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PREVALENCE AND FACTORS ASSOCIATED WITH DIABETES
RETINOPATHY AMONG TYPE 2 DIABETES PATIENTS AT TIKUR
ANBESA SPECIALIZED HOSPITAL ADDIS ABABA, ETHIOPIA, 2018.

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LIST OF ABBREVIATION AND ACRONYMS

AAU	Addis Ababa university
AOR	Adjusted odds ratio
BDR	Baseline Diabetic Retinopathy
BMI	Body mass index
BUN	Blood urea nitrogen
CCR	Creatinine clearance rate
CKd	Chronic kidney disease
Cr	Creatinine
DD	Disc Diameter
DR	Diabetic Retinopathy
FBS	Fasting blood sugar
FPG	Fasting plasma glucose
HbA1c	Hemoglobin A1c or Glycated hemoglobin
IRMAS	Intra-retinal microvascular abnormalities
NPDR	Non Proliferative Diabetic Retinopathy
OR	Odds ratio
PDR	Proliferative Diabetic Retinopathy
SBP	Systolic blood pressure
TADDS	Tool for Assessment of Diabetes and Diabetic Retinopathy
TASH	Tikur Anbesa Specialized Hospital.
USA	United State of America

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ABSTRACT

Introduction: Diabetes retinopathy (DR) is a well-recognized complication of diabetes mellitus that occurs as a result of long-term accumulated damage to the small blood vessels in the retina. It is one of the leading causes of blindness in adults of working age in industrialized countries and the emerging cause of blindness in developing countries. Worldwide prevalence of DR was recently estimated to be 93 million or 34.6%. **Objective:** The aim of this study was to assess the prevalence of diabetic retinopathy and associated factor among type 2 diabetes patient who are on follow up services at Tikur Anbesa Specialized Hospital Diabetic Unit. **Methods and materials;** An institution-based cross-sectional study was conducted from March, 1 to April, 1 at Tikur Anbesa Specialized Hospital, Addis Ababa, Ethiopia. The sample size was determined using a single population proportion formula. Systematic random sampling method was used to select participants. Statistical analysis was performed using SPSS version 22. Descriptive statistics was done to identify the distribution of socio-demographic characteristics of the study participants. Then those variables having p value <0.05 was considered as having significant independent association. **Result:** - There were 191 Participants in this study out of them 98(51.3%) had diabetic retinopathy. Multivariate analysis shows, diabetic retinopathy were nearly 11 times higher for male patients (AOR= 11.248, CI= 1.816-69.689) when compared to female patient. Patients who visit health institution for their diabetic case every one month had about 2.7% (AOR= 0.027, CI=0.003-0.231) less chance to diabetic retinopathy than those patients who visit health institution for their diabetic case every six month. Non-hypertensive patients had about 3.2% less chance for diabetic retinopathy than hypertensive patient (AOR= 0.039, CI=0.008-0.191). Diabetic retinopathy increases with increasing duration of illness. Patient with glycemic control ≤ 7 also had less chance to diabetic retinopathy than patients with poor glycemic control. **Conclusion and recommendation:** - In this study we found that the prevalence of diabetic retinopathy is high. Multivariate logistic regression shows that factors that associated with diabetic retinopathy were being male sex, number of visit, duration of illness, HbA1c and hypertension.

Key words: Diabetic retinopathy; Type 2 diabetes; Prevalence; factors associated; diabetes complication;

1. INTRODUCTION

1.1. Background of the study

Diabetes Mellitus (DM) is a complex metabolic syndrome in which a relative or absolute insulin deficiency affects the metabolism of lipids, carbohydrates and proteins. It is the leading cause of end-stage renal disease (ESRD), traumatic lower extremity amputations, and adult blindness. It also predisposes to cardiovascular diseases. With an increasing incidence worldwide, DM is one of the leading cause of morbidity and mortality worldwide [1].

Globally there is a rising trend in the prevalence of DM due to many factors such as aging, urbanization and increasing prevalence of obesity and physical inactivity. WHO report indicates that the global prevalence of DM between 1980 and 2014 has increased from 4.7% to 8.5% [2]. DM is a complex disease with end organ complications. However, good control of DM will prevent the onset or retard progression of the various complications including diabetes retinopathy (DR) [3].

Diabetes retinopathy (DR) is a well-recognized complication of diabetes mellitus that occurs as a result of long-term accumulated damage to the small blood vessels in the retina. It is one of the leading causes of blindness in adults of working age (20 to 65 years) in industrialized countries and the emerging cause of blindness in developing countries [4]. It is a leading complication of DM with worldwide prevalence ranges from 6.8 to 44.4% in patients with diabetes mellitus. The relationship between diabetes and blindness due to diabetes retinopathy (DR) is well established. Global estimates for the prevalence of blindness are 0.55 %, of which blindness due to DR ranges from 1 to 4.8 % of this total .In Sub-Saharan Africa it is estimated that 21–25 % of people with type 2 diabetes have diabetes retinopathy (DR) at diagnosis [5].

Tissue hypoxia, accompanied by the loss of self-regulation of retinal vessels, is the triggering factor of DR. Fundoscopy changes follow a progressive course from mild DR, characterized by increased vascular permeability, to moderate to severe, characterized by vascular occlusion and subsequent proliferation and wound healing [6].

Diabetes retinopathy is classified into early stage, non proliferative diabetes retinopathy (NPDR), and more advanced stage, proliferative diabetes retinopathy (PDR), Retinopathy was evaluated according to the classification of ETDRS (early treatment of diabetic retinopathy study) [6, 7]. Blindness happens primarily as a result of advanced retinopathy [7, 8].

Earlier diagnosis of diabetes and DR can help to control some of these factors and prevent further complications and vision loss. Population-based educational programs on diabetes and diabetes retinopathy and continuous medical education on diabetes management can improve diabetes care and self-management and prevent eye complications [4].

In Ethiopia the prevalence of DM is 5.2% [9] while the prevalence of blindness due to DM at national level is 1.6 %. In addition 3.7% DM populations have low vision which is very high according to WHO standard [10, 11]. Among the predisposing factor for blindness DR plays great role. Prevalence of DR was studied at Jimma University hospital and Arbaminch General Hospital and prevalence was 41.4% and 13% respectively [12, 13]. The prevalence of DM in Addis Ababa is 6.5% [10] but prevalence of DR is not known. So the aim of this study was to assess the prevalence of DR with associated factor among type 2 diabetes patients attending diabetes follow up clinic of Tikur Anbesa Specialized hospital.

1.2. Statement of the problem

Diabetic retinopathy (DR) is one of the major causes of irreversible blindness in the world, and the main cause of blindness among people in productive age, being considered one of the most feared complications for diabetic patients. It is estimated that, among 80% of patients with type 2 diabetes and 97% type 1 diabetes patients report some degree of retinopathy [6, 8].

Prevalence of DR was recently estimated to be 93 million or 34.6% [14, 15]. In fact, there are great differences in the prevalence of DR among various countries. Specifically, the highest prevalence of DR is 49.6% in African-Americans, while the lowest is 19.9% in Asian groups [16].

In USA, DM is the leading cause of blindness for individuals aged from 20 to 64 years, causing 8000 new causes of blindness every year [3]. In China of DR is 8.1% prevalent [17]. In teaching hospitals of Babol, Iran. it is 64.1% prevalent [7].

