



**Determinants of non-adherence to diabetic's treatment among adult Diabetic patients in
Gambella General Hospital**

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Abstract

Background: Diabetes mellitus (DM) is a disease recognized as a group of heterogeneous disorders with the common elements of hyperglycemia and glucose intolerance, due to insulin deficiency, impaired effectiveness of insulin action, or both. DM is a significant and growing health problem worldwide. Several studies conducted on the diabetes adherence in the country focus only on the magnitude of non-adherence without much consideration of determinant factors causing non-adherence. **Objective:** The objective of this research was to identify determinants of non-adherence to diabetic's treatment among adult diabetic patients attending diabetic clinic in Gambella General Hospital.

Methods and Materials: A facility based unmatched case- control study design was conducted from February to March, 2018 in the diabetic clinic in Gambella Hospital on 229 Type two adult diabetic patients (57 cases and 172 controls). Both cases and controls were selected by using systematic random sampling technique from patient register in the clinic. Pretested structured questionnaire was delivered in a face to face interview. The collected data were entered, cleaned and coded in EpiData 3.1 and exported to SPSS version 21 for analysis. Bivariate analysis for each independent variable with the outcome variable was performed using Chi- square test. All independent variables with p-value less than 0.25 were candidates for multivariable logistic regression model.

Results: In the multivariate analysis, sex, educational level, forgetfulness, information on improper follow up consequences and distance to hospital were independently associated with non-adherence to DM treatment among adult diabetic patients who have been under follow up in the DM clinic in Gambella General Hospital. These were female respondents (AOR 6.295; CI 2.037-19.451) those who cannot read and write (AOR 8.532; CI 2.475-29.411), awareness of improper follow up consequences (AOR 3.661; CI 1.679-7.985), forgetfulness on taking pills (AOR 3.691; CI 1.706-7.986) and patient's home distance to Hospital (AOR 0.242; CI 0.101-0.580).

Conclusion: This study came up with five independent factors that influenced non-adherence to DM treatment. Hence, routinely conducted patient education activities should directed on gender discrepancy on DM treatment. Moreover, those illiterate patients, information gap on DM consequences and difference on distance to hospital should be further studied including the three Zonal Hospitals in Gambella.

Keywords: Diabetes, Non-adherence, Gambella

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List of Abbreviations

DM	Diabetes Mellitus
EFY	Ethiopian Fiscal Year
GTEHSC	Gambella Teachers' Education and Health Science College
MMAS-4/8	Morisky Medication Adherence Scale
MPR	Medication Possession Ratio
PDC	Proportion of Days Covered
NCD	Non-communicable Disease
SNNP	Southern Nations, Nationalities and People
T2DM	Type two diabetes mellitus
WHO	World Health Organization

4. INTRODUCTION

4.1. Background

Diabetes is a disease recognized as a group of heterogeneous disorders with the common elements of hyperglycemia and glucose intolerance, due to insulin deficiency, impaired effectiveness of insulin action, or both (1). It is a chronic disease that requires long-term medical attention both to limit the development of its devastating complications (coronary artery and peripheral vascular disease, stroke, diabetic neuropathy, amputations, renal failure and blindness are resulting in a number of disability, reduced life expectancy, and enormous health costs in every society) and to manage them when they do occur. Diabetes mellitus was estimated to affect at least 285 million people worldwide in 2010, and the number is expected to reach 438 million by the year 2030(2).

Diabetes was previously perceived to be a rare disease, but over the past few decades the increase presents a significant public health and socio-economic burden in the face of scarce resources in low in-come countries where more African countries are affected. Diabetes Mellitus (DM) is also an important problem in Africa. The number of diabetic individuals in the region are 12.1 million people and expected to project up to 23.9 million in the year 2030(1) .

In Sub-Saharan Africa, like the rest of the world, diabetes prevalence coupled with both communicable and non-communicable diseases is on the rise (3). A report from International Diabetes Federation estimated that by 2010, about 12.1 million people were living with diabetes in Africa, and the number is expected to be projected to 23.9 million by 2030 (1) . Type 2 diabetes mellitus (T2DM) is presently the most common form of diabetes in sub-Saharan Africa. Among people with T2DM, the prevalence of non-adherence is high and appears to be an important cause of increased morbidity and mortality (3).

4.2. Problem Statement

Adherence is defined as an extent to which a person's behavior, taking medication, following a prescribed diet, and/or executing lifestyle changes corresponds with agreed recommendations from the healthcare provider (4). Inadequate adherence compromises safety and treatment effectiveness, leading to increased mortality and morbidity. It is argued that more emphasis should be directed to improving adherence to existing treatments rather than developing new

medical treatments because the magnitude of non-adherence and the scope of its effect are high. Adherence rates in developed countries average only about 50% and this figure is expected to be far lower in developing countries. Adherence is a key factor associated with the effectiveness of all pharmacological therapies but is particularly critical for medications prescribed for chronic conditions (4).

In Ethiopia, few researches conducted on diabetic treatment adherence showed non-adherence at varied prevalence levels ranging, in different parts of the country, from 14.9-48.7% (5, 6, 7, 8). According to Gambella Hospital, the magnitude of non-adherence to diabetic treatment among patients under treatment is reported at 27.6 during the year 2017.

The main consequence of poor adherence to diabetic medication is decreased glycemic control, leading to the known complications of diabetes, including microvascular and macrovascular diseases and altered lipid metabolism (9). Other consequences include increased morbidity and mortality, increased costs of outpatient care, emergency room visits and hospitalization (10).

Numerous studies conducted in the country only focus on diabetes medication adherence or non-adherence with less or no emphasis on the determinant factors associated with DM treatment adherence/non-adherence. Thus, this study was aimed at identifying determinants of diabetic treatment non-adherence and this research is the first of its kind in the region at large.

4.3. Significance of the study

Findings from this research were intended to contribute in addressing the underlying causes of non-adherence and will much help those clinicians, patients, health professionals, health researchers, policy makers, health program managers and hospital managers.

2. LITERATURE REVIEW

2.1. Treatment of Diabetes

The overall goals of diabetes treatment are to keep blood glucose levels as near to normal as possible and to prevent the onset of acute and chronic complications including blood pressure and cholesterol control, incorporating lifestyle modifications (11). Since the normal homeostatic control mechanisms are disrupted in patients with diabetes, food intake, emotional stress and changes in physical activity can cause blood glucose to become too low or too high leading to the acute complications of hypoglycemia or hyperglycemia. Moreover, inadequate nutrition and insufficient physical activity increase the risk of developing the long-term complications of the disease, especially heart disease. Patients with Type 2 diabetes are often prescribed oral medications to increase insulin production, decrease insulin resistance, or block carbohydrate absorption and may have to take exogenous insulin adequate metabolic control (4).

Patients presenting with Type 2 diabetes are initially encouraged to maintain a healthy diet and exercise regimen, followed by early medication that generally includes one or more oral hypoglycemic agents and later may include an injectable treatment. To prevent complications associated with Type 2 diabetes, therapy frequently includes medications for control of blood pressure, dyslipidemia and other disorders, because patients often have more than three or four chronic conditions (12). As diabetes is largely self-managed disease, psychosocial and educational factors affect outcomes. Diabetes self-management refers to all of the activities in which patients engage to care for their diabetes, promote health, augment physical, social and emotional resources and prevent long and short- term effects from diabetes (13).

2.2. Adherence to DM treatment in Ethiopia

Like other chronic conditions, different literatures use a cutoff point of 80-90% adherence for successful treatment outcomes in DM. Contemporary perspectives on diabetes care accord a central role to patient self-care, or self-management. Self-care implies that the patient actively monitors and responds to changing environmental and biological conditions by making adaptive adjustments in the different aspects of diabetes treatment in order to maintain adequate metabolic control and reduce the probability of complications (4).

Several cross-sectional studies in Ethiopia came up with varied levels of medication adherence to diabetes treatment. A cross-sectional study conducted in the University of Gondar was 85.1% (9), yet another study on medication adherence on diabetes conducted among type 2 ambulatory patients in Zewditu Memorial Hospital in Addis Ababa was 51.3% (12). Moreover, another cross-sectional study carried out at Jimma University Specialized Hospital on factors associated with non-adherence among Type 2 diabetic patients found an overall adherence of 75.7% (10).

