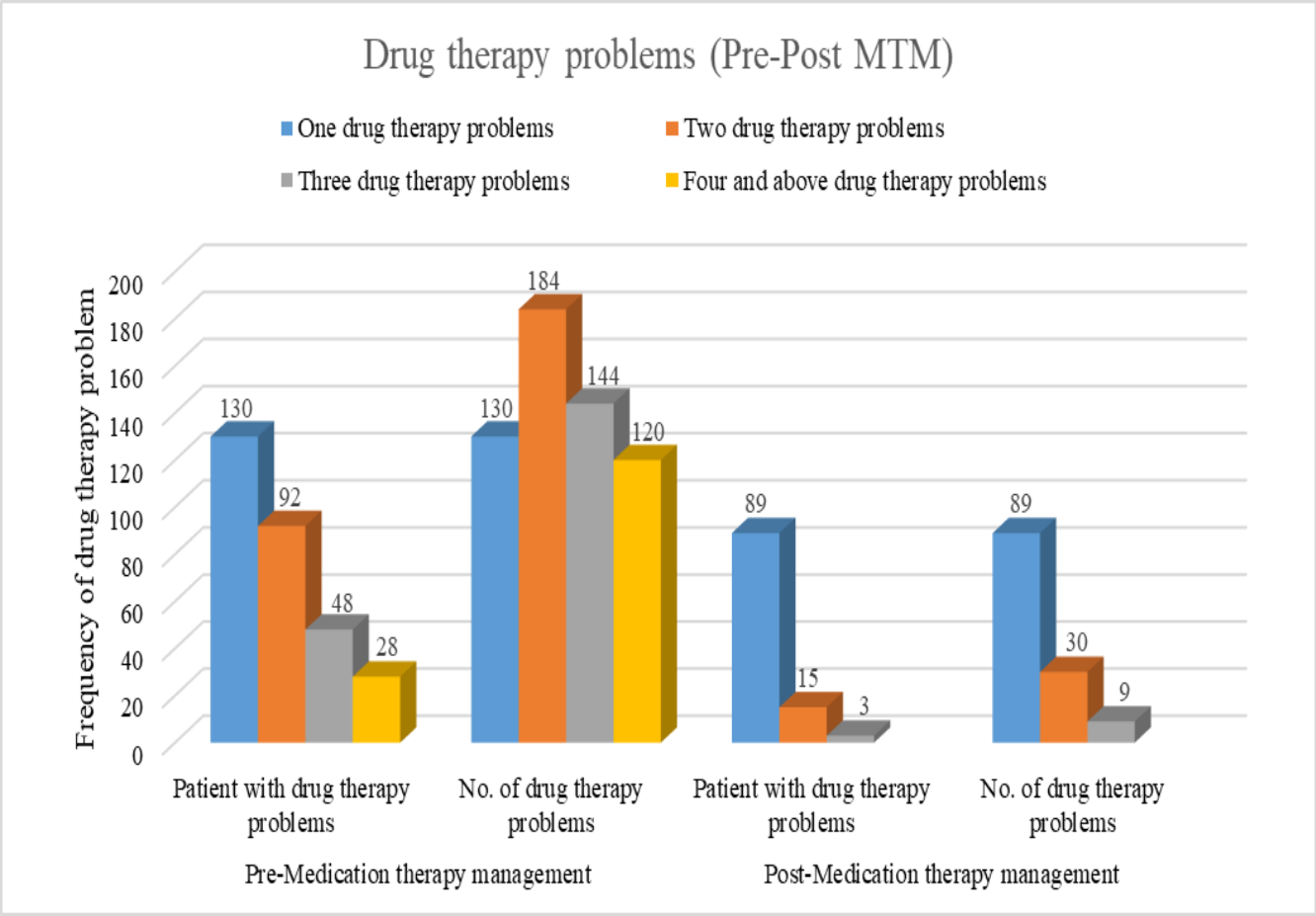

Figure 4: Number of drug therapy problems among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

5.4.2. Type and cause of DTPs

The most frequent type of DTPs were ADR, which occurred in about 46.5% (n=193) of study participants and of thus 34.7% (n=142) of ADRs were an extension of undesired side effect. The second most encountered DTPs were non-adherence (36.9%) followed by needs additional drug therapy (15.4%) (Table 4).

Table 4: Drug therapy problems and causes among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia

Types of drug therapy problems	**Causes**	**Participants**	
		Pre-MTM (N (%))	**Post-MTM (N (%))**
Unnecessary drug therapy		12(2.9)	2(0.5)
	Inappropriate Duplication of drug therapy	2(0.5)	
	No medical indication at this time	1(0.2)	
	Non drug therapy more appropriate	2(0.5)	
	Addiction/recreational drug use	7(1.7)	3(0.7)
	Treating avoidable adverse reaction	1(0.2)	
Needs additional drug therapy		63(15.4)	12(2.9)
	Preventive therapy	33(8.1)	8(2.0)
	Untreated condition	18(4.4)	4(1.0)
	Synergistic therapy	25(6.1)	2(0.5)
Ineffective drug product		4(1.0)	
	More effective drug available	2(0.5)	
	Dosage form inappropriate	1(0.2)	
Dosage too low		55(13.4)	3(0.7)
	Ineffective dose	34(8.3)	3(0.7)
	Frequency inappropriate	12(2.9)	
	Incorrect administration	17(4.2)	1(0.2)
	Drug interaction	1(0.2)	
	Incorrect storage	1(0.2)	
	Duration inappropriate	1(0.2)	
Adverse drug reaction		193(47.2)	55(13.4)
	Undesirable side effect	142(34.7)	47(11.5)
	Unsafe drug for the patient	2(0.5)	
	Drug interaction	53(13.0)	6(1.5)
	Incorrect administration	5(1.2)	2(0.5)
	Allergic reaction	4(1.0)	
	Dosage increase/decrease too fast	2(0.5)	

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Dosage too high		7(1.7)	2(0.5)
	Dose too high	5(1.2)	1(0.2)
	Needs additional monitoring	1(0.2)	1(0.2)
	Frequency too short	2(0.5)	
	Duration too long	2(0.5)	
Non-adherence		25%	19.6%
Number of patient with DTPs		298	107
Number of DTPs identified		578	128
Average number of DTPs per participant		1.94±1.06	1.2±0.47

The DM regimen most frequently involved in DTPs was insulin followed by metformin and insulin combination. From other class of drugs statin and ACEI/ARBs were the most common as described in figure 4.

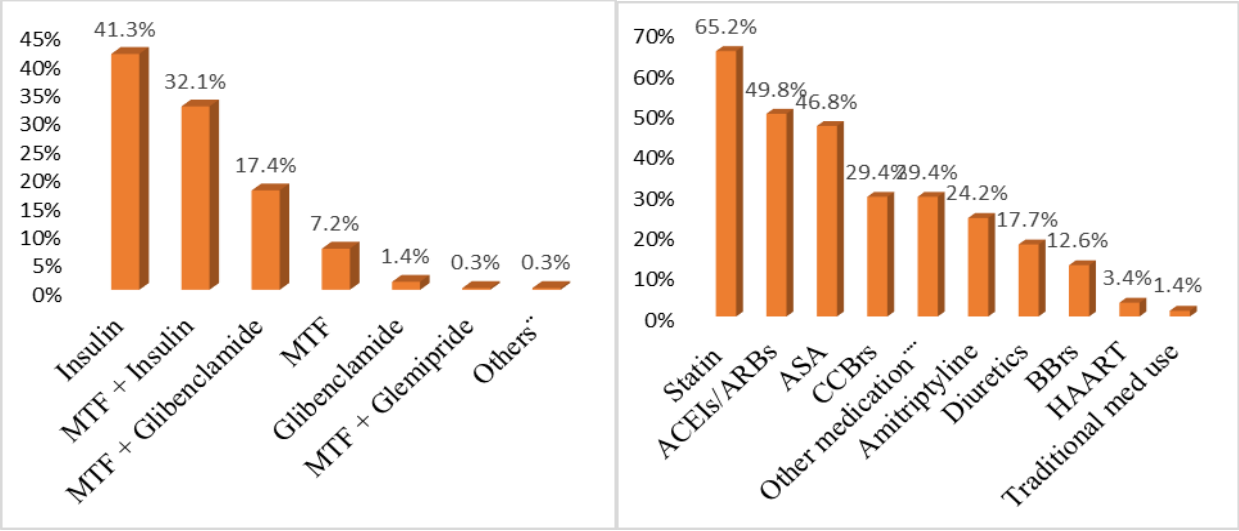

Figure 5: Medications involved in the occurrence of drug therapy problems among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

5.4.3. Examples of drug therapy problems identified in study participants

Table 5: Examples of drug therapy problems identified among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

S.N	Patient presentation	Prescribed medications	Examples of identified drug therapy problems s in patients with diabetes	Status of drug therapy problems
1.	Age=65, Sex=Female Dx:T2DM with Peripheral Neuropathy, Dyslipidemia, central obesity, FBS=200	NPH 34/24, MTF 1gm BID, Amitriptyline 25mg/d; Atorvastatin 20mg/d; ASA 81mg/d	➢ Dosage too low(ineffective dose) patient take 250mg/d due to hearing problem ➢ Non-adherence(does not understand instruction)	Accepted
2.	Age=56,Sex=Female Diagnosis:T2DM, Dyslipidemia; Rheumatoid Arthritis FBS=218	NPH 84/84; MTF 500mg BID; Methotrexate 15mg/week; ASA 81mg/d; Atorvastatin 20mg/d; Omeprazole 20mg/d; Indomethacin supp; Folic acid 5mg/d	➢ Need additional drug therapy(preventive therapy): Statin(atorvastatin) ➢ ADR(Undesirable effect): Dyspepsia(Metformin and atorvastatin) ➢ Non-adherent(patient prefers not to take): Statin(atorvastatin)	Accepted
3.	Age=65,Sex=Male Dx:T2DM, HTN, IHD, Dyslipidemia FBS=173,150,140; BP=146/67	MTF 1gm po/d; Glibenclamide 10mg/d; Enalapril 5mg/d; Atorvastatin 40mg/d; ASA 81mg/d; Amlodipine 10mg/d; HCT 25mg/d; Atenolol 50mg/d	➢ Unnecessary drug therapy(duplication): Amlodipine & Nefidipine; Atorvastatin of different brands ➢ Dosage too low(ineffective dose and frequency inappropriate): patient take Glibenclamide 5mg/d rather than 10mg/d ➢ Dosage too high(dose too high): atorvastatin of different brands ➢ Non-adherent(Does not understand instruction)	Accepted

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4.	Age=58, Sex= Female Dx: T2DM; CLL FBS=239;209;212;144; BMI 27kg/m^2	NPH 36/16	➢ Need additional drug therapy(synergistic): MTF(overweight and low risk of hypoglycemia) ➢ Dosage too low(ineffective): NPH ➢ ADR(undesirable): hypoglycemia ➢ Non-adherent(patients prefer not to take): fear of hypoglycemia	Partially accepted
5.	Age=50, Sex=Male Dx: T2DM, HTN, Seizure FBS=220,283,117 BP=160/100	MTF 500mg BID, Glibenclamide 7.5mg BID; Enalapril 10mg BID; ASA 81mg/d; amitriptyline 25 mg/d; carbamazepine 200mg/d; Amlodipine 10mg/d; Atorvastatin 20mg/d	➢ ADR(drug interaction): ✓ Amlodipine-CBZ: monitor for reduced therapeutic effect amlodipine ✓ Atorvastatin-CBZ: increase dose of atorvastatin ✓ Amitriptyline-ASA: monitor for risk of bleeding	Accepted
6.	Age=61, Sex= Female Dx: T2DM; HTN FBS;141, 88 BP 150/65 BMI: 36kg/m^2	NPH 32/32; MTF 500mg BID; ASA 81mg/d; Simvastatin 20mg/d; Atenolol 25mg/d; Losartan 100mg/d; HCT 25mg/d	➢ Need additional drug therapy(preventive therapy): statin(Simvastatin) ➢ Need additional drug therapy(untreated condition): patient is obese ➢ Dosage too low(ineffective dose): MTF(obese and hypoglycemia)	Statin accepted MTF: partially accepted
7.	Age=57, Sex=Female Dx: T2DM; Dyslipidemia FBS=87,187,120,118,96	NPH 36/24; MTF 1gm BID	➢ Need additional drug therapy(preventive therapy): statin ➢ Need additional drug therapy(synergistic):MTF(discontinued due to hypoglycemia but reinitiate after intervention) ➢ ADR(undesired side effect): dyspepsia(MTF)	Statin rejected MTF accepted

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8.	Age=55, Sex=Male Dx:T2DM; HTN; RVI HgA1c=7.2% FBS=139,198 BP= 140/90	NPH=40/30; ASA 81mg/d; Simvastatin 40mg/d	➢ Need additional drug therapy(untreated condition): HTN ➢ Need additional drug therapy(synergistic therapy): MTF ➢ ADR(undesirable side effect): HCT(polyuria); Enalapril (dry cough) ➢ Non-adherent(patients prefer not to take): Amlodipine	Patient agree to start amlodipine 5mg/d Agree to start MTF after RFT Enalapril and HCT was changed
9.	Age=48, Sex=Female Dx:T2DM with Peripheral neuropathy &Retinopathy, Dyslipidemia FBS=149,131	NPH 41/41; RI 4/4; MTF 1gm BID; Simvastatin 40mg/d	➢ Dosage too low(incorrect administration): injection of insulin ➢ ADR(undesirable side effect): hypoglycemia(NPH & RI) ➢ Non-adherence(does not understand instruction): improper injection & miss dose if time passed ➢ Non-adherence(patient forget to take)	Accepted
10.	Age=65, Sex=Female Dx:T2DM, HTN, Osteoarthritis/DM polyarthritis FBS=63-179 BP=120/80	NPH 70/70; Enalapril 5mg BID; Amitriptyline 37.5 mg/d; Simvastatin 20mg/d; Omeprazole 20mg BID; Diclofenac 75mg/d	➢ Dosage too high (dose too high): patient try to take Glargine as NPH due to lack of information. Consulted to continue NPH with lifestyle modification ➢ Non-adherent(Does not understand instruction): injection of NPH	Accepted
11.	Age=32, Sex= Male Dx: T1DM, HTN FBS=157,89,76 BP 140/79	NPH 36/26 RI 2/2	➢ Need additional drug therapy(Preventive): dietary management ➢ Need additional drug therapy(untreated condition): HTN; patient prefer not to take, Enalapril	Patient agree to control through dietary but didn't agree to take Enalapril