Diabetes duration, blood glucose, blood pressure and, age are broadly accepted risk factors for DR [6, 17]. In addition some studies indicated that blood lipids, body mass index (BMI) and renal function, being under insulin treatment, and impaired glucose regulation also result in DR [4, 8]. Other documented risk factors include genetic factors, high waist-hip-ratio (abdominal obesity), upper socioeconomic status, urban residence, higher plasma total homocysteine level, male gender, insulin treatment, and pregnancy [4, 8].

Clinical trials have shown that good control of diabetes and hypertension significantly reduces the risk for diabetes retinopathy [7]. If DR has already developed, timely treatment of retinopathy can reduce the risk for visual loss by more than 90% [4].

In Ethiopia the prevalence of DR was estimated in some area of the country [12, 13] but its prevalence is not studied so far at Addis Ababa which is the capital city of the country. Addis Ababa contains more than six million people with increasing prevalence of DM related to lifestyle changes and dietary condition of the residents. In addition the center for diabetes follow up clinic is found in Addis within in Tikur Anbesa specialized hospital in which average of more than 90 patients visited in each visiting day. So the aim of this study is to assess the prevalence of DR and its associated factors among DM patients visiting Tikur Anbessa Hospital Diabetic Clinic.

1.3. Rational of the study

The main rational of this study is first, despite extensive study in the developed world on the burden of diabetic retinopathy among diabetic patient, little has been done in sub sharan Africa and Ethiopia on this issue. Second, on the other hand this is the main indicator of health care service quality and patient treatment outcome in large. Third, those diabetic patients may wish to know the impact of the disease on their current vision status. Over all globally it is reported that diabetic cause huge burden on retinopathy. As a result, TASH is largest diabetic care clinic in Ethiopia ,but there was no previous study which investigate the burden of diabetic on retinopathy in this institution ,hence, the main of this study is to assess the prevalence of diabetic retinopathy and associated factor among type 2 diabetic patient in TASH,Addis Ababa , Ethiopia ,2018.

1.4. Significance of the study

This study will determine the prevalence of diabetic retinopathy among type 2 diabetes patients attending diabetic clinic of Tikur Anbesa specialized hospital. In addition, it will help to identify associated factors which contribute for the development of diabetic retinopathy in the study area. Determination of prevalence of DR will help to understand extent of its impact so as to create appropriate investigation and treatment guidelines. Another significance of this study for nursing profession is, it will provide an evidenced based data for diabetic retinopathy care and also helps to improve diabetic retinopathy care. Furthermore, the finding may serve as a base line data for policy makers and researchers.

2. LITRATURE REVIEW

2.1. Introduction

Diabetic retinopathy is a condition that occurs in peoples who have diabetes when high blood sugar level causes damage to the retinal blood vessels and hamper blood flow to the retina. This causes the blood vessel to become swell and leak or they become obstructed. In addition to this there is growth of new abnormal blood vessels. All of this change steal individual's vision [3, 18].

2.2. Prevalence of diabetic retinopathy.

A cross-sectional study conducted in the United State of America among adults with DM aged 40 years and above shows the prevalence of DR was 28.5% with 4.4% vision threatening retinopathy [19]. According to a study conducted in England, 3632(18%) had non proliferative retinopathy and 610(2.9%) had proliferative DR [20]. Another retrospective, cross-sectional, population based study performed in Catalonia, Spain showed that among 108723 patients with type 2 DM the prevalence of any kind of DR was 12.3% [21].

A study conducted in teaching hospitals of Babol, Iran revealed that, diabetic retinopathy was found in 990 (64.1%) patients, and the frequency of non-proliferative diabetic retinopathy was 37.3% and proliferative DR was 26.8% [7]. Similarly a study conducted in Gutenberg Health Study (GHS), Germany the weighted prevalence of diabetic retinopathy in screening-detected type 2 diabetes was 13.0% [22].

An analytic cross-sectional study conducted in Gegharkunik provinces, Armenia shows that the prevalence of DR in the sample was 36.2%. A total of 90.2% of patients with DR had non-proliferative, while 9.8% had proliferative DR [4]. Also a cross-sectional analysis by the community based National Diabetic Retinopathy Screening Service for Wales, the prevalence of any DR and sight-threatening DR in those with type 2 DM was 30.3% and 2.9%, respectively [23]. Findings from a Cross-sectional study Design conducted in Beijing, China, shows that prevalence of DR was 8.1% among individuals with diabetes [17].

According to a study conducted in Rural Central India, DR prevalence was 9.6% [15]. Similarly a study conducted in Pakistan in type 2 Diabetes Mellitus patents, the prevalence of DR was 41.4% [24]. A population-based cross-sectional study conducted in Indonesian adults with type 2 diabetes, among 1184 study participants the prevalence of DR was 43.1% [25].

A study conducted in Tanzania at Kilimanjaro diabetic program , the prevalence of diabetic retinopathy was 2.9% [26]. A hospital based cross-sectional study in Kenya shows the prevalence of DR was 41%. NPDR was the most prevalent 20% and vision threatening DR(PDR) and macular edema was found in 21(8.3%) of patients [27]. Similarly a cross-sectional study conducted in Zambia, 52% of DM patients showed evidence of diabetic retinopathy (DR) [28] and a cross-sectional study conducted in Tunisia, North Africa showed that DR was recorded in 26.3% of diabetic patients [29].

Prevalence of diabetic retinopathy in Jimma University Hospital among 324 diabetic patients, was 41.4%. Of these, 2.2% of the cases had severe non-Proliferative diabetic retinopathy while about 6% of patients had clinically significant macular edema. Vision threatening diabetic retinopathy was found in 7.3% of patients[12]. Similarly, in a study conducted at Arbaminch General Hospital the prevalence of diabetic retinopathy was 13% [13].

2.3. Factors associated with diabetic retinopathy development

According to a study conducted in teaching hospitals of Babol, Iran age, duration of diabetes, FBS, HbA1C, BUN, Cr, Hemoglobin were significantly associated with diabetic retinopathy ($p < 0.05$). No relationships were found for smoking, gender, hypertension and serum lipid profile [7].

According to a study conducted in Gegharkunik provinces, Armenia, being under insulin treatment (OR = 3.24; 95% CI: 1.56–6.75), diabetes duration (OR = 1.23; 95% CI: 1.16–1.31) and age (OR = 1.05; 95% CI: 1.02–1.08) were independently associated with DR [4].

Cross-sectional study design conducted in Beijing, China disease duration ($p < 0.001$), BMI ($p = 0.046$), SBP ($p = 0.012$), creatinine clearance rate (CCR) ($p = 0.014$), UA ($p = 0.018$), and FPG ($p < 0.001$) were independently associated with DR [17].

According to study conducted in Rural Central India, DR was associated with higher age ($P = 0.03$), higher blood glucose concentration ($P < 0.001$), higher HbA_{1c} concentration ($P < 0.001$), and higher blood monocyte count ($P = 0.02$). But, DR was not significantly associated (all $P > 0.05$) with the systemic parameters of blood pressure, BMI, level of education; blood concentrations of cholesterol, hemoglobin, high-density lipoproteins and urea; count of eosinophils, lymphocytes, and neutrophils; and erythrocyte sedimentation rate [15].