2.3. Measurement of adherence to DM treatment

Methods available for measuring adherence in Diabetes treatment can be direct or indirect method of measurement. Direct methods include directly observed therapy, measurement of concentrations of a drug or metabolite in blood or urine, and detection or measurement of a biologic marker added to the drug formulation. Indirect methods of measurement include asking the patient about how easy it is for them to take prescribed medication, assessing clinical response, performing pill counts, ascertaining rates of refilling prescriptions, collecting patient questionnaires, using electronic medication monitors, measuring physiologic markers, asking a patient to keep a medication diary, and assessing children's adherence by asking the help of a caregiver, school nurse or teacher. Direct methods are highly valid and reliable but not feasible in time as well as financially whereas indirect methods are comparatively easy to perform(14).

Medication Possession Ratio (MPR), defined as the proportion of days a patient had a supply of medication during a calendar year or equivalent period, with a cut-off point of 80% is one of the used in the calculation of diabetic medication adherence (15). Another method, proportion of days covered (PDC) used for an individual patient by calculating the number of days of medications supplied between the 1st prescription (x, index date) and the last date (y) for certain period interval following the index date, divided by the total days of the interval (16). A patient is considered as adherent if adherence percentage defined as the number of pills absent in a given time period ('X') divided by the number of pills prescribed in the same time period is greater than or equal to 90%. $\frac{\text{No. of pills absent in time } X}{\text{No. of pills prescribed for time } X} \times 100 \geq 90\%$. A self-reported measurement of adherence known as Morisky Medication Adherence Scale (MMAS-4/8) is also a useful tool. In this self-report scale, the 8 item MMAS consists of 7 items answered with a yes or no and 1

item with 5- point Likert scale. The scores of the MMAS-8 range from 0 to 8. A score below 6 indicates low adherence, a score between 6<8 medium adherence and score of 8 high adherence. Additionally, the four items (MMAS-4) is a commonly used qualitative self-report measurement for adherence to diabetes treatment. The scores of MMAS-4 ranges from 0-4 where 0, 1-2 and 3-4 means high, medium and low adherence respectively (17).

2.4. Factors associated with medication adherence

2.4.1. Patient's behavioral factors

Adherence is a multidimensional issue where different health care actors' efforts meet. Individual patient's characteristics associated with adherence like resources, knowledge and attitude towards the disease, motivation towards its management, beliefs, perceptions and expectancies about the outcomes related to the disease are all important. Age, gender, forgetfulness and alcohol abuse are also patient-related factors associated with medication adherence in diabetes (4). Different means tried towards stable personality characters of a typical non-adherence patient has been futile.

2.4.2. Provider-related factors

Health care provider's interactions with the diabetic patients have been shown to have an important impact on adherence to medication (12). Different variables related to the providers' interaction and communication with their patients are key determinants of adherence to diabetic medication and patient health outcome. In practice, evidences indicate that health care providers give inadequate information and lack skills though some report that they often try to supply information to patients and to motivate them (4).

2.4.3. Socio-economic demographic related factors

In lower-income groups, the cost of diabetic medications can be a reason for their lack of adherence. Poor adherence is linked with financial difficulties and a number of social factors such as taking the medications alone, a need for information, and a lack of social or family support (12). Being engaged in other businesses, being away from home, residence, educational status, use of traditional and /or religious medicines, lack of financial support and fear of medication side effects are some of the reasons for non-adherence in Ethiopia (7, 8, 12).

2.4.4. Health system related factors

Generally, health care systems create barriers to adherence by limiting accessibility to health care services, using a restricted formulary, switching to different and complex formularies and having high costs for drugs that patients cannot afford (14). Capacities of the health care system to educate patients, their provision of accessible treatment resources, provision of follow-up, creating of community support strategy, giving training to providers to implement care protocols and interventions that can support patient self-management are some examples of health care system related factors that determine non-adherence to diabetic medication (4).

2.4.5. Treatment complexity and convenience

Poor medication adherence is more likely to be manifested among diabetic patients who perceive treatment as more challenging when itself is really difficult, onerous, or burdensome. As literatures found that the prescribed number of doses per day is inversely associated with medication adherence, of course, the mean adherence decreased progressively from a once daily dose to a four times daily dose (10). Complexity of the therapy, immediacy treatment effects, side effects and the availability of medical support to alleviate them are some of the contributing factors to poor medication adherence in Type 2 diabetic patients (18).

2.5. Conclusion of the literature review

Several literatures have been conducted on assessing factors associated with diabetes treatment adherence. The reasonable cause of poor adherence mentioned were patient behavior-related factors, provider-related factors, socio-economic related factors, health care system related factors and diabetes treatment and its complexity. A report by WHO on various correlates of adherence behaviors in diabetes treatment came up with four organized clusters such as treatment and disease characteristics, intra-personal factors, inter-personal factors and environmental factors which encompass the already above mentioned factors. However, no study had been conducted to identify factors contributing to non-adherence of diabetes treatment in Gambela region of Ethiopia.

2.6. Conceptual framework

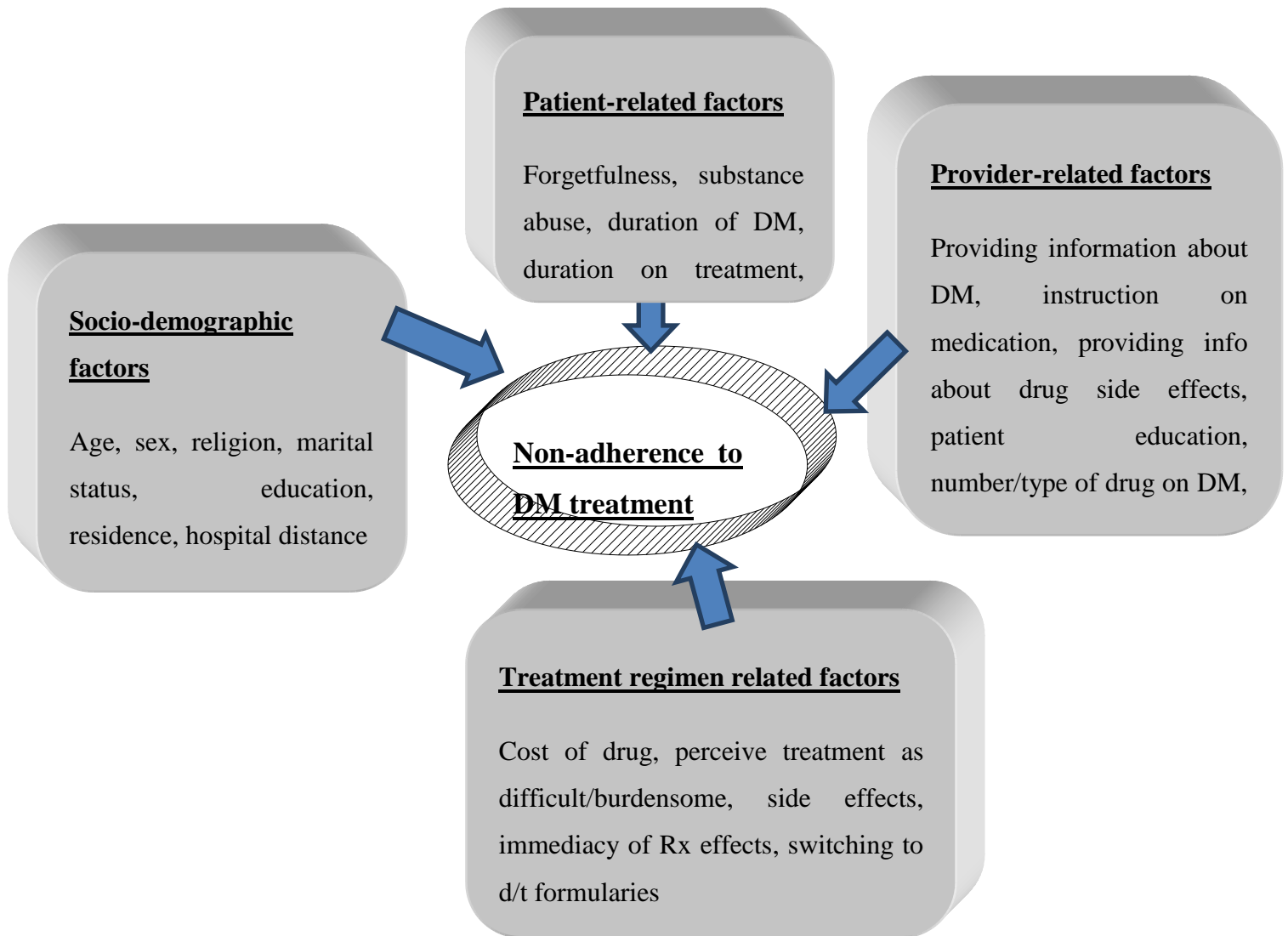


Figure 1: Conceptual framework of the study adapted from reviewed literatures (4, 19).