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12.	Age=60, Sex=Female Dx:T2DM+HTN+Dyslipidemia HgA1c 8.9% FBS=197, 152 BP=140/80	NPH 32/18; MTF 850mg/d; Amlodipine 10mg/d; Enalapril 10mg/d; Simvastatin 40mg/d	➢ Need additional drug therapy(Preventive):dietary ➢ Need additional drug therapy(synergistic therapy): MTF	Accepted and implemented
13.	Age=66, Sex=Female Dx:T2DM+Dyslipidemia+UTI(treated) FBS=150,137,133,160,170	NPH 34/22; MTF 500/1000mg/d; Atorvastatin 20mg/d	➢ Dosage too low(ineffective dose): MTF; NPH: due to fear of ADR ➢ ADR(undesirable effect): dyspepsia(MTF & Atorvastatin), hypoglycemia(NPH) ➢ Non-adherent(patients prefer not to take): fear of hypoglycemia	Patient educated how prevent ADR
14.	Age=27, Sex=Female Dx: T1DM FBS=117,113	NPH 24/16 RI 2/2	➢ ADR(undesirable effect): hypoglycemia ➢ Non-adherent(Does not understand instruction): mixing order(NPH vs RI); angle of injection(45^{o});injection on hand herself(lack of folding)	Accepted
15.	Age=47, Sex=Male Dx:T2DM+Asthma HgA1c 12.8, 6.7 FBS=136, 87,119	MTF 1gm BID; Atorvastatin 20mg/d	➢ ADR(undesirable effect):Hypoglycemia ➢ Discontinue Glibenclamide	Accepted
16.	Age=52, Sex=Female Dx:T2DM with Peripheral neuropathy + HTN + Liver hemangioma FBS=192,170,189 BP 150/90	NPH 44/24; MTF 1gm BID; Simvastatin 20mg/d; Enalapril 5mg BID; CBZ 100mg BID; Amitriptyline 25mg/d	➢ Dosage too low(ineffective dose): MTF(evening dose not taken due to dyspepsia); Enalpril(patient take QD rather than BID) & CBZ(morning dose) ➢ ADR(undesirable effect): dyspepsia(MTF & Simvastatin) ➢ ADR(drug interaction): Simvastatin+CBZ: use alternative Rosuvastatin ➢ Non-adherent(patient prefer not to take): MTF due to dyspepsia	Drug interaction: partially accepted Proper education provided to patients

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17.	Age=63, Sex=Male Dx:T2DM+HTN FBS=140,114,139 BP 141/84	MTF 500mg BID; Glibenclamide 5m BID; ASA 81mg/d; Atorvastatin 40mg/d; Enalapril 10mg/d; Amlodipine 5mg/d	➢ Need additional drug therapy(Preventive): statin(patient not take) ➢ Need additional drug therapy(synergistic therapy): MTF ➢ Non-adherence(patient prefer not to take): Atorvastatin & Enalapril	Accepted
18.	Age=35, Sex=Female Dx:T2DM FBS=139, 70,273,200	NPH 18/10 RI 12/6	➢ Dosage too low(incorrect administration) ➢ ADR(undesirable effect): hypoglycemia ➢ Non-adherent((Does not understand instruction): mixing order(NPH vs RI)) ➢ Non-adherence(patient prefer not to take)	Accepted
19.	Age=60, Sex=Female Dx:T2DM+HTN+Dyslipidemia+old stroke+Brady cardia FBS=237, 180 HgA1c=8.8	NPH 60/60; RI 6/4 MTF 1gm BID; Simvastatin 40mg/d; ASA 81mg/d; Enalapril 10mg/d; HCT 25mg/d	➢ Need additional drug therapy(preventive): diet ➢ Dosage too low(ineffective dose): patient take low dose NPH ➢ ADR(undesirable effect): GI upset(MTF & Simvastatin), hypoglycemia(NPH)	Accepted
20.	Age=64, Sex=Female Dx:T2DM with Peripheral neuropathy+HTN+Dyslipidemia+Osteoarthritis FBS=130-175 HgA1c=6.7% BP 142/68	MTF 1gm BID; HCT 25mg/d; Amlodipine 10mg/d; Atorvastatin 20mg/d; ASA 81mg/d	➢ Need additional drug therapy(preventive):ASA ➢ Need additional drug therapy(untreated condition): Dyslipidemia ➢ Dosage too low(ineffective dose): MTF ➢ Non-adherent(patients forget to take): Hypertensive medication	Accepted

Note: Above case were those got the intervention(Accepted, partially accepted and rejected) Dx: Diagnosis; HTN: Hypertension; MTF: Metformin; ADR: Adverse drug reaction: ASA: Aspirin, NPH: Neutral protamine Hagedorn; HCT: hydrochlorothiazide, T2DM: type 2 DM; FBS: fasting blood sugar: BP: blood pressure; CLL: chronic lymphocytic leukemia; BMI; body mass index; CBZ: carbamazepine; RVI; retroviral infection; UTI: urinary tract infection; RI: regular insulin; QD: once a day; BID: two times a day

5.4.4. Status of the drug therapy problem identified

In this study, MTM program emphasize on the identification of DTPs among study participants and provision of interventions that includes counseling on medication use, individualized education on health and lifestyle-related issues. For the identified DTPs discussion were performed with concerned body such as physician who prescribed treatment regimen, nurses who provided mass education at the morning, pharmacist who dispensed the prescribed medication and patients themselves as necessary. Of identified DTP during study period, clinical pharmacists provide intervention with acceptance rate 86.3% (Figure 6).

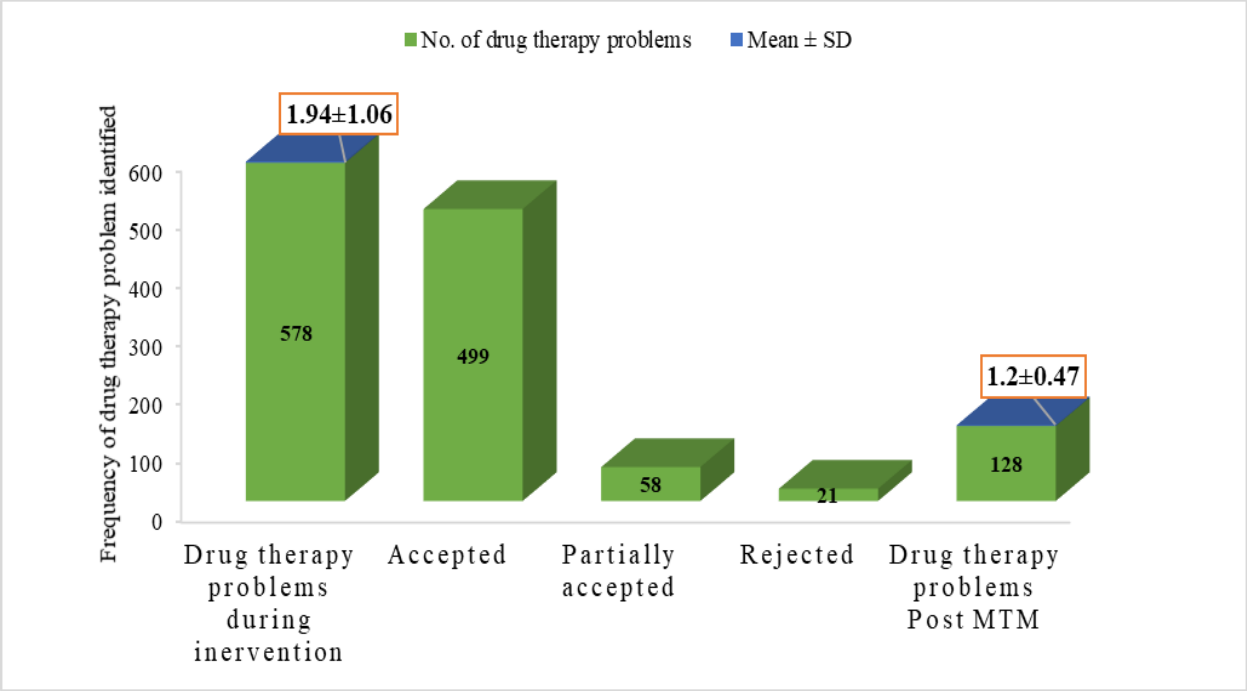

Figure 6: Status of the DTP identified among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

5.4.5. Factors associated with the occurrence of drug therapy problems

In current study, sociodemographic and clinical characteristics of patients assessed during intervention period were considered for binary logistic analysis as predictor of DTPs. Of these, age, gender, marital status, educational status, residency, occupation, poor glycemic control, number of MTM visit, type of DM, presence of comorbidity and complication, duration of disease, number of medication and source of medication were considered for multivariate logistic analysis(Table 6). In this analysis factors such as educational status, poor glycemic control (hypo and hyperglycemia), number of drugs and source medication were significantly associated with DTPs ($p<0.05$). Participants who got their medication through purchase had about two times risk of developing DTPs as compared to free(AOR= 2.27, 95% CI: 1.08-4.77). In this study patients who took two-four drugs (AOR=0.27 95% CI: 0.11-0.67) and five and above (AOR=0.26 95%CI: 0.10-0.58) had significant risk for developing DTP.

During post MTM assessment number of MTM visit and medication adherence were incorporated to pre-MTM variable in the multivariate logistic analysis to determine predictor of post DTPs. Following the MTM intervention, gender and hypoglycemia were the significant factor associated with DTPs. From AOR for sex (AOR=3.06, 95% CI: 1.54-6.07) male gender about three times more likely to develop DTPs than female (Table 6).

Table 6: Bivariate and multivariate analysis of factors associated with drug therapy problems among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Variables	**Categories**	**During MTM**		**Post MTM**	
		Odds Ratios (95% CI)		**Odds Ratios (95% CI)**	
		COR	**AOR**	**COR**	**AOR**
Age(years)	<=40	1.00		1.00	
	40-60	0.92(0.21-4.01)	0.67(0.16-2.93)	0.74(0.19-2.97)	0.71(0.18-2.80)
	>60	1.37(0.26-7.19)	1.06(0.20-5.55)	0.75(0.15-3.77)	0.75(0.15-3.70)
Gender	Female	1.00		1.00	
	Male	2.04(1.01-4.1)	1.38(0.69-2.76)	4.17(1.96-8.87)	**3.85(1.84-8.07)**
Marital status	Widowed	1.00		1.00	
	Married	2.23(0.47-10.55)	2.15(0.48-9.62)	0.35(0.08-1.63)	0.34(0.08-1.56)
	Single	2.28(0.28-14.97)	2.49(0.40-15.74)	0.31(0.05-1.92)	0.31(0.05-1.89)
	Divorced	3.02(0.32-28.66)	3.15(0.38-25.83)	0.70(0.06-7.5)	0.75(0.07-7.88)
Educational status	Diploma and above	1.00		1.00	
	Unable to write & read	1.22(0.31-4.9)	1.05(0.29-3.86)	3.76(0.8-17.56)	3.51(0.76-16.27)
	Informal education	0.99(0.21-4.47)	0.85(0.20-3.53)	2.91(0.52-16.19)	2.51(0.47-13.4)
	Primary school	3.95(1.52-10.24)	**2.94(1.25-6.91)**	1.5(0.59-3.82)	2.06(0.91-2.76)
	Secondary school	1.96(0.85-4.49)	1.41(0.67-2.99)	2.22(0.96-5.12)	0.35(0.08-4.65)
Residency	Addis Ababa	1.00		1.00	
	Out of Addis Ababa	1.67(0.60-4.71)	1.68(0.62-4.52)	0.6(0.21-1.67)	0.63(0.23-1.73)
Occupation	Employed	1.00		1.00	

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	Unemployed	0.32(0.09-1.19)	0.44(0.12-1.58)	1.37(0.38-4.98)	1.42(0.40-5.05)
	Self–employed	0.54(0.16-1.84)	0.80(0.26-2.50)	0.42(0.15-1.19)	0.46(0.17-1.27)
	Others♣	0.61(0.22-1.71)	0.83(0.309-2.22)	0.99(0.38-2.56)	1.05(0.41-2.69)
Hyperglycemia	No	1.00		1.00	
	Yes	0.49(0.24-0.99)	**0.5(0.26-0.95)**	1(0.52-1.94)	1.04(0.54-2.00)
Hypoglycemia	No	1.00		1.00	
	Yes	0.0(0.00-0.18)	**0.03(0.01-0.14)**	0.05(0.01-0.17)	**0.05(0.01-0.19)**
No of MTM visit	One			1.00	
	Two			1.78(0.55-5.83)	1.12(0.37-3.34)
	Three and above			1.94(0.93-4.02)	0.60(0.18-1.94)
Type DM	Type-II	1.00		1.00	
	Type-I	1.58(0.37-6.78)	0.72(0.17-3.10)	1.3(0.38-4.44)	1.28(0.38-4.32)
Number of Comorbidities	No	1.00		1.00	
	1-2	0.91(0.30-2.71)	0.84(0.30-2.38)	1.7(0.64-4.52)	1.65(0.63-4.32)
	>=3	0.63(0.14-284)	0.75(0.19-3.00)	1.49(0.43-5.23)	1.51(0.43-5.26)
Number of Complications	No	1.00		1.00	
	1-2	0.92(0.40-2.12)	0.88(0.41-1.90)	0.75(0.36-1.56)	0.76(0.37-1.55)
	>=3	0.25(0.16-4.01)	0.24(0.02-3.20)	2.23(0.19-26.15)	2.26(0.19-26.83)
Duration of DM	<5yrs	1.00		1.00	
	5-10yrs	0.70(0.19-2.62)	0.74(0.22-2.46)	0.49(0.15-1.58)	0.49(0.15-1.56)
	10-15yrs	0.93(0.25-3.47)	0.80(0.24-2.65)	0.61(0.19-1.99)	0.61(0.19-1.94)
	>=15yrs	0.82(0.23-2.95)	0.82(0.26-2.62)	0.65(0.21-2.00)	0.61(0.20-1.84)

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Number of drugs	One	1.00			
	Two-four	0.27(0.08-0.91)	**0.27(0.11-0.67)**	1.27(0.35-4.60)	1.24(0.34-4.47)
	Five and above	0.28(0.07-1.10)	**0.26(0.10-0.58)**	1.04(0.23-4.62)	1.03(0.23-4.57)
Source of medication	Free	1.00		1.00	
	Buying	2.49(1.09-5.70)	**2.27(1.08-4.77)**	1.51(0.62-3.66)	1.58(0.65-3.82)
Physical activity	Yes			1.00	
	No	0.42(0.16-1.11)	0.57(0.24-1.37)	1.12(0.4-3.18)	1.12(0.40-3.12)
Adherence	High adherence			1.00	
	Medium adherence			1.19(0.45-3.18)	1.13(0.43-2.95)
	Low adherence			0.83(0.31-2.14)	0.96(0.38-2.47)

♣Retired COR: crude odds ratio; AOR: adjusted odds ratio; C.I. confidence interval

5.5. Medication adherence (Post-MTM)

5.5.1. Status of medication adherence

According to the Morisky‘s 8 medication adherence assessment tool cut off for adherence of study participants after intervention high adherence (score 8), medium adherence (score 6-8) and low adherence (score <6) were 273(66.7%), 56(13.7%) and 80(19.6%) respectively. Then the adherence were further categorized in two by combining high and medium adherence as adherent and low adherence as non-adherent (Figure 7).