Study conducted in Tanzania duration of diabetes, systolic blood pressure, random blood sugar and attending governmental diabetic clinic have independent association with any diabetic retinopathy [26]. A hospital based cross-sectional study in Kenya shows Duration of diabetes and systolic blood pressure had a significant association with DR ($p < 0.05$) [27].

A study done at Arbaminch general hospital, Ethiopia, diabetic retinopathy were statistically significantly associated with baseline age (AOR = 6.06: 95%CI; 2.42, 15.21), baseline systolic blood pressure level (AOR = 4.38: 95% CI; 1.64, 11.68), family history of diabetes (AOR = 0.22: 95% CI; 0.08, 0.58) and duration of diabetes (AOR = 8.84: 95% CI; 3.56, 12.89) [13]. Similarly, a study conducted in Jimma University Hospital revealed that there was a statistically significant association between diabetic retinopathy and duration of diabetes, fasting blood sugar, and systemic blood pressure ($p < 0.05$) [12].

2.4. Conceptual Frame Work

This conceptual frame work is developed from Screening of Diabetic Retinopathy, Clinical Practice Guideline, tool for Assessment of Diabetes and Diabetic Retinopathy (TADDS) and different literatures [3, 12, 13, 26, 27]. The diagram shows the relationship between DR with socio-demographic factors, clinical factors, treatment modalities and diabetic care.

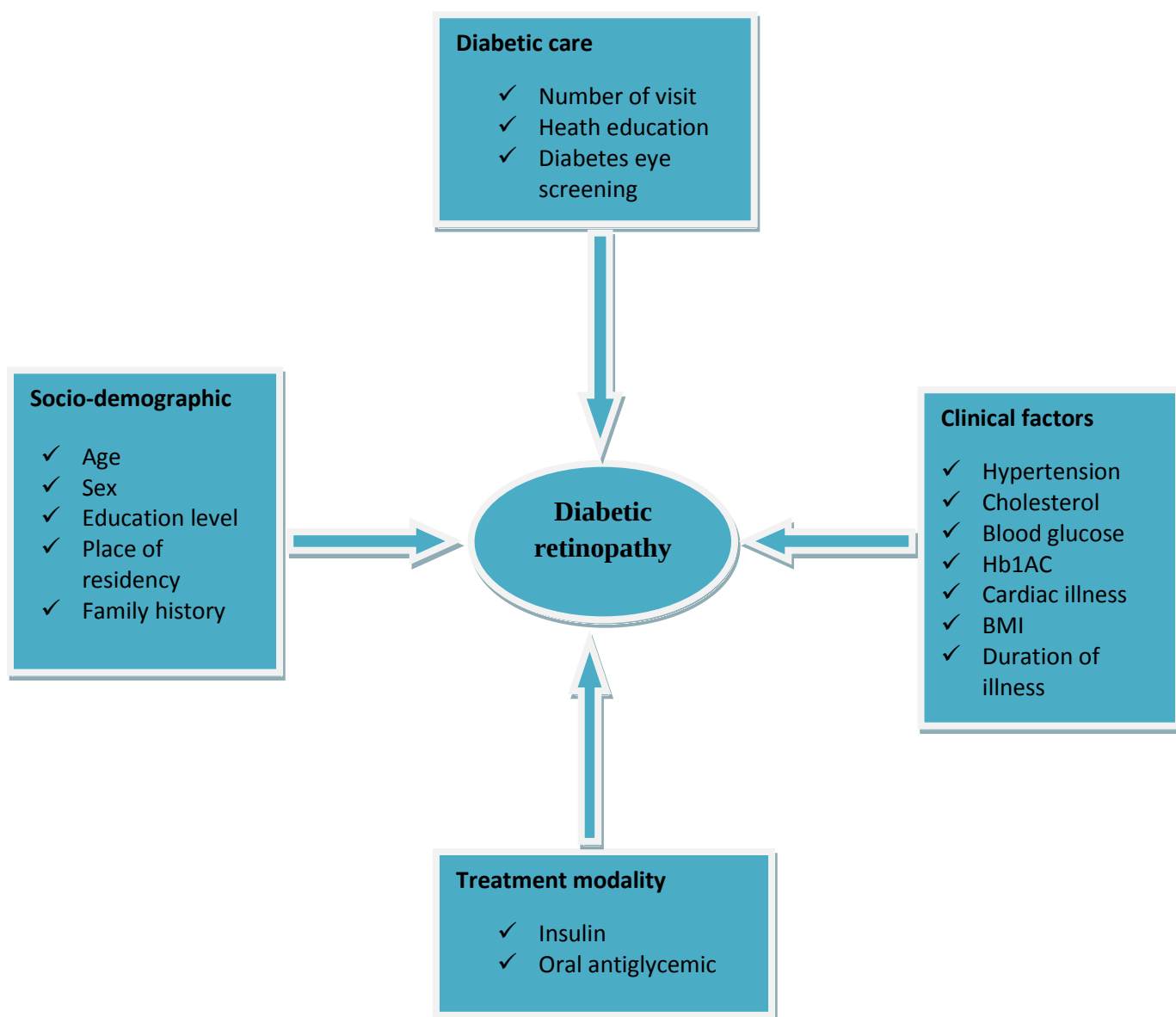


Figure 1:- conceptual frame work for the study on prevalence and factors associated with diabetes retinopathy among type 2 diabetes patients, Addis Ababa, Ethiopia, 2018.

3. OBJECTIVES

3.1. General objective

- To assess the prevalence of diabetic retinopathy and associated factor among type 2 DM patients attending diabetic unit of TASH.

3.2. Specific objectives

- To determine the prevalence of diabetic retinopathy among patients with type 2 DM attending diabetic unit of TASH.
- To identify factors associated with diabetic retinopathy.

4. METHODS AND MATERIALS

4.1 study area and period

The study was conducted from March - Apr 2018 in Tikur Anbesa specialized hospital, Addis Ababa, Ethiopia. Addis Ababa is the largest city in Ethiopia, with a population of around 3.4 million according to the 2013 Population Projection of Ethiopia[30]. Its area is estimated to be 530 Km² with altitudes ranging from 2200 to 3000 meter above sea level, average temperature of 22.8°C and average rainfall of 1,180.4 mm. Tikur Anbesa specialized hospital has established in the year 1963 and situated at the heart of the capital city on Churchill Avenue. It is the largest teaching hospital in Ethiopia and provides a tertiary level referral treatment with 24 hours emergency services and it has different specialty clinics which give follow up service. Among this, diabetic follow up clinics were selected as study unit for this study. The unit has the largest referral clinic of DM in the country regularly more than 200 individuals visited per week for service provision.

4.2. Study design

Institutional based cross-sectional study was conducted.

4.3. Population

4.3.1. Sources Population

The sources population of the study were all DM patients who was attending TASH diabetic unit

4.3.2. Study Population

The study population were all patients with type 2 DM attending diabetic unit of TASH in the specific study period from March to April.

4.3.3. Study Subjects

All type 2 DM patients who fulfill the inclusion criteria

4.4. Eligibility Criteria

4.4.1. Inclusion Criteria

Type 2 DM patients who were attend the study area in the specified study period

4.4.2. Exclusion Criteria

- ✓ Critically ill

4.5. Sample Size Calculation and Sampling Procedure

Sample size (N) was calculated using single proportion formula. Considering the following assumption: standard normal distribution with confidence interval (CI) of 95%(Z=1.95), tolerable margin of error (d=0.05), and anticipated proportion of diabetic retinopathy 13% (p) taken from a study conducted in Arbaminch [13].

$$N = \frac{Z^2 \cdot p(1-p)}{d^2} = \frac{(1.96)^2 \cdot 0.13(1-0.13)}{(0.05)^2} = 174$$

By adding non-response rate of 10%, the final sample size was **192**

4.6. Sampling Procedure

To select study subject systematic random sampling was used from those who full fill the inclusion criteria. The patients follow-up register in the Diabetic Clinic was used as a sampling frame.