3. Objectives

3.1. General Objective

- ❖ To assess determinants of non-adherence to diabetic treatment among adult diabetic patients attending diabetic clinic in Gambella General Hospital

3.2. Specific Objective

- ✓ To identify factors associated with non-adherence to diabetes treatment among adult DM patients

3.3. Hypothesis

- Patient's behavioral factors are associated with the adherence status of DM patients
- Health provider-related factors are associated with the adherence status of DM patients
- Socio-economic related factors are associated with adherence status of DM patients undergoing treatment
- Health system related factors are associated with the adherence status of DM patients undergoing treatment
- Treatment complexity and convenience of diabetes mellitus association with non-adherence

4. Methods and Materials

4.1. Study area and Period

Gambella town where the hospital is located was the study area for this research from February-March 2018 in Gambella People National Regional State. The region is located 766km southwest of Addis Ababa. According to the 2009 Ethiopian Fiscal Year (EFY) population projection, total population of the Gambella people national regional state was estimated at 423,278 (male 220,601, 202,677). The region is bounded from the east and north by Oromiya, in the south by southern nations, nationalities and people (SNNP) and in the west by South Sudan. The total area square of the region is 29,782.82 square kilometer. Administratively, it has three zones; Nuer, Anyua and Majang zones, one special woreda (Itang), 13 woredas/districts with 158 kebeles. Gambella town is the main city of the Gambella people regional state (20). Gambella General Hospital, as the only health facility which provides diabetic treatment in the region, currently registered 868 DM patients with an estimated average attendance of 15 patients per day. The other public health facility in the town is the Gambella health center which cannot provide DM treatment service.

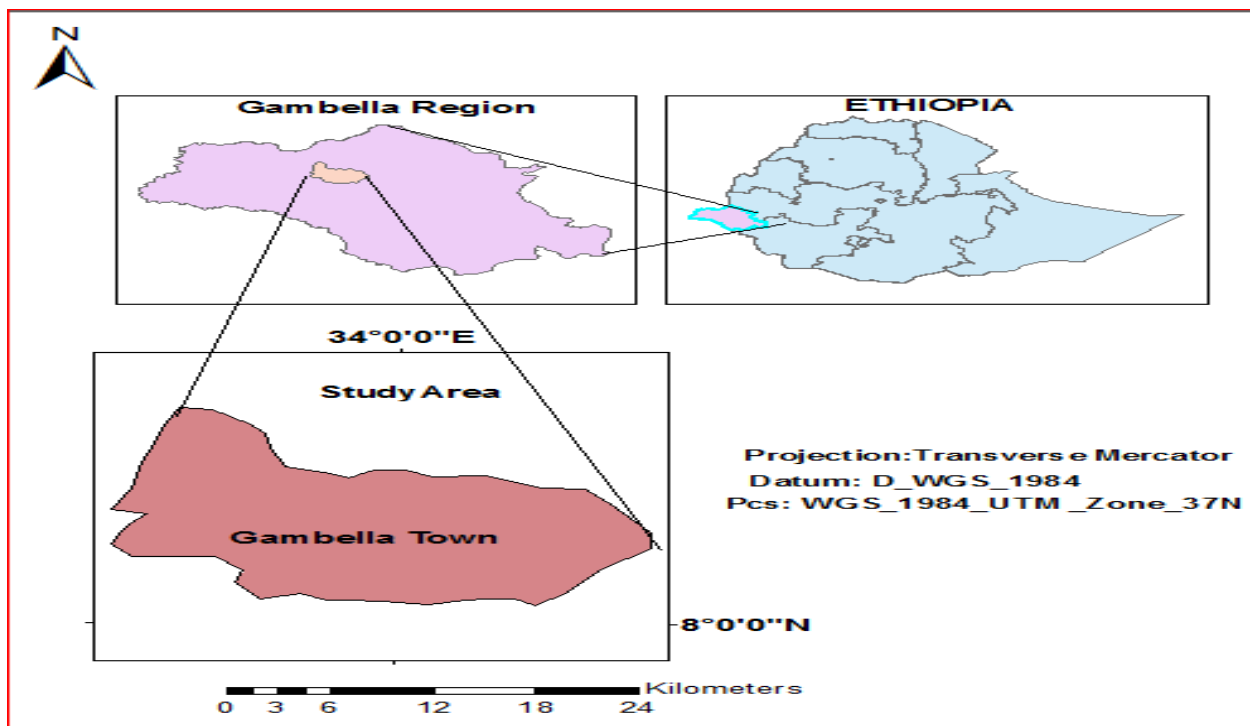


Figure 2: Source: (ArcGIS, 2017)

4.2. Study Design

A facility based case-control study design was conducted to assess determinants of non-adherence among diabetic patients attending diabetic clinic in Gambella General Hospital.

4.3. Population

4.3.1. Source population

The source population was all diabetic patients undergoing anti-diabetic medication registered in the DM clinic of Gambella General Hospital at least six months prior to the start of this research.

4.3.2. Study population

4.3.2.1. *Study population for cases*

According to other studies, cases (non-adherent) were considered as those patients who completed less than 80% of their medication supplies in their six months treatment period using PDC method (21).

4.3.2.2. *Study population for controls*

In DM clinic patient records from patients' registrar under follow up in the hospital were obtained and based on this research's objectives, DM patients who completed 80% of their doses or higher in their 6 months follow-up period were enrolled.

4.3.3. Inclusion and exclusion criteria

Inclusion criteria

- Patients 18 years and above diagnosed with T2DM
- Patients on oral anti-diabetic therapy
- Patients who had at least six months follow up

Exclusion criteria

- Patients with incomplete medical records
- Patients who were unable to communicate for any reason
- Those patients who were not willing to participate

4.4. Sample size Determination

The sample size was determined using an unmatched case control study. However, to minimize manual calculation errors, Epi Info 7 for calculating sample size was used with a power of 80%, the confidence level of 95% and a ratio of controls to cases of 3. Moreover, various

exposure/independent variables from different previous studies including 10% non-respondent rate yielded a maximum sample size of 229.

Table 1 Sample size calculation for the study

Exposure variables	References	CI (%)	Power (%)	Case: Control	% of exposure	OR	Sample size including 10%		
							Case	Control	Total
1. Certificate and above	(5)	95	80	1: 3	34	14.27	11	44	51
2. DM for >3years	(5)	95	80	1:3	66	6.1	34	102	136
3. TID & above dosage frequency	(5)	95	80	1:3	59	3.99	40	119	159
4. Monthly Income >2500	(8)	95	80	1:3	70.2	141	23	67	90
5. Lack of patient-physician relationship and communication	(8)	95	80	1:3	20	3.432	41	120	161
6. Lack of Patient education	(8)	95	80	1:3	28.3	3.854	31	91	122
7. Housewife	(8)	95	80	1:3	45.3	6.06	22	64	86
8. Side effect knowledge	(22)	95	80	1:3	54.8	0.355	52	154	206
9. Illiterate	(22)	95	80	1:3	23.3	0.175	53	157	210
10. Complexity of regimen	(22)	95	80	1:3	54.8	2.822	57	172	229

4.5. Sampling procedures

Cases and controls were grouped separately as they were defined. Simple random sampling technique was employed on individual case as well as on controls on DM patient record lists in the DM clinic. Cases were patients who completed less than 80% of their medication days gained by dividing the number of days of medications supplied between the 1st prescription and the last date of medication, divided by the total days of the interval times 100%. Controls are those who scored above 80%. Study subjects were followed based on their contact addresses like telephone numbers in their treatment records as well as those who returned for follow up were also contacted in the Hospital.