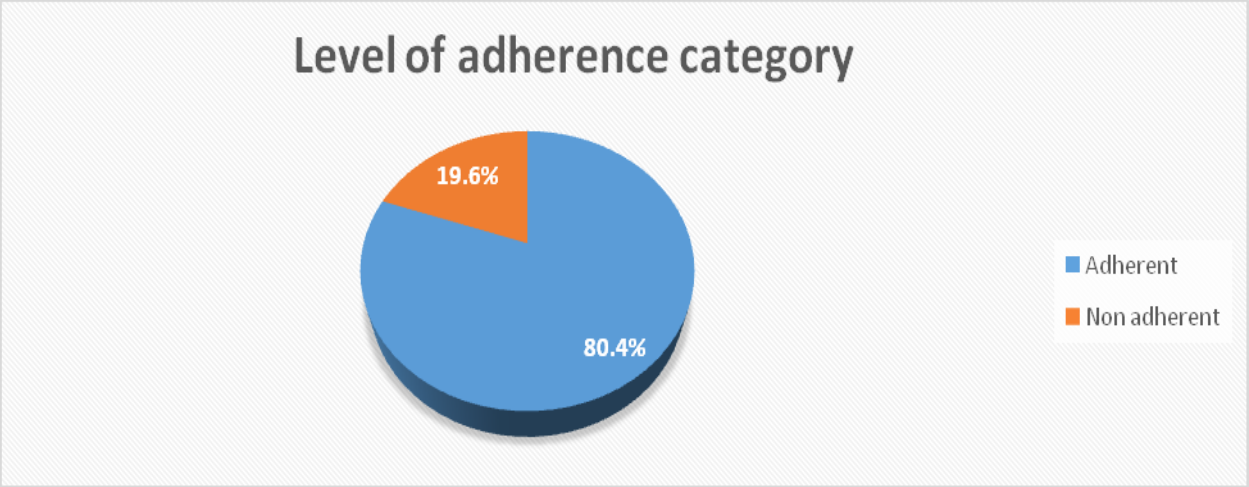

Figure 7: Proportion of post-MTM medication adherence among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

5.5.2. Reasons for the occurrence of poor medication adherence

The most common reason that affect adherence to medication of participant were fear of medication adverse effect, simply forgetfulness and unavailability of medication. The possible reasons for poor adherence among study participants were cost of medication too expensive (0.7%), unavailability of medication (1.7%), fear of medication adverse events (6.8%), regimen complexity (0.5%), inadequate instruction / counseling / education (0.2%), simply forgetfulness (2.4%) and feeling better or worse (1.2%).

5.5.3. Predictors of medication non-adherence

In this study binary logistic result of variables such as age, gender, marital status, education status, residence, occupation, source of medication, poor glycemic control, number of MTM visit, type of DM, presence of comorbidity and complication and presence of DTP were considered for multivariate logistic analysis as predictor of non-adherence. Out of this residency, marital status, poorly glycemic control, type of DM and presence of comorbidity were statistically significant with non-adherence (Table 7). Participants with poor glycemic control (AOR=2.33, 95% CI: 1.17-4.68) were more than twice likely to had non-adherence as compared to those with controlled blood glucose. Presence of three and above comorbidity was also associated with poor adherence (AOR=4.76; 95% CI: 1.4-15.8) as compared to lack of comorbidity. Our finding also showed that being residence and type of DM were also statistically significant predictor of non-adherence.

Table 7: Factors associated with medication non-adherence among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Variables	**Categories**	**Level of adherence**		**Odds Ratio (95% CI)**	
		Adherent N(%)	**Non-adherent N(%)**	**COR**	**AOR**
Age(years)	<=40	89(21.8)	10(2.4)	1.00	
	40-60	128(31.3)	46(11.2)	0.91(0.11-7.41)	1.15(0.16-8.12)
	>60	112(27.4)	24(5.9)	0.13(0.01-1.38)	0.19(0.02-1.75)
Gender	Female	148(36.2)	38(9.3)		
	Male	181(44.3)	42(10.3)	3.01(1.02-8.89)	2.38(0.92-6.15)
Marital status	Married	234(57.2)	58(14.2)	1.00	
	Single	60(14.7)	9(2.2)	1.33(0.40-442)	0.87(0.22-3.4)
	Divorced	11(2.7)	8(2.0)	8.29(2.14-32.499)	1.15(0.19-6.85)
	Widowed	24(5.9)	5(1.2)	**1.15(0.29-14.80)**	**7.2(1.14-45.49)**
Educational status	Diploma and above	123(30.1)	28(6.8)	1.00	
	Unable to write & read	24(5.9)	4(1.0)	0.87(0.10-6.7.7)	0.605(0.93-6.72)
	Informal education	21(5.1)	4(1.0)	3.66(0.44-7.70)	1.410(0.23-8.74)
	Primary school	56(13.7)	18(4.4)	1.4(0.38-4.76)	1.02(0.314-3.33)
	Secondary school	105(25.7)	26(6.4)	2.49(0.79-7.78)	1.73(0.622-4.83)
Residency	Addis Ababa	284(69.4)	61(14.9)	1.00	
	Out of Addis Ababa	45(11.0)	19(4.6)	**0.44(0.15-1.29)**	**0.35(0.14-0.85)**

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Occupation	Employed	93((22.7)	22(5.4)	1.00	
	Unemployed	70(17.1)	12(2.9)	1.43(0.31-6.70)	1.11(0.28-4.38)
	Self-employed	52(12.7)	7(1.7)	0.20(0.03-1.33)	0.33(0.07-1.56)
	Others♦	114(27.9)	39(9.5)	1.55(0.69-3.50)	1.73(0.57-5.23)
Source of medication	Free	267(65.3)	64(15.6)	1.00	
	Buying	62(15.2)	16(3.9)	0.38(0.11-1.32)	0.45(0.15-1.37)
Hyperglycemia	No	208(50.9)	35(8.6)		
	Yes	121(29.6)	45(11.0)	**2.77(1.09-7.08)**	**2.33(1.17-4.68)**
Hypoglycemia	No	307(75.1)	79(19.3)	1.00	
	Yes	22(5.4)	1(0.2)	0.15(0.01-1.71)	0.26(0.03-2.68)
No of MTM visit	Three & above	77(18.8)	17(4.2)	1.00	
	One	45(11.0)	17(4.2)	0.64(0.17-2.41)	0.72(0.21-2.45)
	Two	207(50.6)	46(11.2)	1.28(0.30-5.5)	1.44(0.37-5.55)
Type diabetes	Type-II	246(60.1)	74(18.1)	1.00	
	Type-I	83(20.3)	6(1.5)	0.21(0.03-1.45)	**0.18(0.03-0.99)**
Comorbidities	No	97(23.7)	13(3.2)	1.00	
	One-Two	194(47.4)	46(11.2)	2.70(0.72-1.15)	1.83(0.63-5.31)
	Three & above	38(9.3)	21(5.1)	**5.57(1.2-25.8)**	**4.76(1.4-15.8)**
Complications	No	215(52.6)	43(10.5)	1.00	
	One-Two	108(26.4)	33(8.1)	0.93(0.35-2.4)	0.65(0.12-3.46)
	Three & above	6(1.5)	4(1.0)	1.56(0.20-12.2)	0.74(0.14-3.89)
Duration of diabetes	<5yr	36(12.1)	5(1.7)	1.00	
	5-10yrs	46(15.4)	13(4.4)	3.7(0.82-16.8)	2.47(0.73-8.35)
	10-15	63(21.1)	6(2.0)	0.51(0.01-2.81)	0.74(0.18-2.94)
	>15	105(35.2)	24(8.1)	1.97(0.48-8.12)	2.09(0.67-6.52)
Drug therapy problem	No	257(62.8)	60(14.7)	1.00	
	Yes	72(17.6)	20(4.9	1.64(0.51-5.05)	1.07(0.39-2.93)
Number of drugs	One	69(16.9)	7(1.7)		
	Two-four	111(27.2)	27(6.6)	1.08(0.14-8.54)	1.02(0.14-7.34)
	Five & above	148(36.3)	46(11.3)	2.09(0.20-21.62)	1.59(0.17-14.64)

♦Retired; COR: crude odds ratio; AOR: adjusted odds ratio; C.I. confidence interval

5.6. Treatment satisfaction (Post-MTM)

Based on SATMED-Q score tool the treatment satisfaction rate is described in figure 8 according to the domain score. Table 8 reveals the relationship between treatment satisfaction and sociodemographic and clinical characteristics of the studied diabetes patients. The overall mean score of treatment satisfaction was 75.6(SD, 9.7). We found no statistical difference in treatment satisfaction among gender, marital status, education, residence, occupation, presence of comorbidity and complication, duration of disease and the type regimen. Even though lower

treatment satisfaction scores were reported among females, unable to write & read and primary school education level, unemployed, those who had one or more complication and low duration of disease, the difference was not statistically significant. In this study age, poor glycemic control, type of DM, number of medication used were found significantly related to treatment satisfaction. Diabetes patients of younger age group below 40years (77.66(SD, 8.18)), type-I DM (77.79(SD, 8.46)), managed by one medication (77.89(SD, 7.19)) and those who had good adherence to their medication (76.17(SD, 8.89)) had a significantly higher treatment satisfaction score compared with their counterparts (P<0.05).

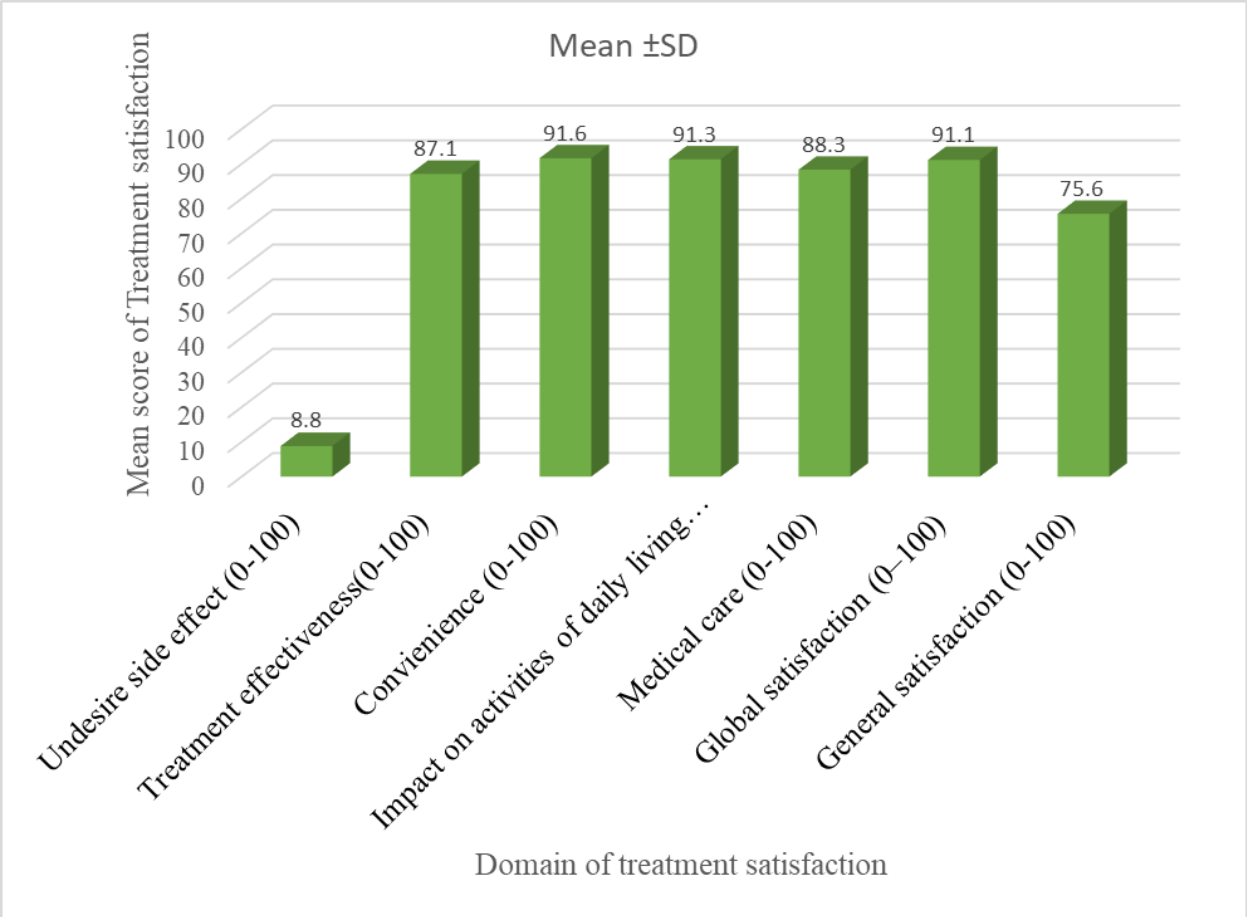

Figure 8: Treatment satisfaction following MTM intervention among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Table 8: Relationship between treatment satisfaction and different characteristics of diabetic patients among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Variables	Category	N	Mean SATMED-Q score ± SD	F	P
Age(years)	<=40	99	77.66± 8.18	3.060	**0.048**
	40-60	174	75.31± 9.94		
	>60	136	74.61± 10.14		
Gender	Male	186	76.52± 8.54	2.800	0.095
	Female	223	74.92± 10.47		
Marital status	Married	292	75.56± 9.97	0.302	0.824
	Single	69	76.25± 9.19		
	Divorced	19	76.59± 7.08		
	Widowed	29	74.46± 9.30		
Education	Unable to write & read	28	73.50± 9.12	1.495	0.203
	Informal education	25	76.38± 10.38		
	Primary school	74	73.78± 10.89		
	Secondary school	131	75.88± 9.70		
	Diploma and above	151	76.63± 8.87		
Residence	Addis Ababa	345	75.67± 9.72	0.013	0.911
	Out of Addis Ababa	64	75.52± 9.42		
Occupation	Employed	115	76.44± 8.85	1.353	0.250
	Unemployed	82	74.88± 10.18		
	Self-employed	59	77.39± 9.25		
	Others♦	153	74.87± 10.02		
Source of medication	Buying	78	75.10± 8.68	0.305	0.581
	Free	331	75.77± 9.89		
Social habits	Non smoker	399	75.77± 9.66	1.449	0.236
	X-smoker	4	73.13± 11.90		
	Smoker	6	69.34± 7.04		
	Drinker	59	76.09± 10.38	0.146	0.702
	None drinker	350	75.57± 9.55		

(Continued)

(Continued)

Family history	Mother/father	24	77.05± 7.00	0.397	0.755
	Sister/brother	18	73.99± 9.61		
	Mother/father/sister/brother	18	76.52± 10.55		
	No/unknown/others♦♦	349	75.59± 9.80		
Hyperglycemic	Yes	166	74.44± 10.29	4.397	**0.037**
	No	243	76.47± 9.14		
Hypoglycemia	Yes	23	75.99± 8.90	0.031	0.860
	No	386	75.63± 9.72		
Number of MTM visit	One	62	77.25± 8.12	1.482	0.228
	Two	253	75.05± 10.05		
	Three and above	94	76.19± 9.47		
Type of DM	Type I	89	77.79± 8.46	5.691	**0.018**
	Type II	320	75.05± 9.90		
Number of Comorbidities	No	110	77.15± 8.07	2.608	0.075
	One-Two	240	74.75± 10.03		
	Three and above	59	76.49± 10.56		
Number of Complications	NO	258	76.30± 9.37	2.028	0.133
	One-Two	141	74.71± 9.89		
	Three and above	10	71.88± 12.60		
DM regimen	Metformin	34	76.57± 8.26	0.391	0.855
	Glibenclamide	4	78.65± 11.42		
	Metformin+ Glibenclamide	79	75.12± 9.28		
	Metformin + Glemipride	1	82.32		
	Metformin + Insulin	121	75.12± 10.95		
	Insulin	170	75.97± 9.16		
Number of medication	One	76	77.89± 7.19	3.064	**0.048**
	Two-Four	138	75.86± 9.48		
	Five and above	194	74.70± 10.44		
Duration of disease	<5yrs	41	74.65±10.17	0.243	0.866
	5-10yrs	59	76.17±10.02		
	10-15yrs	69	75.65±9.11		
	>=15yrs	129	75.19±9.62		

(Continued)

(Continued)

DTP	Yes	92	75.71±10.16	0.004	0.947
	No	317	75.63±9.53		
Adherence	Adherent	329	76.17±8.89	5.039	**0.025**
	Non adherent	80	73.48±12.16		

♦Retired ♦♦Grandparents, Relatives

Table 9 showed the multivariable linear regression analysis result of all statistically significant sociodemographic, clinical parameters and treatment factors in bivariate analysis and SATMED-Q scores. According to the study findings, receiving more than one drugs (AOR: -2.18, P < 0.024) and non-adherent to their medication (AOR: -5.48, P < 0.001) were associated with lower treatment satisfaction.