4.7. Variables

4.7.1 Dependent Variable

- ✚ diabetic retinopathy

4.7.2. Independent Variable

Sociodemographic

- ✚ Age of the patient
- ✚ Sex (male, female)
- ✚ Education level (no education, primary, secondary, diploma and above)
- ✚ Place of Residency (urban, rural)
- ✚ Income of the patient
- ✚ Occupation (governmental, non-governmental, no job)

Clinical factors

- ✚ Hypertension (no, yes)
- ✚ Cholesterol
- ✚ Blood glucose
- ✚ HbA1C (<=7, >7)
- ✚ Chronic kidney disease

- + BMI (18.5-24.9, 25-30, >30)
- + Duration of illness
- + Treatment modality (insulin, Oral antiglycemic)

Diabetic care

- + Number of visit (every one month, every three months, every six month)
- + Attending health education (no, yes)

4.8. Operational Definition

Diabetic retinopathy: - on retinal camera examination the presence of microaneurysms, haemorrhages, exudation, cotton wool spot, and/or new vessels [31].

Background diabetic retinopathy: - on retinal camera examination the presence of microaneurysms, haemorrhages, exudation, and/or cotton wool spot [31].

Maculopathy:- on retinal camera examination the presence of exudates within 1 disc diameter(DD) of the fovea, circinate/tracking within 2DD of the fovea [32].

Pre-proliferative DR: - on retinal camera examination the presence of 5 or more cotton wool spots, large blot haemorrhages, intra-retinal microvascular abnormalities (IRMAs), and/or venous abnormalities [32].

Proliferative DR: - on retinal camera examination the presence of new vessel elsewhere, new vessel on disc and/or pre-retinal/vitreous hemorrhage [32].

4.9. Data Collection Tools

Data was collected using semi- structured questionnaire and direct Topcon retinal camera examination. The questioner was adapted from different literature with modification. The investigator has developed the questionnaire for face to face interviews with diabetic patients. The questionnaire has four-part, part 1 socio-demographic variable, part 2 diabetic care, part 3 treatment modality and part 4 clinical factor.

4.10. Data Collection Procedure

Data was collected by 2 nurses who are trained about DR screening and who are working in the study area during the study period. Those patients who attend diabetic clinic and fulfill the inclusion criteria have undergo Topcon retinal camera examination following pupil dilation. The laboratory investigation like, fasting blood glucose, glyciated hemoglobin, cholesterol, value were collected from the patient's document.

4.11 Data Quality Control

To ensure quality of the data, the questioner was examined by senior experts to the area of study for content validity and pretest was done on 5% of total population at Zwditu Hospital. Any error found during expert evaluation and pretest was corrected and modification was made into the final version of the data collection format. To maintain consistency of the tool the questioner was first translated from English to Amharic then back to English. Training will be give to data collectors and supervisors for two days before actual data collection task and training guide was prepared to facilitate the training. Data quality was controlled by designing the proper data collection materials, through continues supervision. All completed data collection forms were examined for completeness and consistency during data management, storage, cleaning and analysis. The data was entered and cleaned by principal investigator before analysis. Two nurses, who received retinal screening training and working on diabetic unit, collected the data. The principal investigator of the study controlled the overall activity.

4.12. Data Processing and Analysis

The collected data was cleaned and checked for any missing and inconsistency, and then it was entered into SPSS version 22. Descriptive statistics was performed to identify the distribution of socio-demographic characteristics of the study participants. In addition, Bivariet logistic regression was used to assess the association between dependent and independent variables. To control confounding effect those variables having p value <0.25 in Bivariet logistic regression was entered to multivariate logistic regression. Then those variables having p value <0.05 were considered as having significant independent association.

4.13. Ethical Consideration

Ethical clearance and approval was obtained from the Institutional Review Board (IRB) of the College of Health Sciences of Addis Ababa University. Official letter was obtained from Department of Nursing and Midwifery, TASH. After explaining the purpose and possible benefit of the study, oral and written informed consent was obtained from each patient before starting the procedure. The confidentiality was maintained in each level of the response in this study. The study was explained fully (i.e. the aim of the study; significance of the study) to each patient before joining the study and if the patient agrees to participate then informed consent was given to sign. For the purpose of confidentiality, the names of the participants

was not be recorded instead code number was used. The study participants were informed about their rights to refuse to join, ask any question or withdraw at any particular point during data collection process without being frustrated.

4.14. Dissemination Of the Result

The findings of the study will be submitted and presented to Addis Ababa University Department of Nursing and Midwifery. The result also will be disseminated to TASH diabetic clinic. The findings will be published on peer reviewed journal. Hard and soft copies will be available in the library of AAU

5. Result

5.1 Socio demographic characteristics of the patient

From a total of 192 participants recruited, 191 participated in the study while 1 unwilling to participate in the study, yielding the response rate of 99.4%. Among 191 patents about 25(13.1%) were in age group 36-45 years and 61(31.9%) were in age group 46-55 and the remaining patients 105(55%) were greater or equals to 56 years old. More than one third,77(40.3%) of patients in this study were male and the remaining 114(59.7%) were females. The number of patients with no education or illiterate patents in this study were 23(12.0%) and 51(26.7%) patients were patients who were at primary school level and 56(29.3%) patient were patients at secondary school level and the remaining patients 61(31.9%) were patients who diploma and above. 36(18.8%) of the patients were governmental worker, 40(20.9%) were non-governmental worker and 115(60.2%) of the patients were patients without a job. Majority,171(89.5%) of patients were lives in urban area and the other 20(10.5%) were lives in rural area. Table 1 below reveal all details about socio-demographic characteristics of diabetic retinopathy patients.

Table 1: Socio-demographic characteristics of type 2 DM patient at Tikur Anbesa specialized Hospital, Addis Ababa, Ethiopia, 2018.

Variables	Frequency	Percentage
Age (mean=57.2(SD $\pm$ 10.10))		
36-45	25	13.1
46-55	61	31.9
≥ 56	105	55.0
Sex		
Male	77	40.3
Female	114	59.7
Educational Level		
No education	23	12.0
Primary	51	26.7
Secondary	56	29.3
Diploma and above	61	31.9
Occupation		
Governmental	36	18.8
Non-governmental	40	20.9
No job	115	60.2
Residence		
Urban	171	89.5
Rural	20	10.5

5.2 Clinical factors, treatment modality and diabetic care of the patient

In this study the number of hypertensive patients were 106(55.5%) and 85(44.5%) were patient who were non hypertensive. Among 191 participants 36(18.8%) patients were patients with chronic kidney disease and the remaining 155(81.2%) were patients without chronic kidney disease. More than half, 55(57.9%) of the patients whose glycemic level were less than 7 and the other 40(42.1%) were patient whose glycemic level were greater than 7. About one third, 60(32.3%) of the patient had a body mass index (BMI) of 18.5-24.9 kg/m² and 80(43.0%) had BMI of 25-30 kg/m² and the remaining 46(24.7%) had BMI >30 kg/m². Among those 191 patients in the study 9(4.7%) of them used insulin and 137(71.9%) of them used oral antiglycemic and the remaining used both insulin and oral antiglycemic. About one quarter 43(22.6%) of the patient visit health institution for their diabetic case every one month and 72(37.9%) of the patient visit health institution for their diabetic case three month and 75(39.5%) of the patient visit health institution for their diabetic case every six month. Nearly half, 92(48.2%) of the patient did not attend the education about diabetic which is given in the hospital and 99(51.8%) of them attend the education about diabetic which is given in the

hospital. (Table 2 below reveal all details about Clinical factors, treatment modality and diabetic care of diabetic retinopathy patients.)