4.6. Variables

Independent variables

➤ **Socio-demographic factors**

- ✓ Age
- ✓ Sex
- ✓ Ethnicity
- ✓ Marital status
- ✓ Religion
- ✓ Residence
- ✓ Educational background
- ✓ Monthly income
- ✓ Occupational status

➤ **Patient-related factors**

- ✓ Forgetfulness
- ✓ Substance abuse (alcohol, chat and smoking)
- ✓ Duration of the disease (DM)
- ✓ Duration on treatment
- ✓ Distance to DM clinic

➤ **Provider-related factors**

- ✓ Providing information about DM
- ✓ Instruction on medication

- ✓ Patient education
- ✓ Providing information about the drug side effects
- ✓ Get trained on DM
- ✓ Provide follow up
- **Treatment regimen related factors**
- ✓ Cost of drug
- ✓ Perceive treatment as difficult/burdensome
- ✓ Side effects from medication
- ✓ Switching to different formularies
- ✓ Immediacy of treatment effects
- ❖ **Outcome variable**
- ✓ Non-Adherence

4.7. Data collection instruments and procedures

Pretested structured questionnaire was adapted and delivered in a face to face interview. The questionnaire that was prepared in English was translated to Amharic by experienced personnel and later on translated back to English. Data collectors were four/4 diploma graduates from Gambella Teacher Education and Health Science College (GTEHSC), who were able to speak and write both English and Amharic. Supervisor was a GTEHSC teacher who is able to speak the local language. Data collectors' experience and skill was considered during the recruitment stage and ease of communication, especially English and Amharic though local languages' knowledge was not ignored.

4.8. Data quality control

Data collectors were trained two days prior to the data collection and pre-testing of the questionnaire was conducted on ten/10 outpatient T2DM patients within the Hospital to ensure data quality. Data collected were regularly checked by the data collectors, by the supervisor and after all checked by the principal investigator after each session to ensure whether the collected data are completed or not to make corrections. Data validation and double entry with Epi Data 3.1 was carried out to minimize errors during entry.

4.9. Data processing and analysis

To ensure clean data set, editing, coding and cleaning of the collected data was performed. After data entry procedures were completed, data were exported to SPSS version 21. Bivariate analysis for each independent variable with the outcome variable was performed using Chi-square test. After completing bivariate analysis, multicollinearity among the variables which qualified for multiple logistic regression was checked by considering Pearson correlation coefficient (r), at the cut-off point $r=0.8$ and above, indicating multicollinearity, resulting in removing one of the variables and retaining the other to avoid redundancy. All independent variables with p-value less than 0.25 were taken as candidates for multivariable logistic regression model. Multivariate logistic regression model was built using backward LR by removing all the insignificant variables until a simple model with main predictors obtained. Adequacy of the model to fit the outcome variable with the predictors was checked using Hosmer and Lemeshow Test for goodness of fit. With the p-value less than 0.05, the model could be considered as it would not fit the data very well.

4.10. Ethical consideration

Ethical approval was obtained from IRB of Institute of Health of Jimma University. Formal letter of permission for the Gambella Regional Health Bureau was provided from the Faculty of Public Health of Jimma University. Another formal letter for the Gambella Hospital was provided by the Gambella Health Bureau to seek permission from authorities of the Hospital. Verbal informed consent was obtained from the study subjects.

4.11. Dissemination plan

The findings will be submitted to the Department of Epidemiology, Jimma University and Gambella Regional Health Bureau, and Gambella General Hospital. It will be published in a peer reviewed scientific journal. It will also be printed and used by health staffs, policy makers and as well as clinicians working at DM clinic at the specific study area.

4.12. Operational definitions

Adherence: The extent to which a person's behavior taking anti-diabetic corresponds with agreed recommendations from a health care provider measures in 6 months period(23).

Adherent: Those T2DM patients who completed 80% or higher of their medication days in a six months period (21).

Non-adherent: These are T2DM patients who completed less than 80% of their medication days in a six months period (21).

Substance use: Patient's use of substance (chat, alcohol and cigarette) after being confirmed as diabetic patient within 6 months follow up.

5. RESULTS

5.1. Description of socio-demographic characteristics

The sample population interviewed was 229 (57 cases and 172 controls) with 100% response rate. The study revealed that 51 (89.5%) of cases were male and 126 (73.3%) of them were adherent. The mean age for the studied population was 41.89 ± 9.93 (ranges from 19-62 years) of which 11 (19.3%) of cases were 18-30, 10 (17.5%) were 31-40, 27 (47.4%) were 41-50 and 9 (15.8%) were 51 years and above. 24 (42.1%) participants who are non-adherent (cases) cannot read and write and 4 (7%) of them were diploma and above. Twenty (35.1%) of cases were earning a monthly income less than Birr 1,000 whereas 12 (21.1%) were earning a monthly income more than Birr 3000. Majority of the study non-adherent participants (86%) were found to live in urban areas; (Table 2).

Table 2 Socio-demographic characteristics respondents of non-adherent and adherent to diabetic treatment in Gambella General Hospital, February-March, 2018

Socio-demographic variables		Category	Cases N (%)	Controls N (%)
Respondent's sex		Male	89.5	73.3%
		Female	10.5	26.7%
Age		18-30 years old	19.3	18.6%
		31-40 years	17.5	22.7%
		41-50 years	47.4	35.5%
		51 years and above	15.8	23.3%
Patient's ethnic background	ethnic	Nuer	5.3	10.5%
		Anyuak	8.8	7%
		Majang	5.3	2.3%
		Oromo	5.3	16.3%
		Amhara	12.3	9.9%
	Tigre	5.3	7.6%	

	Others*	57.9	46.5%
Monthly income in birr	Less than 1000	35.1	37.8%
	1001-2000	29.8	27.9%
	2001-3000	14	11%
	More than 3000	21.1	23.3%
Patient's educational status	Illiterate	42.1	9.9%
	Grade 1-8	26.3	25%
	Secondary (9-12)	14	30%
	Diploma & above	7	19.2%
Marital status	Single	14.5	23.8%
	Married	66.7	59.3%
	Widowed	3.5	3.5%
	Divorced	5.3	5.8%
	Separated	7	7.6%
Religion	Orthodox	35.1	35.5%
	Muslim	15.8	28.5%
	Protestant	38.6	21.5%
	Catholic		5.8%
	Others**	10.5	8.7%
Distance to Hospital	Less than 5km	73.7	57%
	More than 5km (from woreda)	26.3	43%
Residence	Urban	86	69.2%
	Rural	14	30.8%

*Note: *Other ethnic groups mean Kembata, Keffa, Wolaita, Hadiya and Sheka**other religions mean 7th Day Adventist, Baba John and Traditional beliefs*

5.2. Socio-demographic factors associated with non-adherence to diabetic treatment in bivariate analysis

The result of bivariate analysis indicated that, sex, being illiterate, living more than 5 kilometers away from the treatment site, religion and ethnicity were found to be candidate variables ($p < 0.25$) for multivariate analysis (Table 3).