Table 9: Multivariable linear regression for the association between treatment satisfaction and sociodemographic, clinical parameters and treatment factors among adult diabetic patients on follow up at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Parameters	AOR(95.0% CI)	p-value
Sex(Male vs Female)	-0.51(-2.74,1.71)	0.651
Education(no education vs any other)	0.57(-0.42,1.55)	0.259
Occupation status(employed vs any other)	-0.20(-0.87,0.47)	0.566
Source of medication recode(buying vs free)	0.46(-2.33,3.25)	0.745
Hyperglycemic(hyperglycemia vs normal)	1.37(-0.85,3.58)	0.225
comorbidity(No vs any comorbidity)	1.20(-0.88,3.28)	0.258
Complications (No vs any complications)	-1.10(-3.27,1.06)	0.316
DM Regimen(MTF vs Any other medication)	-0.33(-1.04,0.38)	0.357
Number of drugs(more than one vs one)	-2.18(-4.07,-0.29)	**0.024**
Duration of disease(below five years vs above five years)	0.31(-0.75,1.37)	0.567
DTP(Yes vs No)	1.08(-1.51,3.67)	0.412
Level of adherence category(Non-adherent vs Adherent)	-5.48(-8.45,-2.51)	**<0.001**

6. Discussion

Diabetic patients are at high risk of having DTPs and medication adherence issues owing to presence of comorbidity and polypharmacy. Identification and resolution of common types of DTPs contributes to reduction of drug related hospitalizations, morbidity and mortality(Shareef *et al.*, 2015). Therefore, the aim of this study was to evaluate the impact of introducing MTM services on DTPs, medication adherence and treatment satisfaction in patients with DMs. The study findings showed that there were decreases in A1C, FBS and SBP by 0.92%, 25.04mg/dl and 6.62 mm Hg respectively ($P< 0.05$) from pre-intervention. During MTM intervention 578 DTPs were identified from 72.9% of study participants with mean 1.92(SD, 0.98) DTPs per participant. Of interventions provided for identified DTPs, 86.3% were get an acceptance. After MTM interventions provided the DTPs were reduced to 128, which were identified in about 26% of participants. In post-MTM intervention assessment about 80.4% of participants were adherent to their medication with the overall mean score of treatment satisfactions of 75.6(SD, 9.7).

6.1. Clinical outcome

In current study, most of study participants (~73%) had one or more co-morbidity while about 37% had one or more DM related complication. These might be due to most of study participants had age of above forty years, type 2 DM and had disease duration of more than 10years. This finding were in line with the study conducted in Australia (Zoungas *et al.*, 2014) and United States (Lochner *et al.*, 2013) that showed age and diabetes duration were strongly associated with macro-vascular and microvascular events.

From clinical parameters targeted as an outcome in current study, HgA1c showed a reduction of about 0.92% from pre-intervention. The results are consistent and similar to the numerous studies done in other pharmacist-managed diabetic clinics in ambulatory and community pharmacy models when pharmacists are involved in the care of patients with diabetes(Rodis *et al.*, 2017; Tilton *et al.*, 2019; Brummel *et al.*, 2013; Ndefo *et al.*, 2017; McAdam-Marx *et al.*, 2015). This could be due to the intervention provided targeting lifestyle modification and enhanced medication adherence through face-to-face education and phone consultation.

In present study during the initiation of MTM service, about 68% of the participant were hyperglycemic but post intervention these were reduced to 40%. The study conducted in Thailand also showed that there were reduction in number patient with hyperglycemia after intervention even though it was not statistically significant(Tunpichart *et al.*, 2012). Our result was lower than study conducted in India that showed reduction of hyperglycemia from 83% to 44%(Pathania *et al.*, 2016). This difference might be due to guideline used as cut point for hyperglycemia, participants' awareness and sociodemographic factors. Thus, increase in participants with good glycemic control suggests that interventions provided through MTM service can play an important role in glycemic control.

In present study, post-MTM intervention assessment showed FBS reduction of an average 25.3mg/dl from pre-intervention. This is concordant with a systematic review of randomized controlled trials, that showed MTM service reduced FBS an average range of 5.9 to 66.87 mg/dl in intervention group compared to control groups(Pousinho *et al.*, 2016). This could be due to awareness created about lifestyle modification, reduced medication related adverse effect and enhanced adherence through MTM program.

In current study, the MTM intervention reduced an average of 6.62 mmHg of SBP from the baseline SBP. Similarly study carried out in California, Chicago, Mississippi and Thailand MTM service showed a significant reduction in SBP as compared to control group(Tilton *et al.*, 2019; Davis *et al.*, 2017; Ip *et al.*, 2013; Tunpichart *et al.*, 2012). In systematic review of randomized controlled trials also showed that pharmacists' intervention reduced SBP a range of 3.3 to 23.05 mmHg(Pousinho *et al.*, 2016). This could be due to awareness created by pharmacist about lifestyle, medication-taking behavior and management of medication related problem.

In present study MTM intervention reduced HgA1c in about 0.92%. Improvement in glycemic control has been shown to result in fewer microvascular and slowed progression of macrovascular complications(Nadine Shehab, 2017). In study conducted in 23 hospital based clinics in England, Scotland, and Northern Ireland showed that a 1% decrease in serum HbA1c corresponds to a significant decreased risk of complications. In that study 1% reduction of HgA1c also cause 43% reduction in amputation or fatal peripheral blood vessel disease, 37%

reduction in microvascular complications e.g. kidney disease and blindness, 21% reduction in all deaths, 14% reduction in heart attacks and 12% reduction in strokes(Stratton *et al.*, 2000).

6.2. Drug therapy problems

In current study pre- MTM intervention period, about 72.6% of the participant were found to have at least one DTP. The mean number of DTP per patient was 1.92(SD, 0.98). These finding were similar in study conducted in Indonesia, India and Ethiopia at Gondar towns in which the incidence of DTP were in a range of 71.1-94% with mean number of DTPs per patient between 1.3 (SD, 1.1)- 2.88(SD, 1.23)(Adnyana, 2017; Shareef *et al.*, 2015; Abegaz *et al.*, 2018). This high numbers of DTPs might be associated with presence of comorbidities in majority of study participants that exposed them to polypharmacy. But our findings were higher than study conducted in Ethiopia at TASH(Teklemariam *et al.*, 2018), UK and Saudi Arabia(Al Hamid *et al.*, 2016) and China(Wong, 2017). Such variation across the studies might be because of the difference in patient selection criteria, data collection methods, population, pharmacists' clinical experience, as well as study duration and setting.

The most common DTP in our study were ADR (47.2%). Our finding was in line with study conducted in UK and Saudi Arabia (Al Hamid *et al.*, 2016) in which ADR were the most reported DTP. The possible explanation for high ADR might be the presence of comorbidity and complication as well as polypharmacy among study participants. In addition, most of current study participants were type 2 DM, which mostly required combination of drugs to achieve target because of delay during diagnosis. On the other hand study conducted in Ethiopia at Gondar(Abegaz *et al.*, 2018) and Jimma towns(Yimama *et al.*, 2018), India(Shareef *et al.*, 2015) and USA(Ombengi *et al.*, 2016) needing additional and taking unnecessary drug therapy were the most prevalent DTPs. This difference might be associated with difference in study setting, socio-demographic characteristics, patient recruited criteria, pharmacist clinical skills and used tools for DTP assessment.

In current study, undesired side effects were the most common reported ADR, which accounted 34.7% of identified DTPs. Out of these undesired side effect, hypoglycemia were the concern of many participants as contributor of non-adherence and challenge for target achievement. This

might be due to fear of hypoglycemia. In addition, about 33% of study participants were elderly who might be at risk of side effects. As hypertension is the most common comorbid condition, three most commonly used antihypertensive agents ACEIs, CCBs and diuretics were known to cause ADR. This study results were consistent with other two studies(Lopez *et al.*, 2014; Walz *et al.*, 2014).

In this study non-adherence to medication, need additional drug therapy and dosage too low were also the common DTPs among study participants. Similarly in study conducted in Ethiopia at Wolaita Soddo town, Nigeria and Jordan non-adherence, unnecessary drugs and the need for more drugs were the most frequently identified DTPs (Ogbonna *et al.*, 2014; Al-Azzam *et al.*, 2016; Koyra *et al.*, 2017). This might be due to lacked understanding of the disease state and the management, being ignorant of the consequences, presence of the elderly who tend to have reduced memory, poor health practices, poor adherence to medications and dietary control. The cause for its high prevalence of need additional drug therapy might be the absence of statins and antiplatelet for cardiovascular prevention due to DM, hypertension and other comorbid disease.

In this study, numbers of drugs were one of significant predictors of DTPs. In contrary to many literature the current study finding showed that study patients who took two-four drugs (AOR=0.27 95%CI: 0.11-0.67) and five and above (AOR=0.26 95%CI: 0.10-0.58) were less likely for developing DTPs. Finding showed that polypharmacy was the commonly reported risk factors for the development of DTPs(Huri and Ling, 2013; Zazuli *et al.*, 2017). This difference might be due to less number of patients who took one drug because most had disease duration of more than 10years and type-2 DM with many comorbidity and complications that need more drugs for better management in current study. In addition this single drug mostly either insulin or metformin, which associated with adverse effect such as hypoglycemia, injection site pain and dyspepsia that affect highly medication adherence.

After provision of comprehensive MTM intervention the DTPs occurred in about 26% participants with mean number of 1.2(SD, 0.46) DTPs per patient which was lower than DTPs during pre-MTM intervention. Similar findings were reported by different scholars, which showed pharmacist-provided MTM services resulted in lower DTPs prevalence (Barnett *et al.*,

2009; Rodis *et al.*, 2017; Ramalho de Oliveira *et al.*, 2010). This reduction of DTPs might be associated with the awareness created to patients by clinical pharmacist in lifestyle modification, side effect prevention and management, medication misuse and importance of medication adherence. In addition, it might be also due to a good communication created between pharmacist and physician during intervention in preventing the occurrence of DTPs.

In post MTM intervention study, gender and hypoglycemia were the significant factor associated with DTPs. From AOR for sex, male gender (AOR=3.06, 95% CI: 1.54-6.07) was about three times more likely to develop DTPs than female. Our finding was in line with study conducted in Malaysia and Jordan that showed male patients had a higher chance of having DTPs compared to female patients(Huri and Ling, 2013; Al-Taani *et al.*, 2017). These might be related to either to biological differences or differences in health behavior such as social habit involvement between males and females.

During MTM intervention out of 578 DTPs identified by clinical pharmacist under their scope of practice about 499 DTPs (86.3%) were accepted and implemented. ADR, needs additional drug therapy and Dosage too low were the most addressed DTPs. This result were comparable with the acceptance rate in study conducted in Texas at Austin (82.1%) and Houston (100%), Ethiopia Gondar towns (76.7%), Denmark (76%), Taiwan (80.8%) and US (84%)(Barner *et al.*, 2015; Ndefo *et al.*, 2017; Abegaz *et al.*, 2018; Nielsen *et al.*, 2013; Wang *et al.*, 2017; Ploenzke *et al.*, 2016). High acceptance rate of recommendations in our study might be associated with the presence of many comorbidities, complications and polypharmacy that need multidisciplinary team. In current study acceptance rate of interventions were higher than previously reported overall physician acceptance rates of 50 % in North Carolina(Christensen *et al.*, 2007) and about 52.4% in India(Shareef *et al.*, 2015). This difference might be due to the presence of many comorbidities and complications, low awareness of participants and skill gap might led to an increase in the acceptance rate of recommendations in current study.

In this study, about 10% of DTPs were partially accepted and 3.6% were rejected as result of either prescribers or patients' refusal. This might be due to knowledge gap, presence of many

complications and comorbidity, patients' perception about medication and ADR, availability and cost of medication.

6.3. Medication adherence

Based on a self-reported 8-item Morisky's medication adherence scale tool the adherence level of study participant in current study were 66.7%, 13.7% and 19.6% for high, medium and poor adherence, respectively. The overall prevalence of non-adherence among respondents in this study were lower than the baseline study which was 25 %(Teklemariam *et al.*, 2018). In line with current finding study in Southern California, Texas, U.S. state of Tennessee, Minnesota, Washington DC, California and North Carolina showed that medication adherence rate was improved after MTM provision(Spence *et al.*, 2014; Ndefo *et al.*, 2017; Skinner *et al.*, 2015; Soliman, 2013; Perlroth *et al.*, 2013; Lee *et al.*, 2006; Murray *et al.*, 2007). This improvement in adherence was due to pharmacist-directed MTM service provided to enhance patients' awareness about medication taking behavior and lifestyle modification.

In present study, patients with age of more than 40years, female gender, lack of job, out-of-pocket costs of medications, had one MTM visit, disease duration of more than five years and took more than one drugs had low level of adherence. This finding was in line with study conducted in USA(Curkendall *et al.*, 2013). This might be due to that as patient become elder their memory will decrease, retired from job, source income decreased and comorbidities increased. All this factors affect the medication adherence of patients. In contrast to current finding study in Nepal showed that there was no association between medication adherence and factors like age groups, treatment complexity, health literacy and social or family support(Shrestha *et al.*, 2013). The difference in this study might be due to difference in sample size, assessment tools applied, sociodemographic characteristics of participants.

In current study factors associated with non-adherence were age, sex, residence, presence of comorbidity and poor glycemic control. In line with this, study undergone in Palestine proved that medication adherence was found to be positively correlated with age and duration of illness(Jamous *et al.*, 2011). In this study, participants of age greater than 40 years were found to be non-adherent. This might be attributed to that as age increase the risk of comorbidity could be

increase that lead to polypharmacy. In addition, management with single agent was also reduced as duration of disease increase with age. In contrary to current finding the study conducted in Malaysia showed that older age patients were adherent to their medication(Bakar *et al.*, 2016). This difference might be due to variation in recruited patients, setup and sample size.

Relative to patients came from Addis Ababa; those patients from out of Addis Ababa had high non-adherence score. Low adherence of living out of Addis Ababa might be also related to lower levels of education, low income and fatigness through their journey. This is in line with study Palestine village residency, low income and low education level were associated with low adherence to medication(Sa'ed *et al.*, 2013).

The most common reason that affect adherence of participant were fear of medication adverse effect, simply forgetfulness, inadequate availability of medication and inadequate instruction/counseling/education, feeling better or worse. Similarly two study in different setup agreed with current study(Almaghaslah *et al.*, 2018; Mathew *et al.*, 2016).