Table 2: Clinical, treatment modality and diabetic care factors of type 2 DM patient at Tikur Anbesa specialized Hospital, Addis Ababa, Ethiopia, 2018.

Variables	Frequency	Percentage
Hypertension		
No	85	44.5
Yes	106	55.5
CKD		
No	155	81.2
Yes	36	18.8
HbA1C		
≤ 7	55	57.9
> 7	40	42.1
BMI		
18.5-24.9	60	32.3
25-30	80	43.0
> 30	46	24.7
Treatment Modality		
Insulin	9	4.7
Oral	137	71.9
Both	45	23.6
Number of visit		
Every one month	43	22.6
Every three month	72	37.9
Every six month	75	39.5
Attending health		
No	92	48.2
Yes	99	51.8

CKD -chronic kidney disease, BMI-body mass index, HbA1C-hemoglobin a1c

5.3 prevalence of diabetic retinopathy

There were 191 Participants in this study out of them 98(51.3%) with 95% (44-59.2%) had diabetic retinopathy and the remaining 93(48.7%) did not had diabetic retinopathy. Therefore, as shown in figure1 below the prevalence of retinopathy among type 2 diabetic patient was 51.3%.

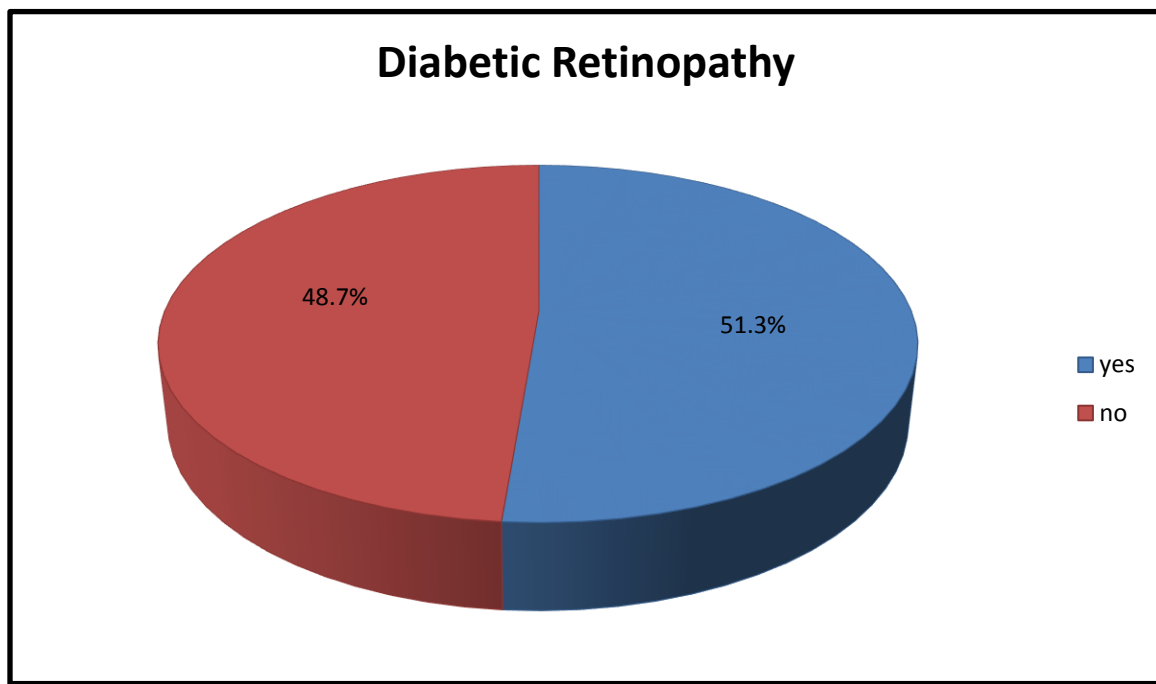


Figure 2: Prevalence of retinopathy among type 2diabetic patient at Tikur-Anbessa specialized Hospital, Addis Ababa, Ethiopia, 2018.

5.4. Single Covariate Analysis

The relationship between each single covariate and diabetic retinopathy patients are presented in Table 5.4 As can be seen from this table, diabetic retinopathy is significantly related with sex, hypertension, HbA1c, number of visit and duration of illness. The covariates age, residence, occupation, educational level, income, Ckd, BMI, treatment modality, blood glucose, cholesterol level and attending health education are not statistically significant at 5% significance level. To control confounding effect those variable having p value <0.25 in Bivariet logistic regression were entered to multivariate logistic regression. These variables are age, sex, resident, Occupation, hypertension, HbA1c, BMI, duration of illness and number of visit.

Table 3: Single covariate analysis for socio-demographic, health and diabetic care variables that have a significant effect for DR at Tikur Anbesa specialized Hospital, Addis Ababa, Ethiopia, 2018.

Variables	COR	95% CI	P-value
Age	1.456	0.970-2.186	0.070
Sex	0.517	0.287-0.931	0.028*
Educational Level	0.950	0.718-1.256	0.719
Occupation	1.245	0.687-1.790	0.236
Residence	2.417	0.887-6.584	0.084
Income	1	1.000-1.000	0.447
Hypertension	7.255	3.812-13.807	0.000*
HbA1C	3.935	1.658-9.338	0.002*
BMI	1.427	0.967-2.107	0.073
CKd	1.234	0.595-2.558	0.572
Blood glucose	1.000	0.996-1.005	0.847
Cholesterol level	1.001	0.996-1.007	0.698
Duration of illness	1.078	1.035-1.123	0.000*
Treatment Modality	1.351	0.760-2.405	0.306
Number of Visit	1.759	1.198-2.583	0.004*
Attending health education	0.727	0.411-1.285	0.272

(*) Statistically significant at $\alpha=0.05$

5.5 Multivariate logistic regression analysis

We use an α -value of 0.25 to select candidate variables for the multi-covariate analysis from the single covariate findings. The odds ratio in the final model is interpreted as follows. The following interpretations are based on Table 5.5 below. After adjusting for other covariates,

the odds ratio for the variable sex shows diabetic retinopathy were nearly 11 times higher for male patients (AOR= 11.248, CI= 1.816-69.689) when compared to female patient. Patients who visit health institution for their diabetic case every one month had about 2.7% (AOR= 0.025, CI=0.003-0.253) less chance to diabetic retinopathy than those patient who visit health institution for their diabetic case every six month. The odds ratio for the variable duration of illness shows that diabetic retinopathy increase with increasing the duration of illness (AOR= 1.126, CI= 1.126(1.022-1.242). It was also observed that patients with glycemic control less than 7 had about 9.9% less chance (AOR= 0.099, CI=0.020-0.485) to DR than those patients with uncontrolled glycemic. Non hypertensive patients had about 3.2% less chance for diabetic retinopathy than hypertensive patient (AOR= 0.032, CI=0.006-0.167). The other covariates age, residence, occupation and BMI are does not have a significant effect on Diabetic retinopathy. (Table 4 below reveals all details about multivariate logistic regression.)