Table 3 Socio-demographic variables associated with non-adherence to diabetic treatment in bivariate analysis, February-March, 2018

Socio-demographic variables	Adherence status		COR	95% CI	P-value	
	Non-adherent	Adherent				
Respondent's sex	Female	6	46	1		
	Male	51	126	3.103	1.248-7.715	0.015*
Educational level	Illiterate	30	43	11.647	3.475-39.037	0.001*
	Grade 1-8	15	43	2.878	0.873-9.484	
	Grade 9-12	8	53	1.245	0.347-4.463	
	Diploma & above	4	33	1		
Distance	Less than 5km	42	98	1		
	More than 5km	15	74	0.473	0.244-0.917	0.027*
Religion	Orthodox	20	61	1		
	Muslim	9	49	11.647	3.475-39.037	0.001*
	Protestant	20	37	1.904	0.486-7.459	
	Catholic	3	10	2.878	0.873-9.484	
	Others	5	15	1.245	0.347-4.463	
	Ethnicity	Nuer	3	18	1	
	Anyuak	5	12	2.500	0.501-12.469	0.264
	Majang	3	4	4.500	0.652-31.082	0.127*
	Oromo	3	28	0.643	0.117-3.541	0.612
	Amhara	7	17	2.471	0.548-11.141	0.239*

Tigre	3	13	1.385	0.240-7.985	0.716
Others	33	80	2.475	0.683-8.971	0.168*

*Note:-1 indicates the reference variable; COR=crude odds ratio, CI=confidence interval at 95% significance level, * indicates a variable is significant at cut-off 0.25*

- Other religions mean 7th Day Adventist, Baba John and Traditional beliefs

- Other ethnic groups mean Kembata, Keffa, Wolaita, Hadiya and Sheka

5.3. Description of factors related to patient

Two (3.5%) of cases (non-adherent) were smoking, and 17 (29.8%) were alcohol users. Among the cases, 16 (9.3%) of them reported to chew chat in the last six months. Majority of cases (34.3%) have reported to have stayed on treatment for one year. Forty three (43.1%) of cases said that they were not informed of improper follow up consequences. Likewise, 43.5% among cases reported to have once forgotten to take their medications in the last six months period; (Table 4).

Table 4: Patient-related factors associated to non-adherence to diabetic treatment in bivariate analysis, Gambella General Hospital, February-March, 2018

Variables		Adherence		COR	95% CI	P-value
		Non-adherent	Adherent			
Smoking	Yes	2 (3.5%)	5 (2.9%)	1		
	No	55 (96.5%)	167 (97.1%)	0.823	0.155-4.365	0.819
Chewing chat	Yes	8 (41%)	16 (9.3%)	1		
	No	49 (23.9%)	156 (76.1%)	0.628	0.254-1.557	0.315
Alcohol use	Yes	17 (29.8%)	32 (18.6%)	1		
	No	40 (70.2%)	140 (81.4%)	0.538	0.271-1.067	0.076*

If aware of side effects	Yes	20 (35.1%)	108 (62.8%)	1		
	No	37 (64.9%)	64 (37.2%)	3.122	1.670-5.836	0.001*
Treatment cost	Affordable	23 (40.4%)	52 (30.2%)	1		
	Unaffordable	34 (59.6%)	120 (69.8%)	0.641	0.344-1.192	0.160*
Duration of treatment	6 months	18 (31.6%)	52 (30.2%)	1		
	up to 1 year	19 (33.3%)	59 (34.3%)	0.930	0.442-1.959	0.992
	up to 5 years	19 (33.3%)	57 (33.1%)	0.963	0.457-2.031	0.921
	More than 5 years	1 (1.8%)	4 (2.3%)	0.722	0.076-6.893	0.777
	Difficult	27 (22.1%)	95 (55.2%)	0.898	0.459-1.754	0.752
Types of drugs taken a day	Somehow	8 (14%)	16 (9.3%)	1.579	0.585-4.263	0.367
	Easy	2 (3.5%)	1 (0.6%)	6.316	0.542-73.577	0.141*
	Very easy	1 (1.8%)				
	One	36 (63.2%)	103 (59.9%)	1		
	Two	18 (31.6%)	64 (37.2%)	0.805	0.422-1.535	0.510
Frequency of medication	More than two	3 (5.3%)	5 (2.9%)	1.717	0.390-7.547	0.474
	One time	6 (10.5%)	13 (7.6%)	1		
	Two times	51 (89.5%)	158 (91.9%)	0.699	0.253-1.935	

		Three times				
If the patient is told how to take medicines	Yes	47 (82.5%)	163 (94.8%)	1		
	No	10 (17.5%)	9 (5.2%)	3.853	1.480-10.036	0.006
Forgetfulness	Yes	27 (11.8%)	35 (15.3%)	0.304	0.157-0.590	0.001
	No	30 (13.1%)	137 (59.8%)	1		
Improper follow up consequences	Yes	29 (12.7%)	135 (59%)	3.293	1.708-6.346	0.01
	No	28 (12.2%)	37 (16.2%)	1		

5.4. Description of treatment-related factors for diabetic's treatment non-adherence

Thirty four (59.6%) cases reported DM treatment cost is unaffordable. 19 (33.3%) of studied cases reported to have stayed on diabetes treatment for up to five years. Concerning treatment perception, 19 (33.3%) of cases reported DM treatment as very difficult, 36 (63.2%) cases used to take one type of drug a day.

Table 5: Treatment regime-related factors associated to non-adherence to diabetic treatment in bivariate analysis, Gambella General Hospital, February-March, 2018

Variables		Adherence status		COR	95% CI	P-value
		Non-adherent	Adherence			
If aware of side effects	Yes	20 (35.1%)	108 (62.8%)	1		
	No	37 (64.9%)	64 (37.2%)	3.122	1.670-5.836	0.001*
Treatment cost	Affordable	23 (40.4%)	52 (30.2%)	1		
	Unaffordable	34 (59.6%)	120 (69.8%)	0.641	0.344-1.192	0.160*
Duration on	6 months	18 (31.6%)	52 (30.2%)	1		

treatment	up to 1 year	19 (33.3%)	59 (34.3%)	0.930	0.442- 1.959	0.992
	up to 5 years	19 (33.3%)	57 (33.1%)	0.963	0.457- 2.031	0.921
	More than 5 years	1 (1.8%)	4 (2.3%)	0.722	0.076- 6.893	0.777
Treatment perception	Very difficult	19 (33.3%)	60 (34.9%)	1		
	Difficult	27 (22.1%)	95 (55.2%)	0.898	0.459- 1.754	0.752
	Somehow	8 (14%)	16 (9.3%)	1.579	0.585- 4.263	0.367
	Easy	2 (3.5%)	1 (0.6%)	6.316	0.542- 73.577	0.141*
	Very easy	1 (1.8%)				
Types of drugs taken a day	One	36 (63.2%)	103 (59.9%)	1		
	Two	18 (31.6%)	64 (37.2%)	0.805	0.422- 1.535	0.510
	More than two	3 (5.3%)	5 (2.9%)	1.717	0.390- 7.547	0.474
Frequency of medication	One time	6 (10.5%)	13 (7.6%)	1		
	Two times	51 (89.5%)	158 (91.9%)	0.699	0.253- 1.935	
	Three times		1 (0.6%)			
	No	10 (17.5%)	9 (5.2%)	3.853	1.480- 10.036	0.006

6. Factors independently associated with non-adherence to diabetic's treatment

Variables that qualified for multivariate analysis ($p < 0.25$) in bivariate analysis were alcohol use, whether the patient is aware of side effects or not, treatment cost, improper follow up consequences, forgetfulness, sex, religion, ethnicity, educational level, residence and distance to Hospital. In the multivariate analysis, five predictors were independently associated with non-adherence to DM treatment among adult diabetic patients who have been under follow up in the DM clinic in Gambella General Hospital. These variables were respondent's sex, educational level, and awareness of improper follow up consequences, forgetfulness on taking pills and patient's home distance to Hospital. Male individuals were 6.295 (CI: 2.037-19.451) times more likely to be non-adherent than their female counterparts. Diabetic patients who cannot read and write are 8.532 (CI: 2.475-29.411) times more likely to be non-adherent than those who have diploma and above. Patients on diabetic treatment who reported to forget taking their pills are 3.691 (CI: 1.706-7.986) times more likely to be non-adherent than those who remember to take their pills. Further, those individuals who responded to have never been informed of improper follow up consequences were found to be 3.661 (CI: 1.679-7.985) times more likely to be non-adherent than those who are informed. Moreover, DM patients coming from the distance of more than 5 kilometers away (districts) are 0.242 (CI: 0.101-0.580) times more likely to be non-adherent than those who came from less than 5 kilometers.