Patients marital status widowed were about seven times non-adherent to medications compared to married patients (AOR 7.2, 95% CI 1.14-45.49, $p<0.05$). This might be associated with social factor such as stress due to loss of partner. In contrast to current finding study in Saudi Arabia and Malaysia, marital status was not associated with medication adherence(Aloudah *et al.*, 2018; Bakar *et al.*, 2016). This difference might be associated with different classification system of marital status, recruitment of study participants and different sociodemographic characteristic of participants.

6.4. Treatment satisfaction

Patients' treatment satisfaction is an important component of the quality of medical care. Therefore, determining the treatment satisfaction level is central for improving health care. In current study, based on SATMED-Q tools, the mean score of global satisfaction and treatment effectiveness were 91.1(SD, 12.3) and 87.1(SD, 17.9) respectively among study participant. Based on standardized scores for the SATMED-Q ranged from zero to 100, the overall mean score of treatment satisfaction among study participants were 75.6(SD, 9.7). Findings in present

study were consistent with the finding of two studies that showed MTM provided by pharmacist had an average score of treatment satisfaction more than 75(Ndefo *et al.*, 2017; Sa'ed *et al.*, 2013). This good treatment satisfaction score might be due to higher rate of compliance, improvement in clinical parameter and reduced DTPs.

In this study diabetic patients of age group below 40years (77.66(SD, 8.18); P=0.048) were one of the factors observed to be predictors of treatment satisfaction. This was in line with study conducted Qatar and Pakistan(Bener *et al.*, 2014; Jalil *et al.*, 2017). Our finding refute previous results reported in Netherland that showed young age were associated with low treatment satisfaction(Redekop *et al.*, 2002). The lower treatment satisfaction among older age group in current finding might be due to presence many comorbidity, complication and long duration of disease along with age. This condition might lead to polypharmacy and economic burden that affect quality of life.

In current study, female patient had lower treatment satisfaction score than male which was not statistically significant. This finding were in line with two findings(Bener *et al.*, 2014; Al-Aujan *et al.*, 2012). In study conducted among chronic patients in Israel also showed that female patients had lower treatment satisfaction than male patients ($P < 0.001$)(Biderman *et al.*, 2009). This might be due to low socio-economic factors and low adherence to dietary habits, physical activity, medications use, and follow-up visits. This condition related to difficulties in adherence to taking medications that is a determinant of treatment satisfaction.

In this study type-I DM patients showed high treatment satisfaction score as compared to type II DM. In contrast to our finding study in Qatar type-I DM patients had low treatment satisfaction score(Bener *et al.*, 2014). This difference might be due to difference in tool used for assessment, awareness of participant, perception of participant to ward their medication. This high treatment satisfaction score in current study might be due to single drugs use, easy adjustment of insulin and low adverse effect as GI upset most patient encounter with metformin and other oral glucose lowering agents. In addition our study found that patient who were in single agent showed high treatment satisfaction score (77.89 ± 7.19; $p = 0.048$).

In current study patients' adherent to their medication had high treatment satisfaction score compared to non-adherent (76.17±8.89 p=0.025). Therefore, increase in the satisfaction domains scores was significantly associated with medication adherence. Our results are coinciding with four studies that showed patient whom adherence level increased their treatment satisfaction were enhanced simultaneously (Mathew *et al.*, 2016; Aitken and Valkova, 2013; Morisky *et al.*, 2008; Bharmal *et al.*, 2009). Treatment satisfaction might be associated with medication adherence as it related with patients' attitudes or beliefs towards taking their medications.

In this study, participants who encounter poor glycemic control had low satisfaction score compared to the counterpart who had good glycemic control. Findings in the present study were consistent with the findings of two studies(Bener *et al.*, 2014; Abu Sheikh *et al.*, 2018). In contrast to current finding study conducted in Saudi Arabia showed that there was no relationship between satisfaction score and HbA1c(Al-Aujan *et al.*, 2012). This difference might be due to small sample size and different tools used to assess treatment satisfaction in that study.

7. Limitation

While positive significant study outcomes were realized, there are study limitations to be considered in our study.

- ✓ Short duration intervention(six month) which is difficult to generalize
- ✓ Single center study
- ✓ Brochure prepared only in Amharic language
- ✓ Lack economic evaluation
- ✓ Budget and resources constraints were main considerations in the a priori determination of sample size.
- ✓ Self-reporting methods are considered as a convenient and economical way to assess medication adherence, it lack objective measure so it is over reported.

8. Conclusion

In summary, this study suggests that delivering MTM program had showed improvement in clinical parameter such as HgA1c, FBS and BP relative to baseline data among study participants at the end of MTM follow up. MTM services assessed in this study identified numerous drug therapy problems among ambulatory diabetes mellitus patients in TASH that were reduced upon intervention provided compared with its pre-intervention data. Exposure to MTM service showed also an increase in overall medication adherence rate and treatment satisfaction among study participant after the provision of MTM service.

9. Recommendation

Based on our findings from the current study, the following recommendations are put forward.

- MTM service should be incorporated within chronic disease management hospital services.
- Large-scale national study should be performed to design polices and increase patients access to MTM services.
- As availability of medication most common reason for non-adherence, PFSA should ensure effective/safer medication availability within the hospital with an affordable and lower possible price as needed.
- Potential drug-drug interactions should be checked especially for those drugs whose interaction lead to an adverse effect.

References

Abegaz T.M., Bhagavathula A.S., Tefera Y.G., Belachew S.A. & Tegegn H.G. 2018. Medication therapy management services in emergency and ambulatory care of Gondar University Hospital, northwest Ethiopia. *Journal of Pharmacy Practice and Research,* 48**,** 320-327.

Abu Sheikh B., Arabiat D., Holmes S., Khader Y., Hiyasat D., Collyer D.*, et al.* 2018. Correlates of treatment satisfaction and well-being among patients with type II diabetes. *International nursing review,* 65**,** 114-121.

ADA 2010. Diagnosis and classification of diabetes mellitus. *Diabetes care.*

ADA 2018. Standards of Medical Care in Diabetes—2018 Abridged for Primary Care Providers. Diabetes Care.

Adnyana I.K. 2017. Drug-related problems in Type 2 diabetic patients with hypertension in Cimahi, West Java, Indonesia: A prospective study. *International Journal of Green Pharmacy (IJGP),* 11.

Adusumilli P. & Adepu R. 2014. Drug related problems: an over view of various classification systems. *Asian J Pharm Clin Res,* 7**,** 7-10.

Aitken M. & Valkova S. 2013. Avoidable costs in US healthcare: the $200 billion opportunity from using medicines more responsibly. *IMS Institute for Healthcare Informatics***,** 27-29.

Al-Aujan S., Al-Aqeel S., Al-Harbi A. & Al-Abdulltif E. 2012. Patients' satisfaction with diabetes medications in one hospital, Saudi Arabia. *Patient preference and adherence,* 6**,** 735.

Al-Azzam S.I., Alzoubi K.H., AbuRuz S. & Alefan Q. 2016. Drug-related problems in a sample of outpatients with chronic diseases: a cross-sectional study from Jordan. *Therapeutics and clinical risk management,* 12**,** 233.

Al-Taani G.M., Al-Azzam S.I., Alzoubi K.H., Elhajji F.W.D., Scott M.G., Alfahel H.*, et al.* 2017. Prediction of drug-related problems in diabetic outpatients in a number of hospitals, using a modeling approach. *Drug, healthcare and patient safety,* 9**,** 65.

Al Hamid A., Aslanpour Z., Aljadhey H. & Ghaleb M. 2016. Hospitalisation resulting from medicine-related problems in adult patients with Cardiovascular diseases and diabetes in the United Kingdom and Saudi Arabia. *International journal of environmental research and public health,* 13**,** 479.

Al Shahrani A. & Baraja M. 2014. Patient satisfaction and it's relation to diabetic control in a primary care setting. *Journal of family medicine and primary care,* 3**,** 5.

Almaghaslah D., Abdelrhman A.K., AL-Masdaf S.K., Mohammed L., Majrashi B.M.M., Asiri W.M., *et al.* 2018. Factors contributing to non-adherence to insulin therapy among type 1 and type2 diabetes mellitus patients in Asser region, Saudi Arabia. *diabetes,* 4**,** 5.

Aloudah N.M., Scott N.W., Aljadhey H.S., Araujo-Soares V., Alrubeaan K.A. & Watson M.C. 2018. Medication adherence among patients with Type 2 diabetes: A mixed methods study. *PloS one,* 13**,** e0207583.

Aschner P. 2017. New IDF clinical practice recommendations for managing type 2 diabetes in primary care.

Ayele Y., Melaku K., Dechasa M., Ayalew M.B. & Horsa B.A. 2018. Assessment of drug related problems among type 2 diabetes mellitus patients with hypertension in Hiwot Fana Specialized University Hospital, Harar, Eastern Ethiopia. *BMC research notes,* 11**,** 728.

Aziz A.M.B.A., Manan M.M.B., Bahri S.B., Yusof F.A.B.M., Kamarruddin Z.B., Said S.B., *et al.* 2013. Drug Utilization in the Treatment of Diabetes Mellitus in the Ministry of Health Facilities.

Bakar Z.A., Fahrni M.L. & Khan T.M. 2016. Patient satisfaction and medication adherence assessment amongst patients at the diabetes medication therapy adherence clinic. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews,* 10**,** S139-S143.

Barner J.C., Lawson K.A., Kim Roberson R.P. & Makhinova T. 2015. Clinical and Economic Outcomes of the Texas Medicaid Medication Therapy Management (MTM) Pilot. *Center for Pharmacoeconomic Studies***,** 1-32.

Barnett M., Frank J., Wehring H., Newland B., VonMuenster S., Kumbera P., *et al.* 2009. Analysis of pharmacist-provided medication therapy management (MTM) services in community pharmacies over 7 years. *Journal of managed care pharmacy,* 15**,** 18-31.

Baxter M., Hudson R., Mahon J., Bartlett C., Samyshkin Y., Alexiou D., *et al.* 2016. Estimating the impact of better management of glycaemic control in adults with type 1 and type 2 diabetes on the number of clinical complications and the associated financial benefit. *Diabetic Medicine,* 33**,** 1575-1581.

Bener A., Al-Hamaq A., Yousafzai M. & Abdul-Ghani M. 2014. Relationship between patient satisfactions with diabetes care and treatment. *Nigerian journal of clinical practice,* 17**,** 218-225.

Bharmal M., Payne K., Atkinson M.J., Desrosiers M.-P., Morisky D.E. & Gemmen E. 2009. Validation of an abbreviated Treatment Satisfaction Questionnaire for Medication (TSQM-9) among patients on antihypertensive medications. *Health and quality of life outcomes,* 7**,** 36.

Biderman A., Noff E., Harris S.B., Friedman N. & Levy A. 2009. Treatment satisfaction of diabetic patients: what are the contributing factors? *Family practice,* 26**,** 102-108.

Brod M., Valensi P., Shaban J.A., Bushnell D.M. & Christensen T.L. 2010. Patient treatment satisfaction after switching to NovoMix® 30 (BIAsp 30) in the IMPROVE™ study: an analysis of the influence of prior and current treatment factors. *Quality of Life Research,* 19**,** 1285-1293.

Brummel A.R., Soliman A.M., Carlson A.M. & de Oliveira D.R. 2013. Optimal diabetes care outcomes following face-to-face medication therapy management services. *Population health management,* 16**,** 28-34.

Brvar M., Fokter N., Bunc M. & Mozina M. 2009. The frequency of adverse drug reaction related admissions according to method of detection, admission urgency and medical department specialty. *BMC clinical pharmacology,* 9**,** 8.

Burns A. 2008. Medication therapy management in pharmacy practice: core elements of an MTM service model (version 2.0). *Journal of the American Pharmacists Association,* 48**,** 341-353.

Capoccia K., Odegard P.S. & Letassy N. 2016. Medication adherence with diabetes medication: a systematic review of the literature. *The Diabetes Educator,* 42**,** 34-71.

Chisholm-Burns M.A. & Spivey C.A. 2012. The'cost'of medication nonadherence: consequences we cannot afford to accept. *Journal of the American Pharmacists Association,* 52**,** 823-826.

Christensen D.B., Roth M., Trygstad T. & Byrd J. 2007. Evaluation of a pilot medication therapy management project within the North Carolina State Health Plan. *Journal of the American Pharmacists Association,* 47**,** 471-483.

Cipolle R.J., Strand L.M. & Morley P.C. 2012. *Pharmaceutical care practice: the patient-centered approach to medication management*, McGraw Hill Professional.

Cranor C.W., Bunting B.A. & Christensen D.B. 2003. The Asheville Project: long-term clinical and economic outcomes of a community pharmacy diabetes care program. *Journal of the American Pharmaceutical Association,* 43**,** 173-184.

Curkendall S.M., Thomas N., Bell K.F., Juneau P.L. & Weiss A.J. 2013. Predictors of medication adherence in patients with type 2 diabetes mellitus. *Current medical research and opinion,* 29**,** 1275-1286.

Davis C.S., Ross L.A.R. & Bloodworth L.S. 2017. The impact of clinical pharmacist integration on a collaborative interdisciplinary diabetes management team. *Journal of pharmacy practice,* 30**,** 286-290.

Debussche X. 2014. Is adherence a relevant issue in the self-management education of diabetes? A mixed narrative review. *Diabetes, metabolic syndrome and obesity: targets and therapy,* 7**,** 357.

Degli Esposti L., Saragoni S., Buda S., Sturani A. & Degli Esposti E. 2013. Glycemic control and diabetes-related health care costs in type 2 diabetes; retrospective analysis based on clinical and administrative databases. *ClinicoEconomics and outcomes research: CEOR,* 5**,** 193.

Fulton M.M. & Riley Allen E. 2005. Polypharmacy in the elderly: a literature review. *Journal of the American Academy of Nurse Practitioners,* 17**,** 123-132.

Garber A.J., Abrahamson M.J., Barzilay J.I., Blonde L., Bloomgarden Z.T., Bush M.A., *et al.* 2018. Consensus statement by the American Association of Clinical Endocrinologists and American College of Endocrinology on the comprehensive type 2 diabetes management algorithm–2018 executive summary. *Endocrine practice,* 24**,** 91-120.

Golden S.H., Robinson K.A., Saldanha I., Anton B. & Ladenson P.W. 2009. Prevalence and incidence of endocrine and metabolic disorders in the United States: a comprehensive review. *The Journal of Clinical Endocrinology & Metabolism,* 94**,** 1853-1878.

Hayward R.A., Krein S.L. & Vijan S. 2005. Proactive case management of high-risk patients with type 2 diabetes mellitus by a clinical pharmacist: a randomized controlled trial. *The American journal of managed care,* 11**,** 253.

Health U.D.o. & Services H. 2018. Physical activity guidelines advisory committee scientific report.

Huri H.Z. & Ling L.C. 2013. Drug-related problems in type 2 diabetes mellitus patients with dyslipidemia. *BMC Public Health,* 13**,** 1192.

IDF 2015. International Diabetes Federation 7th Edition.

IDF 2017. IDF Diabetes Atlas. *International Diabetes Federation (IDF).* Brussels, Belgium: IDF Diabetes Atlas.