Table 4: Multiple Covariate Analysis for socio-demographic, health and diabetic care variables that have a significant effect for DR at Tikur Anbesa specialized Hospital, Addis Ababa, Ethiopia, 2018.

Variables	<u>DR</u>		OR (95% CI)	
	No	Yes	COR	AOR
Sex				
Male	30(32.3)	47(48.0)	1.935(1.075,3.485) *	11.248(1.816,69.689) **
Female (reference)	63(67.7)	51(52.0)	1	1
Age				
36-45	13(14.0)	12(12.2)	0.640(0.267,1.537)	3.913(0.365,41.943)
46-55	37(39.8)	24(24.5)	0.450(0.236,0.857)	1.410(0.225,8.859)
>56(reference)	43(46.2)	62(63.3)	1	1
Resident				
Urban	87(93.5)	84(85.7)	0.414(0.152,1.127)	0.582(0.061,5.575)
Rural(reference)	6(6.5)	14(14.3)	1	1
Occupation				
Governmental	19(20.4)	17(17.3)	0.713(0.337,1.510)	1.112(0.136,9.083)
Non-governmental	23(24.7)	17(17.3)	0.589(0.285,1.218)	1.509(0.242,9.400)
No Job(reference)	51(54.8)	64(65.3)	1	1
Number of visit				
Every one month	29(31.5)	14(14.3)	0.304(0.138,0.670) *	0.027(0.003,0.253) *
Every three months	34(37.0)	38(38.8)	0.705(0.366,1.358)	0.643(0.125,3.319)
Every six(reference)	29(31.5)	46(46.9)	1	1
Duration of illness			1.078(1.035,1.123) *	1.126(1.022,1.242) *
HbA1C				
≤7	36(73.5)	19(41.3)	0.254(0.107,0.603) *	0.099(0.020,0.485) **
>7(reference)	13(26.5)	27(58.7)	1	1
Body mass Index				
18.5-24.9	33(36.7)	27(28.1)	0.480(0.219,1.052)	1.102(0.098,12.419)
25-30	40(44.4)	40(41.7)	0.586(0.279,1.231)	0.850(0.105,6.870)
>30(reference)	17(18.9)	29(30.2)	1	1
Hypertension				
>5 person	32	118	2.441(1.066-5.588)	2.556(1.014-6.447) *
≤5 person	8	72	1	1

(*) Statistically significant at p- ≤0.02, (**) statistically significant at p- >0.02 OR= Odds Ratio

6. Discussion

This study identified variables/factors that are significantly associated with increased risk of diabetic retinopathy. Identifying patients at a higher risk of diabetic retinopathy has the advantage that due attention will be given to the risk group during their follow up to minimize the risk of being diabetic retinopathy while they are taking the treatment.

In this study the prevalence of diabetic retinopathy among type 2 diabetic patients was 51.3% 95% (44-59.2%). This finding is higher than a study done in Arbaminch which is 13% [13], Jimma university Hospital 41.4% [12], Kenya 41% [27], Armenia 36.2% [4], and China 8.1% [17]. However this finding is even lower than a study done in Babol teaching hospitals, Iran 64.1% [7]. This gap might be difference in methodology, sample size, time variation in the study period and different health seeking behavior among the study participant.

The binary logistic regression model fitted using complete case analysis identified five variables that jointly serve as predictive factors for being diabetic retinopathy. These variables are sex, number of visit, glycemic control, duration of illness and Hypertension. The risk of being diabetic retinopathy for male was 11 times than that of females. This result agrees with the result obtained from previous study which is the presence and severity of diabetic retinopathy at the time of diagnosis in type 2 diabetes appears to be more associated with male sex [28]. Men had a higher prevalence of retinopathy compared with women [27]. There was no discernible sex difference in the prevalence of any DR [30].

Unlike the study done in Tunisia, North Africa and Embu Provincial General Hospital, Central Kenya [27, 29], this study found a positive association between DR and number of visit. Study subjects who visit health institution for their diabetic case every one month had about 2.7% (AOR= 0.025, CI=0.003-0.253) less chance to diabetic retinopathy than those patients who visit health institution for their diabetic case every six month. This may be due to, most diabetic patients in this study were appointed every 6 months and more. This contributes to poor glycemic control. Moreover, visits to the clinic were limited to prescription of medications.

In our study duration of illness is one of the factor for diabetic retinopathy which is as diabetic retinopathy increase with increasing of duration of illness. This finding is line with the result taken from previous study. Diabetes duration was significantly associated with development of DR. It was observed a positive relationship between duration of DM and DR, with higher

chances in 11–15 years of disease and >15 years [26]. All DR prevalence end points increased with diabetes duration [29]. longer diabetes duration were independent risk factors for DR [30]. Our study also shows that patient who always visit their doctor were less risky for diabetic retinopathy.

This study shows that patient with glycemic control ($HbA_{1c} \leq 7$) had 9.9% less risky for diabetic retinopathy when compared to patients with HbA_{1c} greater than 7. This finding is in line with a study done in Tanzania which shows that individuals with poor glycemic control had a chance of nearly 4 times risk for DR [26]. The prevalence of any DR increased with HbA_{1c} (18.0 vs. 51.2%, comparing levels ≤ 7.0 with $>9.0\%$) [29].

This study also shows as hypertension is also one of the factors for diabetic retinopathy. This result is similar with the done in Khartoum, Sudan and Arbaminch, Ethiopia [13, 33]. Diabetic retinopathy prevalence is related with blood pressure levels [29]. A multiple logistic regression of the all-factor analysis (with diagnosis age, waistline, and hipline excluded) was also conducted, and the results showed that higher SBP were the independent risk factors for DR ($p < 0.05$) [30].

7. Conclusion and Recommendation

7.1 Conclusion

This study found that the prevalence of diabetic retinopathy is high (51.3%). The multivariate logistic regression shows that factors that associated with diabetic retinopathy were sex, number of visit, duration of illness, HbA1c and hypertension. Males had high chance to diabetic retinopathy than females. Patients who visit health facility for their diabetic purpose every one month had less chance to diabetic retinopathy than those patients who visit health facility for their diabetic purpose every six month. When duration of illness increases the probability to develop diabetic retinopathy also increases. Patients with ≤ 7 HbA1c had less chance to diabetic retinopathy than patients with $\text{HbA1c} > 7$. Non-hypertensive patient had less chance to diabetic retinopathy than hypertensive patients.

7.2 Recommendation

Based on the finding of the study the following recommendations are given:-

1. For federal ministry of health

- To provide an access for awareness creation on prevention and early diagnosis of type two DM and retinal screening to the community.

2. For Addis Ababa health bureau

- Retinal screening and management service is important to provide in other governmental health facilities and private hospitals.