Adequacy of the model to fit the outcome variable, non-adherence, with the predictors was checked using Hosmer and Lemeshow Test for goodness of fit. With the p-value of 0.770, the model was considered to be fit for the variables estimation as it was greater than 0.05. The adjusted odds ratios with their corresponding 95% confidence intervals are given in Table 5 below.

Table 5: Factors independently associated with non-adherence to diabetic’s treatment among adult diabetic patients attending diabetic clinic in Gambella General Hospital, February-March, 2018.

Variables		Adherence status		AOR	95% CI	P-value
		Non-Adherent (N =57)	Adherent (N =172)			
Sex	Female	6	46	1		
	Male	51	126	6.295	2.037-19.451	0.001*
Educational level	Illiterate	30	43	8.532	2.475-29.411	0.001*
	Grade 1-8	15	43	3.850	1.076-13.767	0.002*
	Grade 9-12	8	53	1.393	0.360-5.387	0.001*
	Diploma & above	4	33	1		
Forgetfulness	Yes	27	35	3.691	1.706-7.986	0.001*
	No	30	137	1		
Improper follow up consequences	Yes	29	135	1		
	No	28	37	3.661	1.679-7.985	0.001*
Distance to Hospital	Less than 5km	42	98	1		
	More than 5km	15	74	0.242	0.101-0.580	0.001*

7. DISCUSSION

In order to achieve the desired goals of treatment, DM patients need to strictly comply to the agreement reached with the prescriber. Adherence to diabetic's treatment is crucial to limit the end-stage complications like renal diseases, cardiovascular diseases, blindness and lower limb amputation due to improper or poor medication adherence (4). This particular study showed that non-adherence to DM treatment among adult diabetic patients who were undergoing treatment in the DM clinic in Gambella General Hospital in Gambella region, Southwest Ethiopia, was influenced by components of which some are attributed to patients and others to the general health care; an issue which has been acknowledged by previous studies (8). Hence; the study has thematically discussed the prominent determinants of non-adherence to DM medication as follows.

The study has pointed out that, being male individual, being illiterate, being not informed of improper follow up consequences, forgetting to take pills and living more than 5km away from the Hospital were independently associated with non-adherence to DM treatment among the diabetic patients. Gender discrepancy on non-adherence in this study showed male were more likely to be non-adherence than female but this finding is in contrast to the finding from Sudan where there was no significant association with non-adherence (24). This current study is similar to the finding from Gaza Strip, Palestine (25). The possible reasons for educational level could be the fact that, being illiterate or no formal education makes it difficult for an individual to understand the prescribed drug therapy as treatment duration increases and the patient is required to adhere to multiple drug therapy. This is inconsistent with the study from Tanzania and the possible reasons are the source population characteristics and the time differences (26). Finding from this study is in line with the study conducted in Addis Ababa, Zewditu Memorial Hospital (22).

Diabetic patients who reported to have had ever forgot to take their pills are more likely to be non-adherent to their treatment than those who responded to have taken their pills regularly without forgetting. Similar findings were reported by other scholars from Sudan and Nigeria, respectively (24, 27). Similarly, DM patients who reported to have not been informed of

improper treatment follow up consequences were found more likely to be non-adherent to treatment than those who are informed. This corresponded to the findings from Ethiopia where patient's awareness on the diabetes and its management was emphasized to be important in order to achieve positive diabetes outcome (22).

Patients who come within 5 kilometers away (districts) to the Hospital are less likely to be non-adherent to DM treatment than those who live peripheral to the Hospital. This is because long distance travelers are given more doses considering their being far apart and the probability of missing appointments as long distance can incur increased transportation cost and other concurrent uncertain scenarios. Other potential reasons are long distance travels can hinder other works and by avoiding this, patients far from the Hospital are prone to be non-adherent (27). This finding is contrary to the one conducted in Northern Ethiopia where distance had no significant association with DM non-adherence (5). Possible reason behind this revelation is because Gambella General Hospital have been serving as the only health facility that deliver diabetic treatment service in the region; and due to this scenario, patients from far apart are forced to travel long distance and end up missing their promised appointments.

In this study, age has not been found associated with non-adherence to DM treatment, unlike the previous studies Tanzania and Lagos, Nigeria, respectively (28). Unlike previous studies in the country, monthly income, duration of diabetic treatment and marital status were not found as determinants for treatment non-adherence. The probable reasons behind in this current finding are the source population and the design effect difference (8, 22).

This study has addressed various determinants of non-adherence to DM treatment by including different health system in addition to socio-demographic factors. Most studies had exclusively dealt with socio-economic factors. Strength of this study was that the recall bias was minimized by reviewing the patient medical records and cross checking some variables that might intrude recall or difficulty in remembering by the patient. For instance; duration on DM treatment, DM treatment or months in which a patient interrupted/missed his/her drugs was retrieved from records.

8. LIMITATIONS

Besides the findings from the current research, there were some limitations and reservations. Thus, generalization of the finding to wider region is under question as the sample population was taken from only one public health facility.

9. CONCLUSION

The study has profoundly addressed numerous factors that influenced non adherence to DM treatment among adult diabetic patients in Gambella General Hospital in the Gambella Regional State, Southwest Ethiopia. The findings acknowledged that, determinants of non-adherence to DM treatment were patient's socio-demographic factors such as sex, educational level that have a positive association with the outcome variable, and the patient's home distance to the Hospital which have a negative association with non-adherence. Moreover, general health system-related factors including forgetfulness on taking pills and having not been informed of improper follow up consequences, which were positively associated with the outcome variable, were found to be other determinants of non-adherence for this particular study.

10. RECOMMENDATIONS

In order to reverse non-adherence to diabetic's treatment in the study area, further enquiries should be carried out to find out why male are fail to strictly follow their treatment than their female counterparts. Further, Gambella Regional Health Bureau should facilitate build the capacity of patients who are illiterate to comply with their medication as well as encourage all patients under follow up for the disadvantages of improper appointment follow ups. Moreover, diabetic treatment service should be extended to three Primary Hospitals recently inaugurated in Nuer, Anyuak and Majang Zones to minimize long distance travel to get service in the study area and further study should be conducted in these respective 3 Zonal Hospitals.

References

1. Nigel Unwin, Delice Gan, Jean Claude Mbanya, Ambady Ramachandran, Gojka Roglic, Jonathan Shaw, Gyula Soltész, David Whiting, Janice Zgibor, Ping Zhang PZ. IDF DIABETES ATLAS. IDF. 2009.
2. Hall V, Thomsen RW, Henriksen O, Lohse N. Diabetes in Sub Saharan Africa 1999-2011 : Epidemiology and public health implications . a systematic review. BMC Public Health [Internet]. 2011;11(1):564. Available from: <http://www.biomedcentral.com/1471-2458/11/564>
3. Blackburn F. David S and LM. Non-adherence in type 2 diabetes : practical considerations for interpreting the literature. 2013;
4. Sebate . Adherence to long- term therapies; World Health Organization 2003.
5. Abebaw M, Messele A, Hailu M, Zewdu F. Adherence and Associated Factors towards Antidiabetic Medication among Type II Diabetic Patients on Follow-Up at University of Gondar Hospital , Northwest Ethiopia. Adv Nurs. 2016;2016.
6. Teklay G, Hussien J TD. Non-adherence and associated factors among type 2 diabetes patients at Jimma University Specialized Hospital, Southwest Ethiopia. Vol. 13, Journal of Medical Sciences. Jimma; 2013. 13 (7):p. 578–84. DOI: 10.3923/jms.2013.578.584/[Accessed 15 December 2017].
7. Gelaw BK, Mohammed A, Tegegne GT, Defersha AD, Fromsa M, Tadesse E, et al. Nonadherence and Contributing Factors among Ambulatory Patients with Antidiabetic Medications in Adama Referral Hospital. 2014; Hindawi Publishing/Corporation Journal of Diabetes Research, 2014. Article ID 61704. Available from <http://dx.doi.org/10.1155/2014/617041>/[Accessed on 11
8. Mesfin Y. Assegid S. and Beshir M. Medication Adherence among Type 2 Diabetes Ambulatory Patients in Zewditu Memorial Hospital, Addis Ababa, Ethiopia. Epidemiol. 2017;7(5). 5 DOI: 10.4172/2161-1165.1000322/[Accessed 5 December 2017].
9. American Diabetes Association . Standards of Medical Care in Diabetes 2013. 2013;36(October 2012)/ (Accessed on 2017 9th November).
10. Polonsky WH, Henry RR. Poor medication adherence in type 2 diabetes : recognizing the