Ip E.J., Shah B.M., Yu J., Chan J., Nguyen L.T. & Bhatt D.C. 2013. Enhancing diabetes care by adding a pharmacist to the primary care team. *American Journal of Health-System Pharmacy,* 70**,** 877-886.

Jalil A., Zakar R., Zakar M.Z. & Fischer F. 2017. Patient satisfaction with doctor-patient interactions: a mixed methods study among diabetes mellitus patients in Pakistan. *BMC health services research,* 17**,** 155.

Jamous R., Sweileh W., Abu-Taha A., Sawalha A., Zyoud S. & Morisky D. 2011. Adherence and satisfaction with oral hypoglycemic medications: a pilot study in Palestine. *International Journal of Clinical Pharmacy,* 33**,** 942–948.

Joseph DiPiro R.T., Gary Yee, Gary Matzke, Barbara Wells, L. Michael Posey 2017. *Pharmacotherapy: A Pathophysiologic Approach, 10th Edition*, McGraw-Hill Education / Medical; 10 edition (December 13, 2016).

Koyra H.C., Tuka S.B. & Tufa E. 2017. Epidemiology and predictors of drug therapy problems among type 2 diabetic patients at Wolaita Soddo University teaching hospital, southern Ethiopia. *Am J Pharmacol Sci,* 5**,** 40-8.

Lee J.K., Grace K.A. & Taylor A.J. 2006. Effect of a pharmacy care program on medication adherence and persistence, blood pressure, and low-density lipoprotein cholesterol: a randomized controlled trial. *Jama,* 296**,** 2563-2571.

Lenderking W.R. 2005. Brief reflections on treatment satisfaction. *Value in Health,* 8**,** S2-S5.

Lochner K.A. & Cox C.S. 2013. Peer Reviewed: Prevalence of Multiple Chronic Conditions Among Medicare Beneficiaries, United States, 2010. *Preventing chronic disease,* 10.

Lochner K.A., Goodman R.A., Posner S. & Parekh A. 2013. Multiple chronic conditions among Medicare beneficiaries: state-level variations in prevalence, utilization, and cost, 2011. *Medicare & medicaid research review,* 3.

Lopez J.M., Annunziata K., Bailey R.A., Rupnow M.F. & Morisky D.E. 2014. Impact of hypoglycemia on patients with type 2 diabetes mellitus and their quality of life, work productivity, and medication adherence. *Patient preference and adherence,* 8**,** 683.

Madhu S. & Srivastava S. 2015. Diabetes mellitus: Diagnosis and management guidelines. *Journal International Medical Sciences Academy,* 1**,** 47-50.

Mathew A., Paluri V. & Venkateswaramurthy N. 2016. A Study on Impact of Clinical Pharmacist Interventions on Relationship between Treatment Satisfaction and Medication Adherence in Hypertensive Patients. *Journal of Pharmaceutical Sciences and Research,* 8**,** 190.

McAdam-Marx C., Dahal A., Jennings B., Singhal M. & Gunning K. 2015. The effect of a diabetes collaborative care management program on clinical and economic outcomes in patients with type 2 diabetes. *Journal of managed care & specialty pharmacy,* 21**,** 452-468.

Menéndez-Conde C.P., Vicedo T.B., Silveira E.D. & Accame E.C. 2011. Adverse drug reactions which provoke hospital admission. *Farmacia Hospitalaria (English Edition),* 35**,** 236-243.

Michels W.M., Grootendorst D.C., Verduijn M., Elliott E.G., Dekker F.W. & Krediet R.T. 2010. Performance of the Cockcroft-Gault, MDRD, and new CKD-EPI formulas in relation to GFR, age, and body size. *Clinical Journal of the American Society of Nephrology,* 5**,** 1003-1009.

Morisky D.E., Ang A., Krousel-Wood M. & Ward H.J. 2008. Predictive validity of a medication adherence measure in an outpatient setting. *The Journal of Clinical Hypertension,* 10**,** 348-354.

Murray M.D., Young J., Hoke S., Tu W., Weiner M., Morrow D., *et al.* 2007. Pharmacist intervention to improve medication adherence in heart failure: a randomized trial. *Annals of internal medicine,* 146**,** 714-725.

Nadine Shehab M.C.L., Andrew I. Geller, Kathleen O. Rose, Nina J. Weidle, and Daniel S. Budnitz, 2017. US Emergency Department Visits for Outpatient Adverse Drug Events, 2013-2014. *JAMA,* 316**,** 2115–2125.

Nam S., Chesla C., Stotts N.A., Kroon L. & Janson S.L. 2011. Barriers to diabetes management: patient and provider factors. *Diabetes research and clinical practice,* 93**,** 1-9.

Ndefo U.A., Moultry A.M., Davis P.N. & Askew R. 2017. Provision of medication therapy management by pharmacists to patients with type-2 diabetes mellitus in a federally qualified health center. *Pharmacy and Therapeutics,* 42**,** 632.

Nicolucci A., Cucinotta D., Squatrito S., Lapolla A., Musacchio N., Leotta S., *et al.* 2009. Clinical and socio-economic correlates of quality of life and treatment satisfaction in patients with type 2 diabetes. *Nutrition, Metabolism and Cardiovascular Diseases,* 19**,** 45-53.

Nielsen T.R.H., Andersen S.E., Rasmussen M. & Honoré P.H. 2013. Clinical pharmacist service in the acute ward. *International journal of clinical pharmacy,* 35**,** 1137-1151.

Nivya K., Kiran V.S.S., Ragoo N., Jayaprakash B. & Sekhar M.S. 2015. Systemic review on drug related hospital admissions–A pubmed based search. *Saudi Pharmaceutical Journal,* 23**,** 1-8.

Ogallo W. & Kanter A.S. Using natural language processing and network analysis to develop a conceptual framework for medication therapy management research. AMIA Annual Symposium Proceedings, 2016. American Medical Informatics Association, 984.

Ogbonna B., Ezenduka C., Opara C. & Ahara L. 2014. Drug therapy problems in patients with Type-2 Diabetes in a tertiary hospital in Nigeria. *Int J Innov Res Dev,* 3**,** 494-502.

Ogurtsova K., da Rocha Fernandes J., Huang Y., Linnenkamp U., Guariguata L., Cho N.H., *et al.* 2017. IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. *Diabetes research and clinical practice,* 128**,** 40-50.

Ombengi D., Ndemo F., Noreddin A.M. & Harris W. 2016. The Disease Burden and the Extent of Drug Therapy Problems in an Underserved Minority Population Receiving Medication Therapy Management at an Ambulatory Care Free Clinic.

Parthasarathi G., Nyfort-Hansen K. & Nahata M.C. 2004. *A Text Book of Clinical Pharmacy Practice: Essential Concepts and Skills*, Orient Blackswan.

Pathania M., Dutt H.K., Gogoi J.B., Rathaur V., Singh G. & Singh P. 2016. Study the Impact of Diabetes Camps on Adherence to Medication and Glycaemic Control in Uttarakhand. *Journal of clinical and diagnostic research: JCDR,* 10**,** OC22.

Perlroth D., Marrufo G., Montesinos A., Lewis C., Dixit A., Li B., *et al.* 2013. Medication therapy management in chronically ill populations.

Pinchevsky Y., Butkow N., Chirwa T. & Raal F. 2017. Treatment Gaps Found in the Management of Type 2 Diabetes at a Community Health Centre in Johannesburg, South Africa. *Journal of diabetes research,* 2017.

Pinto S.L., Kumar J., Partha G. & Bechtol R.A. 2014. Pharmacist-provided medication therapy management (MTM) program impacts outcomes for employees with diabetes. *Population health management,* 17**,** 21-27.

Ploenzke C., Kemp T., Naidl T., Marraffa R. & Bolduc J. 2016. Design and implementation of a targeted approach for pharmacist-mediated medication management at care transitions. *Journal of the American Pharmacists Association,* 56**,** 303-309.

Pousinho S., Morgado M., Falcão A. & Alves G. 2016. Pharmacist interventions in the management of type 2 diabetes mellitus: a systematic review of randomized controlled trials. *Journal of managed care & specialty pharmacy,* 22**,** 493-515.

Ramalho de Oliveira D., Brummel A.R. & Miller D.B. 2010. Medication therapy management: 10 years of experience in a large integrated health care system. *Journal of Managed Care Pharmacy,* 16**,** 185-195.

Redekop W.K., Koopmanschap M.A., Stolk R.P., Rutten G.E., Wolffenbuttel B.H. & Niessen L.W. 2002. Health-related quality of life and treatment satisfaction in Dutch patients with type 2 diabetes. *Diabetes care,* 25**,** 458-463.

Rejas J., Ruiz M.A., Pardo A. & Soto J. 2011. Minimally important difference of the Treatment Satisfaction with Medicines Questionnaire (SATMED-Q). *BMC medical research methodology,* 11**,** 142.

Rodis J.L., Sevin A., Awad M.H., Porter B., Glasgow K., Hornbeck Fox C., *et al.* 2017. Improving chronic disease outcomes through medication therapy management in federally qualified health centers. *Journal of primary care & community health,* 8**,** 324-331.

Ruiz M.A., Pardo A., Rejas J., Soto J., Villasante F. & Aranguren J.L. 2008. Development and Validation of the "Treatment Satisfaction with Medicines Questionnaire" (SATMED-Q)©. *Value in Health,* 11**,** 913-926.

Sa'ed H.Z., Al-Jabi S.W., Sweileh W.M. & Morisky D.E. 2013. Relationship of treatment satisfaction to medication adherence: findings from a cross-sectional survey among hypertensive patients in Palestine. *Health and quality of life outcomes,* 11**,** 191.

SEMDSA 2017. The 2017 SEMDSA Guideline for the Management of Type 2 Diabetes Guideline Committee. *The Society for Endocrinology, Metabolism and Diabetes of South Africa.* JEMDSA.

Shareef J., Fernandes J. & Samaga L. 2015. Clinical pharmacist interventions in drug therapy in patients with diabetes mellitus and hypertension in a University Teaching Hospital. *International Journal of Pharmaceutical Sciences and Research,* 6**,** 4424.

Shikiar R. & Rentz A.M. 2004. Satisfaction with medication: an overview of conceptual, methodologic, and regulatory issues. *Value in Health,* 7**,** 204-215.

Shrestha S.S., Shakya R., Karmacharya B. & Thapa P. 2013. Medication adherence to oral hypoglycemic agents among type II diabetic patients and their clinical outcomes with special reference to fasting blood glucose and glycosylated hemoglobin levels. *Kathmandu university medical journal,* 11**,** 226-232.

Skinner J.S., Poe B., Hopper R., Boyer A. & Wilkins C.H. 2015. Assessing the effectiveness of pharmacist-directed medication therapy management in improving diabetes outcomes in patients with poorly controlled diabetes. *The Diabetes Educator,* 41**,** 459-465.

Soliman A.M.A. 2013. Medication therapy management (MTM): a tool for optimizing clinical and economic outcomes in the management of chronic diseases.

Spence M.M., Makarem A.F., Reyes S.L., Rosa L.L., Nguyen C., Oyekan E.A., *et al.* 2014. Evaluation of an outpatient pharmacy clinical services program on adherence and clinical outcomes among patients with diabetes and/or coronary artery disease. *Journal of Managed Care Pharmacy,* 20**,** 1036-1045.

Stratton I.M., Adler A.I., Neil H.A.W., Matthews D.R., Manley S.E., Cull C.A., *et al.* 2000. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. *Bmj,* 321**,** 405-412.

Stuart B., Loh F.E., Roberto P. & Miller L.M. 2013. Increasing Medicare Part D enrollment in medication therapy management could improve health and lower costs. *Health Affairs,* 32**,** 1212-1220.

Teklemariam G., Workineh S., Helen Y. & Minyahil A. 2018. Drug Therapy Problems among Ambulatory Patients with Type 2 Diabetes at Endocrine and Metabolism Unit of Tikur Anbessa Specialized Hospital. *Addis Ababa University Library*.

Tilton J.J., Edakkunnathu M.G., Moran K.M., Markel Vaysman A., DaPisa J.L., Goen B.M., *et al.* 2019. Impact of a Medication Therapy Management Clinic on Glycosylated Hemoglobin, Blood Pressure, and Resource Utilization. *Annals of Pharmacotherapy,* 53**,** 13-20.

Tunpichart S., Sakulbumrungsil R., Somrongthong R. & Hongsamoot D. 2012. Chronic care model for diabetics by pharmacist home health in Bangkok Metropolitan: A community based study. *International Journal of Medicine and Medical Sciences,* 4**,** 90-96.

US Department of Health Human Services 2014. National action plan for adverse drug event prevention. Washington (DC).

Vermeire E., Hearnshaw H., Van Royen P. & Denekens J. 2001. Patient adherence to treatment: three decades of research. A comprehensive review. *Journal of clinical pharmacy and therapeutics,* 26**,** 331-342.

Viswanathan M., Kahwati L.C., Golin C.E., Blalock S.J., Coker-Schwimmer E., Posey R., *et al.* 2015. Medication therapy management interventions in outpatient settings: a systematic review and meta-analysis. *JAMA internal medicine,* 175**,** 76-87.

Walz L., Pettersson B., Rosenqvist U., Deleskog A., Journath G. & Wändell P. 2014. Impact of symptomatic hypoglycemia on medication adherence, patient satisfaction with treatment, and glycemic control in patients with type 2 diabetes. *Patient preference and adherence,* 8**,** 593.

Wang H.Y., Yeh M.K., Ho C.H., Hu M.K. & Huang Y.B. 2017. Cross-sectional investigation of drug-related problems among adults in a medical center outpatient clinic: application of virtual medicine records in the cloud. *Pharmacoepidemiology and drug safety,* 26**,** 71-80.

Weaver M., Markson P., Frederick M. & Berger M. 1997. Issues in the management of treatment satisfaction. *Am J Manag Care,* 3**,** 579-594.

Whiting D.R., Guariguata L., Weil C. & Shaw J. 2011. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes research and clinical practice,* 94**,** 311-321.

WHO 2016. Global report on diabetes. World Health Organization.

Wong I. 2017. Improving Medication Safety and Diabetes Management in Hong Kong–A Multi-disciplinary Approach. *Hong Kong Medical Journal,* 23**,** 158-167.

Yimama M., Jarso H. & Desse T.A. 2018. Determinants of drug-related problems among ambulatory type 2 diabetes patients with hypertension comorbidity in Southwest Ethiopia: a prospective cross sectional study. *BMC research notes,* 11**,** 679.

Zazuli Z., Rohaya A. & Adnyana I.K. 2017. Drug-Related Problems in Type 2 Diabetic Patients with Hypertension: A prospective Study. *Journal of Basic and Clinical Pharmacy,* 8.

Zhuo X., Zhang P., Kahn H.S., Bardenheier B.H., Li R. & Gregg E.W. 2015. Change in medical spending attributable to diabetes: national data from 1987 to 2011. *Diabetes care,* 38**,** 581-587.

Zillich A.J., Snyder M.E., Frail C.K., Lewis J.L., Deshotels D., Dunham P., *et al.* 2014. A randomized, controlled pragmatic trial of telephonic medication therapy management to reduce hospitalization in home health patients. *Health services research,* 49**,** 1537-1554.

Zoungas S., Woodward M., Li Q., Cooper M.E., Hamet P., Harrap S., *et al.* 2014. Impact of age, age at diagnosis and duration of diabetes on the risk of macrovascular and microvascular complications and death in type 2 diabetes. *Diabetologia,* 57**,** 2465-2474.