3. For Tikur Anbesa specialized Hospital

- Health workers are better to give attention for type IIDM patient's follow up schedule and duration of illness since this are the contributing risk factors for DR.
- Health workers are better to be cautious when a patient had longer duration of illness, hypertensive, and poor glycemic control. When this is the case appropriate clinical measures like medicine and other support should be provided.
- Since males had more chance to diabetic retinopathy it's important to give special attention.
- It is better to advise patient to visit health facility every one month to minimize the risk of being diabetic retinopathy.

- Though Tikur Anbesa Hospital had better facility for diabetic retinopathy screening, it would be important to facilitate specialty in diabetic nurse for nurse professions in order to support the current service.

4. For other researchers

- To conduct further research with large sample size and strong study design including qualitative approach. In addition, they have to figure out why males are highly at risk for DR.

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APPENDIX

ANNEX I. Participant's information sheet

Greeting: Good morning/afternoon

My name is _____ I am working on behalf of research conducted by Tsion Shiberu student of Addis Ababa University, School of Allied health science. I would like to ask few questions which take around 7 minutes. Your genuine responses that you are going to give are very important to identify problems related to DR and design programs. You are selected purposefully to be participant of this study if you give me consent after you have understood the following information sheet:

Title of the study: Prevalence and Factors Associated with Diabetes Retinopathy among Type 2 Diabetes Patients at Tikur Anbesa Specialized Hospital Addis Ababa, Ethiopia 2018

Back ground of the study: Diabetes retinopathy (DR) is a well-recognized complication of diabetes mellitus that occurs as a result of long-term accumulated damage to the small blood vessels in the retina. It is one of the leading causes of blindness in adults of working age.

Objective of the study: To assess the prevalence of DR and factors associated Type 2 DM patients at Tikur Anbesa Specialized Hospital Addis Ababa, Ethiopia 2018.

Benefit of the study: you will not gain any direct benefit, yet if you have DR during examination, opportunities for management will be arranged and you will be followed. If you don't have DR you will be recommended for annual screening.

Risk of the study: The study has no any risk for the participants and interview will be private to make safe participants from any fear.

Rights of participants: Participating and not participation in the study is the full rights of participants and you can ask any question which is not clear for you. You do not have to answer any questions that you do not want to answer and you may end this interview at any time you want to.

Confidentiality: Any information forwarded will be kept private and her/his name will not be specified.

ANNEX II. Informed consent

I have read this form or it has been read to me in the language I comprehend and understand all conditions stated above. Are you willing to participate in this study?

1.No (Say Thank you)

2. Yes →participant's signature

Continue your interview

I certify that the nature and purpose, the potential benefits and possible risks associated with participating in this study have been explained to the volunteer.

Signature of interviewer

Date

Result of interview: 1. Completed 2. Respondent not available

3. Refused. 4. Partially completed

Checked by supervisor, name _____Signature _____Date

ANNEX III: DATA COLLECTION FORM OF ENGLISH VERSION

Part 1:- Socio-demographic Information

S. N.	Question	Response category	Code
1	Age	_____	
2	Sex	1. Male 2. Female	
3	Place of residency	1. Urban 2. Rural	
4	Marital status	1. Single 2. Married 3. Divorced 4. Widowed 5. Other _____	
5	Religion	1. Orthodox 2. Muslim 3. protestant 4. catholic 5. other _____	
6	Occupation	1. Government employee 2. Nongovernmental employee 3. Self employed 4. Farmer 5. Student 6. Other (specify) _____	
7	Educational level	1. Unable to read and write 2. read and write 3. Primary 4. Secondary 5. Diploma 6. Degree and Above	
8	Income	Enter _____ birr per month	

Part 2:- Clinical data

s.no	Questions	Response	Remark
1	How long have you been since you have diagnosed with DM	_____	
2	History of hypertension	1. Yes 2. No	
3	If you have hypertension which Anti hypertensive medications are you taking?	1. ACE inhibitor 2. calcium channel blocker 3. diuretics 4. combination 5. not taking	
4	History of chronic kidney disease	1. Yes 2. No	
5	Fasting blood glucose level	_____	
6	Result of HA1c	_____	
7	Result of lipid profile	1. Total cholesterol 2. HDL 3. LDL 4. TG	
8	History of heart disease	1. Yes 2. No	
9	BMI	_____	

Part III. Treatment related factors

S.no	Question	response	Remark
1	Does the client currently taking insulin	1.yes 2.no	
2	If the patient is on insulin, when does the patient start insulin	_____	
3	Does the client currently taking oral antiglycemic	1.yes 2.no	
4	If yes on question number 2 please state the medication	_____	

Part IV. Diabetic care related

S.no	Questions	Response
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1	How often do you visit health care institution for your diabetes follow ups?	1. 1 to 3 months 2. Every 3 months 3. Every 6 months 4. Once a year
2	Did you have an eye screening for retinopathy in the last one year?	1. Yes 2. No
3	Have you ever attended a Diabetes education session?	1. Yes 2. No

THANK YOU FOR YOUR TIME!!!!!!

I have finished my interview

Part 5. Record of retinopathy data

S.no	Variable	Response	
001	Does the patient have Diabetic retinopathy on the right eye	1.yes 2.no	
	If yes which type	1. Background diabetic retinopathy 2. Maculopathy 3. Pre-proliferative 4. Proliferative	
002	Does the patient have Diabetic retinopathy on the left eye	1.yes 2.no	
	If yes which type	1. Background diabetic retinopathy 2. Maculopathy 3. Pre-proliferative 4. Proliferative	

ANNEX IV: Amharic version of information sheet

የአማርኛ መረጃ መስብሰቢያ መሳሪያ

በጥቁር አንበሳ ስፔሻላይዝድ ሆስፒታል የስኳር ህክምና ክሊኒክ በተመላላሽ ህክምና የሁለተኛው አይነት የስኳር ህመምተኞችን በስኳር ህመም የሚመጣው የአይን ችግርና ተያያዥ ጉዳዮችን ለማጥናት የተዘጋጀ መጠይቅ

ሀ. የተሳታፊዎች የጥናቱ መረጃ መግለጫ

ሰላምታ፡ እንደምን ዋልሽ/ክ ወይም እንደምን አደርሽ/ክ

ስሜይባላል፡፡ በአዲስ አበባ በህክምናና ጤና ሳይንስ ኮሌጅ የ2^{ተኛ} ድግሪ ተመራቂ ተማሪ የሆነችው ጸዮን ሽብሩ በምታካሂደው ጥናት ላይ የመረጃ ሰብሳቢ ነኝ ፡፡ በስኳር ህመም የሚመጣው የአይን ችግርን አስመልክቶ እስከ 7 ደቂቃ የሚወስድ ጥያቄዎችን ልጠይቀዎ እወዳለሁ የእርስዎ ምላሽ በስኳር ህመም የሚመጣው የአይን ችግር ጋር ተያይዞ ያሉ ችግሮችን ለመለየት እና መፍትሄ አቅጣጫዎችን ለማስቀመጥ እንደሚያግዝ አምናለሁ፡፡ እርስዎ የተመረጡት በሌላ ምክንያት ሳይሆን በአጋጣሚ እንደሆነ ልነግርዎት እወዳለሁ፡፡ ጥናቱን አስመልክቶ አንዳንድ ነገር ግልፅ ለማድረግ ያህል፡-

የጥናቱ ርዕስ፡- በጥቁር አንበሳ ስፔሻላይዝድ ሆስፒታል የስኳር ህክምና ክሊኒክ በተመላላሽ ህክምና የሁለተኛው አይነት የስኳር ህመምተኞችን በስኳር ህመም የሚመጣው የአይን ችግርና ተያያዥ ጉዳዮች የሚል ነው፡፡