- scope of the problem and its key contributors. 2016; Patient Preference and Adherence.1299–307.)/ [Accessed 18 December 2017].
11. Nguyen HT, Pharm D. Diabetes Mellitus Pharmacology Review. Am Diabetes Assoc Stand Med Care Diabetes. 2015;38(1) 38(1)/ [Accessed 17 December 2017].
 12. Luis-Emilio G., Pe ´rez M., Tatiana D., V., G., G. and Domingo O.B.: Adherence to Therapies in Patients with Type 2 Diabetes. Diabetes Ther (2013) 4:175–194 DOI 10.1007/s13300-013-0034-y/[Accessed 10 December 2017].
 13. Richardson CR, Wyckoff JA, Funnell MM, Herman WH, Release I, Recent M, et al. Management of Type 2 Diabetes Mellitus Key points. [Accessed 15th December 2017].
 14. Osterberg L, Blaschke T. Adherence to Medication. N Engl J Med 2005; 353: 487–97. (Available from www.nejm.org)
 15. Sharon J. Rolnick, Pamala A. Pawloski, Brita D. Hedblom SEA and RJB. Patient Characteristics Associated with Medication Adherence. 2013; Clinical Medicine & Research. 11(2):54–65. doi:10.3121/cmr.2013.1113/[Accessed on 5 December 2017].
 16. Carola A. Huber, Roland Rapold, Beat Br ¨ungger OR and TR. One-year adherence to oral antihyperglycemic medication and risk prediction of patient outcomes for adults with diabetes mellitus. 2016;0(March). Medicine: 2016:95:26. [Accessed 29 November 2017].
 17. Plakas S, Mastrogiannis D, Mantzorou M. Validation of the 8-Item Morisky Medication Adherence Scale in Chronically Ill Ambulatory Patients in Rural Greece. Open Journal of Nursing 2016;(March):158–69. Available <http://dx.doi.org/10.4236/ojn.2016.63017>/[Accessed 17 December 2017].
 18. World Health Organization. Adherence to Long-term Therapies: Policy for Action. Geneva: World Health Organization. Meeting report, 2001.
 19. Brown MT, Bussell JK. Medication Adherence: WHO Cares? Mayo Clin Proc. 2011; 86(4):304-314. Available from: doi:10.4065/mcp.2010.0575/[Accessed on 14 December 2017).
 20. Gambella Regional Health Bureau. Gambella Regional Health Bureau, Gambella; 2017.
 21. Kirkman MS, Rowan- MT, Levin R, Fonseca VA, Schmittiel JA, Herman WH, et al. Determinants of Adherence to Diabetes Medications : Findings From a Large Pharmacy Claims Database. Diabetes Care 2015;38(April):604–9. Available from: DOI:

- 10.2337/dc14-2098/[Accessed on 8 November 2017).
22. Ali M., Alemu T. and Sada O. Medication adherence and its associated factors among diabetic patients at Zewditu Memorial Hospital, Addis Ababa, Ethiopia. *BMC Res Notes* (2017) 10:676 <https://doi.org/10.1186/s13104-017-3025-7>[Accessed on 30 December 2017).
 23. Blackburn F. David S and LM. Non-adherence in type 2 diabetes : practical considerations for interpreting the literature. . *Patient Preference and Adherence* 2013: 7.
 24. EI-Hadiyah, T.M., Madani, A.M., Abdelrahim, H.M. and Yousif, A.K. (2016): Factors Affecting Medication Non Adherence in Type 2 Sudanese Diabetic Patients. *Pharmacology & Pharmacy*, 7, 141-146. <http://dx.doi.org/10.4236/pp.2016.74018/> [Accessed on April 20/2018].
 25. Elsous A., Radwan M., Al-Sharif H. and Mustafa A. Medication Adherence and Associated Factors among Patients with Type 2 Diabetes Mellitus in the Gaza Strip, Palestine. *Front. Endocrinol.* 8:100 /doi: 10.3389/fendo.2017.00100[Accessed on March 30/2018].
 26. Godfrey M. R. Adherence to anti-diabetic drugs among patients with Type 2 diabetes mellitus at Muhimbili National Hospital, Dar es Salaam, Tanzania- A cross-sectional study. *Pan African Medical Journal.* 2014; 17:252/doi:10.11604/pamj.2014.17.252.2972/[accessed on April 10/2018].
 27. Okoro R. N and Ngong C. K. Assessment of patient's anti-diabetic medication adherence levels in noncomorbid diabetes mellitus in a tertiary health care setting in Nigeria. *Pharmacie Globale (IJCP)* 2012, 7 (01)/ [Accessed on April 20/2018].
 28. Awodele O and Osulale J.A. Medication adherence in type 2 diabetes patients: study of patients in Alimosho General Hospital, Igando, Lagos, Nigeria. *African Health Sciences* Vol 15 Issue 2, June 2015/[Accessed on May 1/2018].

ANNEX I: QUESTIONNAIRES (English version)

**JIMMA UNIVERSITY
INSTITUTE OF HEALTH
FACULTY OF PUBLIC HEALTH**

Postgraduate Program of MPH in General Public Health (GMPH)

Principal investigator's name _____ Name of data collector(s)

Dear Sir/madam;

As part of academic requirements, I am conducting an assessment of adherence to diabetic's treatment and associated factors in Gambella Hospital. You are kindly requested as a patient under DM treatment in this Hospital to help us by participating voluntarily and you are able to quit as it is your right. The information obtained from you will not be disclosed to any other third body. Rather it will be used for research purpose only for solving the problems related to DM medication.

Therefore, I am kindly asking your cooperation to participate in this interview and contribute for the improvement of diabetes disease management.

Respondent's identification information

001. Zone.....Woreda/District.....Kebele.....

002 Case (non-adherent) (1)DM patient who failed to complete 80% of their medication days in a 6 months period.

003. Control (adherent) (0)..... A DM patient who completed 80% of their medication days in a 6 months period

Section 1: Socio-demographic information of the respondent

First, I would like to ask you some questions about yourself

Q. #	Questions	Codes
1	Gender/sex	1. Male 2. Female

2	How old are you?	Age in years-----
3	What is your marital status	Single-----1 Married-----2 Widowed-----3 Divorced-----4 Separated-----5
4	What is your religion?	Orthodox.....1 Muslim.....2 Protestant.....3 Catholic.....4 Other specify88
5	To which ethnic group do you belong?	Nuer.....1 Anyuak.....2 Majang.....3 Oromo.....4 Amhara.....5 Tigre6 Other, specify88
6	What is your occupation?	Employed.....1 Merchant2 Unemployed.....3 Farmer4 Housewife.....5 Other, specify88
7	What is your average monthly income in Birr?
8	What is your educational status?	Illiterate.....1 Read & write only2 Primary (G1-8 th).....3

		Secondary (9-12 th).....4
		Diploma and above.....5
9	What is your residence now?	Urban1
		Rural.....2

Section two: Questions concerning patients related factors that influence adherence to DM treatment

Q#	Questions (8 scales of Morisky Measurement of Medication Adherence- MMAS-8)	Codes
10	Do you sometimes forget to take your pills?	Yes1 No2
11	People sometimes miss taking their medications for reasons other than forgetting. Thinking over the past two weeks, were there any days when you did not take your medicine?	Yes1 No2
12	Have you ever cut back or stopped taking your medicine without telling your doctor because you felt worse when you took it?	Yes1 No2
13	When you travel or leave home, do you sometimes forget to bring along your medicine?	Yes1 No2
14	Did you take all your medicine yesterday?	Yes1 No2
15	When you feel like your symptoms are under control, do you sometimes stop taking your medicine?	Yes1 No2
16	Taking medicine every day is a real inconvenience for some people. Do you ever feel troubled about sticking to your treatment plan?	Yes1 No2
17	How often do you have difficulty remembering to take all your medicine?	Never/rarely...1 Once in a while..2