Appendixes

Appendix A: informed Consent form
Card number_____ Code number---------- date----------

Dear Participant,

My name is _____, and I am a member in research conducted under the title assessment of medication therapy management service in patients with diabetes mellitus visiting ambulatory DM clinic at Tikur Anbessa Specialized Hospital (TASH). The study conducted by Zenebe Negash, under supervision Dr. Workineh Shibeshi, Alemseged Beyene and Dr. Ablulrezak Ahmed for the purposes of obtaining a Master's Degree in Clinical Pharmacy at AAU CHS SOP. My area of focus is to assess impact of introduction of MTM service at ambulatory DM clinic of TASH with post exposure assessment of patient satisfaction and adherence.

Your participation in this study helps to identify medication therapy problems and provide appropriate intervention with appropriate education concerning disease condition and medication. This helps to improve medication adherence in order to achieve blood glucose target that reduce further complications of the disease. For this, purpose the study conducted by assessment of your medical card and through face to face interview. The interview may take 20-30 min so you are kindly asked to provide important information as honestly as you can.

Participation in the study is voluntary. If you do not wish to participate or withdraw at any time during the study, your wishes will be complied with, and nothing will be held against you. The information gathered during this study will remain confidential and will be protected by the use of initial names and all data will be secured and available only to researcher.

You are welcome to ask the researchers any questions that occur to you during the survey or interview. If you have further questions once the interview is completed, you are encouraged to contact the principal researcher using the contact information given below.

Name _____ Phone no._____ Email_____
I, _____, have read the above information. I freely agree to participate in this study. I understand that I am free to refuse to answer any question and to withdraw from the study at any time. I understand that my responses will be kept anonymous.
Participant Signature_____ Date _____
Thank you for your participation.

Pharmacy Contact Information Here

1. Patient information

Age (year):_____ Sex: ____

Marital status: Single ☐ Married ☐ Divorced ☐ Widowed ☐

Educational status: Unable to write & read ☐ Informal education ☐ Secondary school ☐ primary school ☐ College diploma and above ☐

Residence(current): _____

Occupation ☐ Employed ☐ Unemployed ☐ Private ☐ Student ☐ Other(specify)_____

How do get your medication? Buying ☐ Free ☐ Company ☐ Third Party Coverage ☐

Treating physician _____

Caregiver (if applicable) _____ phone no._____

Pharmacist completing review _____

2. Health Information and Lifestyle Factors

Inquiry	Yes/No	Details/ comments
a. Allergies	◯ Y ◯ N	Reaction
b. Smoker	◯ Y ◯ N	Cigarettes/day:
c. Alcohol Consumption	◯ Y ◯ N	Drinks/week:
d. Caffeine Intake	◯ Y ◯ N	Cups/day:
e. Grapefruit (Juice) Consumption	◯ Y ◯ N	Comments:
f. Restricted Diet	◯ Y ◯ N	Specify :
g. Physically Active	◯ Y ◯ N	Type of activity:Hours/week
h. Recreational/Other Drug Use	◯ Y ◯ N	Specify:

i. BMI(kg/m^2)	◯Normal ◯Overweight ◯Underweight ◯Obese ◯Morbid obese	Height(m):_____Weight(kg)____
j. WC(cm)	◯ Normal ◯ Increased	
k. Do you have person assist you in medication use	◯ Y ◯ N	
l. Aids, Alerts, Devices, etc.	Others	

Past medical history (relevant illnesses, hospitalizations, surgical procedures, injuries, pregnancies). _____

Past medication(s)_____

Family History (FH): _____

Functional History (if relevant- i.e. geriatrics, stroke patient, homeless, etc.): _____

Physical Examination (PE)/**vital** signs:

Parameters	**Date(dd/mm/yy**									
BP										
PR										
RR										
T^0										
Others:										

Relevant **laboratory** series results (Lab Findings of at least for three consecutive results).

Parameters	Date(dd/mm/yy									
HbA1c (%):										
FBS(mg/dL):										
RBS(mg/dL):										
Lipid profiles	LDL: mg/dl									
	TG: mg/dl									
	HDL: mg/dl									
	Total C									
OFTs	ALT/SGOPT									
	AST/SGPT									
	ALP									
	GFR									
	SrCr									
Others										

Current Medical Conditions *(List medicalconditions in numbered spaces with relevant information/parameters)*

1.	2.	3.	4.
5.	6.	7.	8.

Head to toe Assessment regarding othercomplaints/concerns/bothersomesymptoms:

Complaints/Concerns:

Bothersome symptoms:

Do any ever require self-treatment?

Medications (Prescription, Non-Prescription, Herbal Products)

Medication Name, strength	How taken Dose, route, frequency,	Purpose for use	Starting date	Stopped date	Who stopped it? Reason for stopping	Issues identified		Additional comments
						Yes: proceed to DTPs identified	No: verify to continue as per	

	time of day, special instruction							

Drug Therapy Problems Identified and Addressed by MTM Pharmacists

DTP type	Categories of DTP	Drug therapy problem cause
Indication	1. Unnecessary drug therapy	☐ Duplicate therapy ☐ No medical indication at this time ☐ Nondrug therapy more appropriate ☐ Addiction/recreational drug use ☐ Treating avoidable adverse reaction
	2. Needs additional drug therapy	☐ Preventive therapy ☐ Untreated condition ☐ Synergistic therapy
Effectiveness	3. Ineffective drug	☐ More effective drug available ☐ Condition refractory to drug ☐ Dosage form inappropriate ☐ Contraindication present ☐ Drug not indicated for condition
	4. Dosage too low	☐ Ineffective dose ☐ Needs additional monitoring ☐ Frequency inappropriate ☐ Incorrect administration ☐ Drug interaction ☐ Incorrect storage ☐ Duration inappropriate

Safety	5. Adverse drug reaction	☐ Undesirable effect ☐ Unsafe drug for the patient ☐ Drug interaction ☐ Incorrect administration ☐ Allergic reaction ☐ Dosage increase/decrease too fast
	6. Dosage too high	☐ Dose too high ☐ Needs additional monitoring ☐ Frequency too short ☐ Duration too long ☐ Drug interaction
Compliance	7. None adherent	☐ Does not understand instructions ☐ Cannot afford drug product ☐ Patient prefers not to take ☐ Patient forgets to take ☐ Drug product not available ☐ Cannot swallow/administer drug

Drug therapy problems identified

No drug therapy problems were identified

Priority Number Drug Therapy Problem (DTP)

_____

_____

For those drug therapy problems above which can be corrected with *immediate action* and *no further research or consultation*, document your plan below:

DTP #	Proposed solution	Discussed with patient	Follow-up plan

For those drug therapy problems requiring *further research, contact with other health care providers* and *care plan development*, utilize the **Pharmacy Care Plan** worksheet.

Pharmacy Care Plan

Data: Subjective information provided by the patient and/or objective data that you have collected.

Assessment: State the drug therapy problem.

Plan: For each alternative, consider *treatment efficacy, safety, drug interactions, adherence, cost, drug cover age* and *non-pharmacological interventions*.

Alternative#1:

Alternative#2:

Monitoring:

Planned date of follow-up:_____

Pharmacist signature_____ Date of Review_____

Patient action plan

Date of comprehensive medication review:_____

As a result of comprehensive medication review, I will do the following:

1.
2.
3.

Patient follow record

Date follow up	Reason for follow-up	Results	Pharmacist comments &plan
		Any new concerns?	Intervention complete? ☐Yes ☐No
		Any new concerns?	Intervention complete? Yes No
		Any new concerns?	Intervention complete? Yes No

Health Care Practitioner Communication Form

Date:_____

Healthcare Practitioner	Re:(Patient's Name)
Address	Address
Phone#	Age Phone #

Dear Dr._____

Your patient had a Comprehensive Medication Review completed on----------. Listed below are my assessment(s) and recommendation(s).Please provide a response below (if indicated) at your earliest opportunity.Should you like to discuss any ofthe information contained don'thesitate to contactme.

Drug Therapy Problem	PharmacistRecommendation		Make Changes as Recommended	PrescribeComments/Revisions
	Information Only☐	Action Required ☐	Yes☐ No ☐	
	Information Only☐	Action Required ☐	Yes☐ No ☐	
PharmacistName:			Prescriber Signature:____ Date _____	

Compliance information

Morisky 8-Item Medication Adherence Questionnaire

Scores: >2 = low adherence; 1 or 2 = medium adherence; 0 = high adherence

Questions	Patient Answer Score(Yes=1;No=0)
Do you sometimes forget to take your medicine?	
People sometimes miss taking their medicines for reasons other than forgetting. Thinking over the past 2 weeks, were there any days when you did not take your medicine?	
Have you ever cut back or stopped taking your medicine without telling your doctor because you felt worse when you took it?	
When you travel or leave home, do you sometimes forget to bring along your medicine?	
Did you take all your medicines yesterday?	

When you feel like your symptoms are under control, do you sometimes stop taking your medicine?	
Taking medicine every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?	
How often do you have difficulty remembering to take all your medicine? A. Never/rarely__ B. Once in a while__ C. Sometimes___ D. Usually___ E. All the time	A = 0; B-E = 1
	Total score__

Possible reasons/determinants for poor medication Adherence:

☐ Fear of medication adverse events	☐ Disbelief in drug effectiveness
☐ Inadequate instruction	☐ Patient prefers not to take
☐ Inadequate availability of medication	☐ Difficulty of administration
☐ Simply Forgetfulness	☐ Regimen complexity
☐ Feeling better or worse	☐ Cost of medication too expensive
☐ Due to work load/busy	Others ….....

Part IV. Assessment of adverse drug reaction (undesirable effect)

Have you experienced any undesirable, unusual adverse drug events /allergic reaction to the prescribed medicines? ☐Yes ☐ No:

If yes would you describe the manifestation of the events ----------

Hypoglycemia ☐	Epigastric pain ☐	Head ache ☐	Diarrhea/constipation ☐	Weight gain ☐
Irritability ☐	Blurred vision ☐	Depression ☐	Weakness ☐	Hypersomnia ☐
Forgetfulness ☐	Skin rash ☐	Confusion ☐	Others please specify ----------	

SATMED-Q® Questionnaire

We want to ask you about your satisfaction with the medicine you are taking. You may be taking medicines to treat more than one medical condition. For each question, put a cross through the number that best reflects your opinion. There are no right or wrong answers. If you are not sure of any of the answers, mark the one you consider most appropriate.

	Not at all	**A little bit**	**Some-what**	**Quite a bit**	**Very much**
▪ **Undesirable side effects**					
1. The side effects of the medicine interfere with my physical activity (e.g. lifting, walking, jogging, etc.).	⓪	①	②	③	④
2. The side effects of the medicine interfere with my leisure and free time activities (e.g. gardening, reading, dancing, visiting friends, etc.)	⓪	①	②	③	④
3. The side effects of the medicine interfere with my daily activities (e.g. shopping, working, housekeeping, etc.).	⓪	①	②	③	④
▪ **Efficacy of the medicine**					
4. The medicine I am taking reduces my symptoms.	⓪	①	②	③	④
5. I am satisfied with the time it takes for the medicine to start to have an effect.	⓪	①	②	③	④
6. I feel better now than I did before starting the treatment.	⓪	①	②	③	④
▪ **Convenience and ease of use** of the medicine.					
7. I find my medicine convenient to take.	⓪	①	②	③	④
8. I find it easy to use/take the medicine in its present form (taste, size, etc).	⓪	①	②	③	④
9. The timetable for taking the medicine suits me.	⓪	①	②	③	④
▪ **Impact of the medicine** on your everyday life.					
10. Thanks to the medicine I am taking I can undertake my leisure and free time activities.	⓪	①	②	③	④
11. Thanks to my medicine I can more easily look after my personal hygiene (e.g. shaving, brushing my hair, bathing, etc.)	⓪	①	②	③	④

12. Thanks to my medicine I can perform my everyday chores better.	⓪	①	②	③	④
▪ **Medical follow-up/review** of your condition					
13. My doctor has informed me in detail about my medical condition.	⓪	①	②	③	④
14. My doctor has informed me about the right way to treat my medical condition.	⓪	①	②	③	④
▪ **Overall opinion** of the medicine and your health					
15. I intend to continue using this treatment.	⓪	①	②	③	④
16. I feel happy with my treatment.	⓪	①	②	③	④
17. In general, I feel satisfied with the treatment.	⓪	①	②	③	④

Annex: Questionnaire, Amharic Version (የአማርኛ መጠይቅ ቅፅ)

Card number_____ Code number---------- date----------

አዲስ አበባ ዩኒቨርሲቲ፣ ጤና ሳይንስ ኮሌጅ፤ ፋርማሲ ት/ቤት፤ ፋርማኮልጅና ክሊኒካሌ ፋርማሲ ትምህርት ክፍል

ቅጽ 1: <u>የጥናቱ መረጃ ቅጽ</u>

ውድ የቃለ መጠይቅ ተሳታፊ፤ እንደምን አደሩ/ዋሉ?