የጥናቱ አላማ፡- በጥቁር አንበሳ ስፔሻላይዝድ ሆስፒታል የስኳር ህክምና ክሊኒክ በተመላላሽ ህክምና የሁለተኛው አይነት የስኳር ህመምተኞችን በስኳር ህመም የሚመጣው የአይን ችግርና ተያያዥ ጉዳዮችን መመርመር ነው፡፡

የጥናቱ ጥቅም፡- ምን እንኳን በጥናቱ ላይ የሚሳተፉ ሰዎች በቀጥታ የሚያገኙት ጥቅም ባይኖርም ከጥናቱ የሚያገኘው መረጃ በጥቁር አንበሳ ስፔሻላይዝድ ሆስፒታል የስኳር ህክምና ክሊኒክ በተመላላሽ ህክምና የሁለተኛው አይነት የስኳር ህመምተኞች ላይ በስኳር ህመም የሚመጣው የአይን ችግር ጋር ተያይዞ የሚመጡ ችግሮችን ለመቅረፍ ከማስቻል በላይ በሀገር ደረጃ የራሱ አስተዋጽኦ እንደሚኖረዉ ይታመናል፡፡

የጥናቱ ስጋት፡- በጥናቱ ላይ መሳተፍ ለተሳታፊዎች ምንም የሚያመጣው ችግር የሌለ እና የሚሰጡት መረጃ ሚስጥራዊነቱ የተጠበቀ ነው፡፡

የተሳታፊዎች መብት፡- በጥናቱ ላይ መሳተፍም አለመሳተፍም ሙሉ መብት ያላቸው ሲሆን ተሳታፊዎችም በማንኛውም ጊዜ እራሳቸውን ከጥናቱ ማግለል ይችላሉ፤ ከዚህም በተጨማሪ በጥናቱ ላይ ማንም አይነት ጥያቄዎች ካሏቸው የበለጠ እንዲበራራላቸው መጠየቅ ይችላሉ፡፡

የጥናቱ ሚስጥራዊነት፡- ማንኛውም መረጃ ሚስጥራዊነቱ የተጠበቀ ሲሆን በመጠይቁ ላይ የተሳታፊዎችን ስም መግለፅም አስፈላጊ አይደለም፡፡ከማንነትም ጋር በቀጥታ ተያያዥነት ያሏቸው መረጃዎች በሙሉ በዋና ተመራማሪው ሚስጥራዊ በሆነ የመረጃ ጥንቅር ዘዴ ከተቀየሩ በኋላ ብቻ ህምርምር ሂደቱ የሚውለ ይሆናል፡፡

ANEEX V: Amharic version of consent form

ለ. የስምምነት ቅጽ

ከላይ ያነበብኩልዎትን መረጃ በሚገባ ከተረዱት በጥናቱ ላይ ለመሳትፍ ፈቀደኛ ነዎት ?

- 1) አይደለሁም (አመሰግናለሁ)
- 2) አዎ (ቃለ መጠይቁ ይቀጥላል)

ጥናቱን የሚያካሄደው ተማሪ :- ዲዮን ሽብሩ

የተጠያቂው ፊርማ ቀን.....

ቃለ መጠይቁ የተካሄደበት ቀን.....

የቃለ መጠይቁ ውጤት

- | | |
|------------------------|---------------|
| 1) የተፈጸመ | 2) መልስ ሰጭ የለም |
| 3) መልስ ሰጭው ፍቃደኛ ያልሆነበት | 4) በከፊል የተሞላ |

ያረጋገጠው ተቆጣጣሪ ስም.....ፊርማ.....ቀን.....

ANEEX VI: Amharic version of Questionnaire

ክፍል 1:-ማህበራዊና ስነህዝባዊ መረጃዎችን በተመለከተ የተዘጋጀ ቃለ መጠይቅ

ቁ	ጥያቄ	የኮድ ክፍፍል
1	ዕድሜ	_____ ዓመት
2	ጾታ	1. ሴት 2. ወንድ
3	የመኖሪያ ቦታ	1. ከተማ 2. ገጠር
4	የጋብቻ ሁኔታ?	1. ያገባ 2. ያላገባ 3. በሞት የተለየ 4. ፊት 5. ሌላ ካለ ይግለጹ
5	የስራህ/ሽ/ ሁኔታ	1. የመንግስት ሰራተኛ 2. የመንግስታዊ ያልሆነ ቅጥር 3. የግል ስራ 4. አርሶ አደር 5. ተማሪ 6. ሌላ ካለ ይግለጹ
6	ሃይማኖት	1. ኦርቶዶክስ 4. ካቶሊክ 2. ሙስሊም 5. ሌላ ካለ ይግለጹ
7	የትምህርት ደረጃ	1. ማንበብና መፃፍ የማይችል/ትችል 2. ማንበብና መፃፍ የሚችል/ትችል 3. 1 ^ኛ ደረጃ 4. 2 ^{ተኛ} ደረጃ 5. ዲፕሎማ 6. ድግሪ እና ከዚያ በላይ
8	የወርሃዊ ገቢ	_____ ብር

ክፍል 2: ህክምና ነክ መግለጫዎች

ቁ	ጥያቄ	የኮድ ክፍፍል	
1	የስኳር ህመምተኛ ከሆኑ ምን ያህል ጊዜ ሆኖት	_____	
2	ከዚህ በፊት የደም ግፊት አለቦት	1. አዎ 2. የለም	
3	ካለቦትስ የሚወስዱት የደም ግፊት መድሃኒት ምን ይባላል	_____	
4	ከዚህ በፊት የቆየ የኩላሊት በሽታ አለቦት	1. አዎ 2. የለም	
5	በባዶ ሆድ የሚሰራ የስኳር መጠን ውጤት	_____	
6	የስኳር የ 3ወር ውጤት	_____	

7	የደም ውስጥ የቅባት መጠን	_____	
8	ከዚህ በፊት የቆየ የልብ በሽታ አለቦት	1. አዎ 2. የለም	
9	የከብደት እና ቁመት ምጣኔ	_____	

ክፍል 3: የስኳር መዳኒት አይነቶች

ቁ	ጥያቄ	የኮድ ክፍፍል	
1	ኢንሱሊን ይወስዳሉ	1. አዎ 2. የለም	
2	ኢንሱሊን መውሰድ መቼ ጀመሩ	_____	
3	በአፍ የሚወስዱ የስኳር መዳኒት ይወስዳሉ	1. አዎ 2. የለም	
4	ከወሰዱም የሚወስዱት መድሃኒት አይነት ይጥቀሱ	_____	

ክፍል 4: ስለ ስኳር አጠባብቅ ዘዴ

ቁ	ጥያቄ	የኮድ ክፍፍል	
1	በየሰዓት ጊዜ የስኳር ክትትል ያደርጋሉ	1. እስከ 3 ወር 2. በየ 3ወር 3. በየ 6ወር 4. በአመት አንዴ	
2	ባለፈው አንድ አመት ውስጥ የአይን ምርመራ አርገው ያውቃሉ	1. አዎ 2. የለም	
3	የስኳር ትምህርት በሚሰጥበት ጊዜ ተካፍለው ያቃሉ	1. አዎ 2. የለም	