		Sometimes3
		Usually4
		All the time5
Q#	Questions (other patient-related factors)	
18	On average, what is the distance of your home from the Hospital?	Less than 5km....1 More than 5km (from woreda....2)
19	Do you currently smoke?	Yes1 No2
20	Do you sometimes chew chat?	Yes1 No2
21	Do you currently drink any type of alcohol?	Yes1 No2
Q#	Other factors related to DM treatment adherence	
22	Had you ever informed about the consequences of improper treatment follow up?	Yes1 No2 (If 'No' skip to 24)
23	From whom did you get information?	Health care provider1 Friends.....2 Others (specify) 3
24	Were you told how to take your medicines?	Yes1 No2
25	Were you told about the drug side effects?	Yes1 No2

26	How do you perceive your treatment?	Very difficult ...1 Difficult2 Somehow3 Easy4 Very easy5
27	Sometimes you may have encountered unusual feelings after taking medicines, do you immediately feel better (immediacy of Rx effect)?	Yes1 No2
28	How do you get the treatment costs?	Affordable1 Unaffordable ...2
29	Do you get any supportive information from the provider (follow up)?	Yes1 No2
30	For how long have you been on treatment?	6 months1 Up to 1 year.....2 Up to 5 years3 More than 5 years 4
31	How many types of medications do you take a day?	One1 Two2 More than two ...3
32	What is the frequency of your medication?	One times a day 1 Two times a day 2 Three times a day.....3 Four times a day.....4

I thank you for your participation

ANNEX II: QUESTIONNAIRE (Nuer version)

Dämaar/Nyimaar mi nhoakä

Cet ke taa in goor duel gorkä je, latä thieeni titi ke kuic mäthkä wal juath Thuok-käär kne tin la ran ε pen yoö dere wal math ke guaathde rey Duel Wal kä Gambel. Ca ji thiec luthkä cet ke guan juath mi guur wal juath Thuok-keër ke nhökdu kä ti ke luaj kä yoö dëri je wä ɲok cet ke yoö ε cuɔɔɲdu. Tin bi loc /ca ke bi jakä ba ɲac ε radadien ε ni jɲin kärɔa. Kä ken tin bi loc bä thiele ke mi dɔɲ mi ba lätkë eni kuic juath Tuok-käär kärɔa. Ke kuic emɔ, thiëcä ji luthkä ke luäku ke yoö bi tin thiec ke ji loc ke taa mäthkä walk ε kuic juath Thuok-käär.

Taa ɲäckä ram in looc thieeni titi

01. Zuun.....Wareda/dithtic..... Keβele
02. Këth (thielguurkä jiekä) (1)..... guaan juath thuok-käär mi /kän pek mi cop üë wii kä kuɔr kä pek math walkerey pathni daɲ bakel
03. Kɔntɔrɔl (ram ci walkεguɔr ke guaathde) (0)..... ε guan juath thuok-käär mi ci pek mi bääljien üë wii kä kuɔr thukkekäni

Pek in a: Läär mi ciëkkë pek ciënkä teekä raam in looc thieeni

Kenham, de jenhoken yoö bä thieeni titot thiëc këkuicciëɲä puaanydu

#	Thiec	Kɔdni
Wut/ciëk		1. Wut 2. Ciëk
2	Ti rundi?	Pek runi
3	Taa kuendu	/kan kuëen1 Cä kuëen2 Ciëk jökä3 Cakɔ dak4 Takɔ gööli5
4	Guaath paläduɲu?	Orthodok1 Muthlim2

		Puorthen3 Ketholik4 Mi te mi dɔŋ88
5	Doru ɛŋu?	Nuer 1 Anyuak2 Majaŋ3 Oromo4 Amara4 Tigire6 Mite mi dɔŋ, lare ..88
6	Latdu ɛŋu?	Lat kuume.....1 Tujaar2 Thiele lat.....3 Puurkakä.....4 Ciek ciɛŋ.....5 Mi dɔŋ, lare6
7	Ɛ pek yiowni mi nindj la jeki mɔkɛ pay?	-----
8	Pek gɔrã du nin edi?	/kan gɔar.....a Kuenken gɔr piny karɔa...2 1-8.....3 9-12.....3 Digloma.....5
9	Guaath ciɛŋädute ni?	Rɛk.....1 Wec ɣɔk.....2

Pek in rɔwde: Thieci ni tin lot guan juath tin de guuriwal pɛn wã ke guaathde ke juey thuɔk-käär
Q≠ Thieci ni daŋ badäk tin luockɛ tin pen ke ran käni wal ke guaathde (MMAS-8)

10. Tekε min deri kāniwal pal ruēc? ɣɔɔn1, ɣëëy2
11. Than guathni de ran wāl pāl ece math ε /ci moa ɣöö pālenijeruec. Reɣjuokni dan rew tin ci duoθjok, teke nin ti ci walku mer pak ε /keni kekäk? ɣɔɔn ...1, ɣëëy2
3. Ciwal mer kap cuɔɔn ε /keni lar daktørke ɣöö ce jidäk? ɣɔɔn,1, ɣëëy2
13. Miwijał la walku a pāli ruēc? ɣöön,.....1, ɣëëy2
14. Ciwlku dial kan pan? ɣɔɔn1, ɣëëy2
15. Mi ci puɔnydu te ke guaath, la math wal a kāpi cuɔɔn? ɣɔɔn1, ɣëëy2
16. Math walnicians la bece kā than nath. Cije met jek ebec? ɣɔɔn1, ɣëëy2
17. Pālijeruec kā di en ɣöö bi math walku tit? Thieleje...1, Kä keel...2, Than guathni...3, Guathnitijan....4, Ni cian5

Q≠ Thiecni tin kɔkienkekuic guan juath

18. De pek ciendunin di kamdekene duel wal? /ce kilo ni 5 cop....1, Bāle kilo ni i....2
19. Mathi ke tap entāme? ɣɔɔn1, ɣëëy2
20. La cat a nyueyi than guathni? ɣɔɔn1, ɣëëy2
21. Mathi kekɔanentāme? ɣɔɔn1, ɣëëy2

Q≠ Tin kɔkien tin pen keguurimāthkā wal mi goa

22. Ca ji mer lar riek thiel guurā māth kā wal? 1. ɣɔɔn1, ɣëëy2 (mi ε ɣëëy, wer kā thiec in 24)
23. Liji lääri nikā? kā kimni1, kā māthni kā.....2, mi don, lare.....3
24. Ca ji lar taa māthkā wal? ɣɔɔn1, ɣëëy.....2
25. Ca ji lar riek māthā wal? ɣɔɔn1, ɣëëy2
26. Caari guuri du ke kāni wal idi? 1. Bume lon...2, bume3, thiele nu4, thiake5, thiake lon6,
27. Than guathni dē puɔnydu teke taa mi thiel ni wen, la mal ε locε guāthde? ɣɔɔn...1, ɣëëy2
28. Yor yiowni piny tedi? Thiake1, Bume2
29. Te ke lääri ti la luake ji ε kōmni? ɣɔɔn1, ɣëëy2
30. Ci wal math ke pek mi nindi? Pāth 6, luaje ruɔɔn2, cope run 5....3, Bāale run 5....4

31. La käni wal dandi ke cäj? Keel1, Rew2, Bääł ken rew.....3

32. La wal ε loci ke math kä di ke cäj? Kä keel...1, Kä rew...2, Kä diock....3, Kä ŋuan..4

Cä ji lar tethloac ke kuic latdu neme

ANNEX III: APPROVAL LETTER

ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned accepted the responsibility for the scientific, ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the Faculty of Public Health in effect from the time grant was forwarded.

Name of the student: _____

Date. _____ Signature _____

APPROVAL OF THE FIRST ADVISOR

Name of the first advisor: _____

Date. _____ Signature _____

Name of the second advisor: _____

Date. _____ Signature _____