ስሜ _____ይባላል ፤ “በጥቁር አንበሳ ስፔሻላይዝድ ሆስፒታል በስኪር ህመም ታካሚዎች ላይ የመድሃኒት ህክምና አገልግሎት” በተሰኘ የድህረ ምረቃ ጥናት አባል ነኝ። ጥናቱ የሚካሄውም በ አቶ ዘነበ ነጋሽና በጥናቱ አማካሪዎች ዶ/ር ወርቅነህ ሽበሺ እና ዓለምሰገድ በየነ ከፋርማሲ ት/ቤት የድህረ ምረቃ ፕሮግራም እንዲሁም ዶ/ር አብዱረዛቅ አህመድ ከሕክምና ት/ቤት ፣ ጤና ሳይንስ ኮሌጅ፣አዲስ አበባ ዩኒቨርሲቲ ነው።

የዚህ ጥናት ዋና አለማው ከመድሀኒት ህክምና ጋር ተያያዥነት ያለቸው ችግሮችን በመለየት፣ በታዘዘው መሰረት በአግባቡ እንድወሰድ ማድረግ፣ የመፍትሄ ሀሳቦችን በማቅረብ የህሙማን የጤና ሁኔታ እንዲሻሽል ማድረግ ነው። በዚህ ጥናት ላይ የመድሃኒት ህክምና አገልግሎት ከተሰጣ በኋለ በመድኃኒት ህክምናዎ ሊይ የሚከሰቱ ችግሮች ፤ በታዘዘው መሰረት በአግባቡ የአወሳሰዴና የአጠቃቀም ክህሎትና የእርስዎን የመድሃኒት ህክምና እርካታን ይጠናል። በተጨማሪም ከጥናቱ በሚገኙ ግኝቶች የስኪር ህክምና ዉጤትን በተወሰነ መሌኩ ለማሻሻል እንደሚቻል በመገመት፤ እርስዎ የጥቅሙ ተቋዳሽ ይሆናሉ ብለን እናምናለን። ጥናቱ የሚካሄደው የህክምና ካርዶዎን በመከለስና በገጽ ለገጽ ቃለ መጠይቅ ነው። ስለዚህ የእርስዎ ቅንና ሓቀኛ መረጃ ለጥናቱ እጅግ በጣም ወሳኝ ነው። የተከበረ ጊዜዎን ስለሰጡን እጅግ በጣም እናመሰግንዎታለን።

ቅጽ 2፡ በቃለ መጠይቅ ለመሳተፍ የፈቃድኝነት ቃል መቀበያ ቅጽ

በዚህ ጥናት የእርስዎ መረጃ ሙሉ በሙሉ በምስጥር የተጠበቀና ለምርምሩ አላማ ብቻ የሚዉል ነው። በተጨማሪም የእርስዎ ተሳታፊነት በፈቃደኝነት ላይ የተመሠረተ ነው። የጥናቱ አላማውን ተረድተውና ጊዜዎን ሰውተው፤ ከ 20-30 ደቂቃዎች ለሚፈጅ ቃለ-መጠይቅ እውተኛው መረጃ በመስጠት ፍቃደኛ በመሆንዎ በቅድሚያ አመሰግናለሁ።

በየትኛውም ጊዜ ጥያቄ ካለዎት ዘነበ ነጋሽ በስ.ቁ +251931726546

በኢ-ሜይሌ፡ zenebe.negash@aau.edu.et ይጠይቁን።

_____ _____

የቃለ መጠይቅ የቀረበለት ሰው ፊርማ የቃለ መጠይቅ አቅራቢ ፊርማ

የተከበረ ጊዜዎን ስለሰጡን እጅግ በጣም እናመሰግንዎታለን።

ዋና አጥኚ።

ቅፅ 3: ቃለ-መጠይቅ ከታካሚው

ክፍል 1፡ ስለታካሚው አጠቃላይ መገለጫዎች:				
1. ዕድሜ (በአመት):_____				
2.ጸታ	ወንድ ☐		ሴት ☐	
3. የጋብቻ ሁኔታ:	ያላገባ/ያላገባች ☐		ያገባ/ያገባች ☐ የፈታ/ች ☐	ባል የሞተበት /ሚስት የሞተችበት ☐
4.የትምህርት ደረጃ	ያልተማረ/ች ☐ 1-8ኛ ክፍል ☐		9-10ኛክፍል ☐ 10-12ኛ ክፍል ☐	ከሌጅ ድፕሎማና በላይ ☐
5.የመኖርያ ቦታ	አዲስ አበባ ☐		ከአዲስ አበባ ዉጪ ☐	
6. የስራ ሁኔታ	☐ተቀጣሪ ☐ ስራ አጥ ☐የግል ስራ/ነጋዴ ☐ ተማሪ ☐ሌላ/ሌሎች (ይገለፅ)_			
7.ወርሓዊ ጠቅላላ የቤተሰብ ገቢ(በብር)	☐<1500 ☐ 1500-3000 ☐ 3000-5000 ☐ >5000			
8. ማህበራዊ ልማድ ሁኔታ	8.1. ሲጋራ ያጨሳሉ?		አዎ ☐ አለጨስም ☐	<1እሽግ በሰምንት ☐ ≥1 እሽግ በሰምንት ☐ ድሮ አጨስ ነበር አሁን አቁሜያለሁ ☐
	8.2.መጠጥ (የአልኮል)?		አዎ ☐ አልጠጣም ☐	በቀን ስንት? _____
	ጫት ይቅማሉ?		አዎ ☐ አልቅምም ☐	ድሮ እቅም ነበር አሁን አቁሜያለሁ☐
9.የአከል ብቃት እንቅስቃሴ	በእግር መጓዝ ☐	አዎ ☐	አለደርግም ☐	ካደረጉ ለምን ያህል ጊዜ? በቀንከ30ደቂቃበታች ☐ በቀን ከ30ደቂቃ በላይ ☐

	ስፖርት ☐	አዎ ☐	አልሰራም ☐	ከሰሩ ለምን ያህል ጊዜ? በየቀኑ ☐ 1-3ቀን በሳምንት ☐ 4-6ቀን በሳምንት ☐

ክፍል 2፡ ስለህክምና አጠቃላይ መገለጫዎች			
1.የስኪር ህመምዎት ተመርምረው ካወቁ ምን ያህል ዓመት ሆኖታል? _____			
2.ለዚህ ህመምዎ መዴኃኒት መውሰዴ ከጀመሩ ምን ያህሌ ዓመት ነው? _____			
3.ህመሙን ካወቁ በኋላ ሆስፒታል ገብቶ ያዉቃሉ?	አዎ ☐	የለም ☐	አዎ ከሉ በምን ምክንያት; ☐ በስኪር መብዛት በስኪር መነስ ☐ ላላ ከለ እባክዎን ይግለጹት__
4. ለዚህ ህመምዎ የሚወስዱት መዴሃኒት	☐ አንድ የሚዋጥ_____ ☐ አንድ የሚዋጥ + ኢንሱሊን_____ ☐ 2 የሚዋጥ ብቻ_____ ☐ 2 የሚዋጥ + ኢንሱሊን_____ ☐ 3 የሚዋጥ ብቻ_____ ☐ ኢንሱሊን ብቻ፣ ጥቀስ_____		
5. ለስኪር ህመምዎ ከሚወስዱት ሌላ ተጨማሪ ቋሚ መዴኃኒቶች ወይም (የባህል ወይም ያለሓኪም ትእዛዝ የሚወሰዱት መዴኃኒቶችን) አለ?	☐የለም ☐ አዎ, ካላ እባክዎን ይግለጹት _____ እና ለምን አገልግሎት _____		
6. ተጨማሪ ወይም ሌላ ተያያዥ ህመም አለብዎት?	☐ የለም ☐ አለ , ካለ እበክዎ ይግለጹ _____		
7. በህመሙ ምክንያት የመጣ ችግር	☐ የለም ☐ አለ, ካለ እበክዎ ይግለጹ _____		
8. የመድህኒት ከሰውነት ጋር አለመስማማት)	☐ የልም ☐ አለ, ካለ መድህኒቱ ይገለጽ _____		
9. መድሃኒት የሚያገኙት በምን መልኩ ነው?	በግዢ ☐ በነጻ ☐ ከድርጅት ☐		

ክፍል**2:** ሞሪስኪ” መድኃኒትን በታዘዘው መሰረት በአግባቡ ስለመውሰድ” መለኪያ- **8**

ተ.ቁ	ጥያቄዎች	አዎ	አይደለም
1	አንዳንድ ጊዜ መድኃኒትዎን ረስተው ሳይወሰዱ ቀርተው ያውቃለ?	1	0
2	ሰዎች አንዳንድ ጊዜ ከመርሳት በተጨማሪ ባሉት የተለያዩ ምክንያቶች መድኃኒታቸውን ሳይወስዱ ይቀራሉ።ባለፉት ሁለት ሳምንታት፣ መድኃኒትዎን ሳይወስዱ የቀሩበት ቀናቶች ነበሩ?	1	0
3	መድኃኒትዎን እየወሰዱ ህመምዎ ባለመቆሙ ሐኪምዎን ሳያማከሩ መድኃኒትዎን አቋርጠው ያውቃሉ?	1	0

4	በጉዞ ወይም በሌላ ምክንያት ከቤትዎ እርቀው ሲጓዙ አንዳንድ ጊዜ መድኃኒትዎን ረስተውት ሳይወስዱት ያውቃለ?	1	0
5	በትላንትናው ዕለት ሁሉንም መድኃኒትዎን ውጠዋል?	0	1
6	ህመምዎ ጋብ ሲልሎት (የህመምዎ ስሜቶች ሲጠፈ) አንደንዴ ጊዜ መድኃኒትዎን አቋርጠው ያውቃሉ?	1	0
7	በየቀኑ መድኃኒት መዋጥ፣ ለአንዳንድ ሰዎች አይመችም። እርስዎ በየቀኑ እንድሁም አንዴም ሰዓት ሳያዛንፉ መድኃኒትዎን መዋጥ የመሰለቸት ስሜት ተሰምቶት ያውቃሉ?	1	0
8	መድኃኒትዎን አስታውሰው ለመዋጥ ምን ያክል ይቸገራሉ? ጭራሽ አይቸግረኝም☐በጣም አልፎ አልፎ ከስንት አንድ ጊዜ ይቸግረኛል☐ አንዳንድ ጊዜ ይቸግረኛል☐አብዛኛው ጊዜ ይቸግረኛል☐ ሁሌጊዜ ይቸግረኛል☐		

2.1 መድሃኒቱን በአግባቡ ካልወሰዱ እባክዎ ምክንያት ይግለጹ (ከአንድ በላይ መልስ መምረጥ ይቻላል) .....

☐የጎኒዮሽ ጉዲትን (ሳይዴኢፌክት) በመፍራት	☐ያድነኛል ብዬ ስለማላስብ
☐ስለመድሃኒቱን አወሳሰድ በቂ መረጃ ስለሌለኝ	☐መድሃኒቱን ስወስድ ህመሜ ስለሚባባስበኝ
☐መድሃኒቱንማግኘትስላልቻልኩ	☐መድሃኒቱን ስውጠው ስለሚያስቸገረኝ
☐ስለምረሳው	☐የምወስዳቸው መድሃኒቶች ብዙና ግራ የሚያጋቡ ስለሆኑ
☐ተሸሎኛል ብዬ ስላሰብኩ	☐መድሃኒቱ ውድ ስለሆነ
☐ስራ ስለምበዛብኝ	ሌላም ካለ ይግለፁት……....

ክፍል3 ከመድኃኒትዎ የጎኒዮሽ ጉዲት (ሳይዴኢፋክት) ግምገማን በተመለከተ

3.1 በአሁን ሰዓት ወይም መድሃኒትዎን መውሰድ ሲጀምሩ ከመድሃኒቱ ጋር የተያያዙ ያልተለመዱ ሁኔታዎች/ የጎኒዮሽ ጉዲት አጋጥሞዎት ያውቃል። አዎ ☐ አላጋጠመኝም☐

3.2 መሌስዎ አዎን ከሆነ የመድሃኒቱን ስሙና የነበረው ሁኔታ ይግለጹ (ከአንድ በላይ መልስ መምረጥ ይቻላል)

የስኪርመቀነስ ☐	የጨጓራ ህመም ☐	የራስ ምታት ☐	ተቅማጥ/ድርቀት ☐	የክብደት መጨመር ☐
ግራ መጋባት ☐	የአይን ብዥታ ☐	ድብርት ☐	የዴካም ስሜት ☐	ከመጠን ያለፈ እንቅልፍ ☐
መርሳት ☐	የቆዳ ላይ ሽፊታና ማሳከክ ☐	ራስንማዞር (ብዥታ) ☐	ሌላም ካለ ይግለፁት----------	

SATMED-Q የታካሚዎች ስለሚወስዱት መድሐኒት/ህክምና ያላቸውን እርካታ መመዘኛ መጠይቅ

መመሪያ፡ለእያንዳንዳቸው ጥያቄ የእርስዎን ስሜት ይበልጥ ይገልጥልኛ ልያሉትን ከተሰጡት የእረካታ መመዘኛ አማራጮች መካከል አንዷን ይምረጡ። ለጥያቄዎቹ ትክክለኛ ወይም የተሳሳተ ምለሽ የላቸዉም። ለሚሰጡት ምላሽ እርግጠኛ ካልሆኑ ይበልጥ ይስማማኛል ብለዉ ያሰቡትን ሀሳብ የያዘለወትን ምርጫ ይምረጡ።

በጭራሽ = 0, በትንሹ = 1, በመጠኑ = 2, በጣም = 3 ,እጅግ በጣም = 4

			በጭራሽ	በትንሹ	በመጠኑ	በጣም	እ.በጣም
	ይህ ክፍል ስለመድሃኒቱ የጎዮሽ ጉዳት ይመለከታል።						
1	የመድሃኒቱ የጎንዮሽ ጉዳት በአካላዊ እንቅስቃሴ ላይ ተጽእኖ አሳድሯል		0	1	2	3	4
2	የመድሃኒቱ የጎንዮሽ ጉዳት በእረፍት እና በትርፍ ጊዜዬ ላይ ተጽእኖ አሳድሯል		0	1	2	3	4
3	የመድሃኒቱ የጎንዮሽ ጉዳት በጠቅለላው የእለት ተእለት እንቅስቃሴዬ ላይ ተጽእኖ አሳድሯል		0	1	2	3	4
	ይህ ክፍል ስለመድሐኒቱ ዉጤታማነት ማለትም በሽታዉን ወይም የበሽታዉን ምልክት ስለማከሙ ይገልፃል።						
4	የምወስዳዉ መድሐኒት የበሽታዬን ምልክቶች አጥፍቶአቸዋል።		0	1	2	3	4
5	መድሐኒቱ ከወሰድኩ በኋላ ቶሎ ለውጥ ስለማይበት ረክቻለሁ።		0	1	2	3	4
6	በፊት ከነበረኝ የጤና ሁኔታ ይልቅ ህክምና ከጀመረኩ በኋለ ጥሩ ስሜት እየተሰማኝ ነዉ።		0	1	2	3	4
	ይህ ክፍል ስለመድሐኒቱ ምቹነት ወይም ለአወሳሰድ ቀላል ስለመሆን አለመሆኑ ይመለከታል።						
7	መድሐኒቶቼን በቀላሉ መወሰድ የሚችል እንዳሆነ አዉቂያለሁ።		0	1	2	3	4
8	መድሐኒቶቼ ባለበት ሁኔታ (በጣዕማቸዉ፣ በመጠናቸዉና በመሳሰሉት) በቀላሉ መዉሰድ እንዳምችል አዉቂያለሁ።		0	1	2	3	4
9	መድሐኒቶቼን የምወስድበት የጊዜ ሰሌዳ ተመችቶኛል።		0	1	2	3	4
	ይህ ክፍል መድሐኒቱ በዕለት ከዕለት ኑሮዎት ለይስ ለሚኖረዉ ሚና ይመለከታል።						
10	ዕድሜ ለምወስዳዉ መድሐኒት በትርፍ ጊዜዬ የምሰራቸዉን ስራዎች ማከናዎን ቀላል ሆኖልኛል ነዉ።		0	1	2	3	4
11	ዕድሜ ለመዴሐኒቴ የግል ንፅህናዬን ለመጠበቅ ቀላል ሆኖልኛል ነዉ።		0	1	2	3	4
12	ዕድሜ ለመድሐኒቴ የእልለት ከእለት እንቅስቃሴዬን ለማከናወን ቀላል ሆኖልኛል ነዉ።		0	1	2	3	4
	ይህ ክፍል ስለህክምናዉ ክትትል ይመለከታል።						
13	ሐኪሜ ስለጤናዬ ሁኔታ በጥልቀት አሳዉቆኛል።		0	1	2	3	4
14	ሐኪሜ ያጋጠመኝ የጤና ችግር በተገቢዉ ሁኔታ እንዴት መታከም እንዲለበት አሳዉቆኛል።		0	1	2	3	4
	በመጨረሻም መጠይቁ ስለመድሐኒቱና ስለታካሚዉ ጤንነት አጠቃላይ ያለዉን ሃሳብምን እንዳሚመስል ይመለከታል።						
15	መድሐኒቱን በቀጣይነት ለመዉሰድ አቅጃለሁ		0	1	2	3	4
16	በሚዳረግሌኝ ህክምና ምቾት ተሰምቶኛል።		0	1	2	3	4
17	በአጠቃሊይ በሚደረግሌኝ ህክምና ረክቻለሁ።		0	1	2	3	4
	ጠቅላላ ውጤት						