• Clinical Research •

Factors associated with diabetic retinopathy screening and regular eye checkup practice among diabetic patients attending Felege Hiwot Specialized Hospital

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Abstract

● **AIM:** To identify associated factors of diabetic retinopathy (DR) screening and ey e check-up practice among diabetes mellitus (DM) patients attending Felege Hiwot Specialized Hospital.

● **METHODS:** An institution-based cross-sectional study was applied from October 4, 2019 to January 12, 2020 at Felege Hiwot Specialized Hospital. A systematic random sampling technique was used to recruit participants and an interviewer-administered questionnaire was employed to collect the data. The collected data were entered into Epi Info version 7 and transposed to SPSS version 24 for statistical analysis. Descriptive statistics were executed and associated factors were identified using binary logistic regression. The strength of association between the independent and the outcome variable was determined using an adjusted odds ratio (AOR) with 95% confidence interval (CI).

● **RESULTS:** Four hundred and six participants partake with a response rate of 95.7% and a mean age of 47±11.5y. The magnitude of DR screening was 308 (75.9%, 95%CI: 71.5%, 79.8%). Higher educational level (AOR=3.25; 95%CI: 1.40, 8.78), good knowledge of DR (AOR=2.50; 95%CI: 1.55, 4.46), and family history of DM (AOR=2.15; 95%CI: 1.41, 3.85) were significantly associated with DR screening. On the other side, rural residence [AOR=3.11 (1.89, 5.02)] and undesirable attitudes toward DR [AOR=5.65 (3.14, 8.76)] were significantly associated with poor regular eye checkup practice.

● **CONCLUSION:** Most of the participants are screened for DR. Higher education, family history, and good knowledge are associated with DR screening. In addition, rural residence and undesirable attitudes toward DR are associated with regular eye checkup practice.

● **KEYWORDS:** diabetic retinopathy; eye checkup; eye screening; diabetes mellitus; Ethiopia

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INTRODUCTION

Eye care service utilization is the use of services related to eye health to prevent and cure eye problems, promoting and maintaining eye health[1-4]. Diabetic retinopathy (DR) is one of the major complications of diabetes mellitus (DM) and the major cause of blindness accounting for 4.8% of the total 37 million blind cases worldwide[5]. Besides, more than one-third of patients with DM have some forms of DR and 10% had vision-threatening DR[6-8]. DR screening is one of the major successful practices in diabetes care that reduces/prevents DR-related eye complications which result in visual impairment and blindness[5]. Early detection and treatment of DR are achieved by screening and eye checkup practices as indicated by the American Academy of Ophthalmology[2,8]. Since DR is usually asymptomatic until the late stages, the clinical signs that cause vision loss cannot be identified unless an earlier screening/eye checkup is regularly practiced in DM patients[9].

Urban residence, private health insurance, lack of health education, lack of screening practices, older age, poor access to eye care service providers, poor knowledge/awareness of DR, and private health insurance are the most common factors associated with DR screening and eye checkup practices[10-11].

DR screening is usually performed either directly by ophthalmologists or optometrists using 60, 78, and 90 diopter volk lenses with dilated pupil slit lamp examination or fundus photographic images are taken with dilated pupil by other trained professionals and sent to ophthalmologists for grading and interpretation[12]. People with DM have a higher risk of acquiring DR, cataracts, glaucoma, dry eye, and refractive error as compared to the general population[13]. Therapeutic approaches for diabetic patients who are at risk with DR include; blood glucose control[14], drug therapy to reduce modifiable risk factors, laser photocoagulation, and intraocular surgery[15]. Generally, eye checkup practices and comprehensive eye screening programs are essential health promotion and prevention practices to reduce the late complications manifested in visual impairment and vision loss[12,14-15]. The American Diabetes Association (ADA) recommends screening for retinopathy should be given within 3 to 5y after the onset of type 1 and at/shortly after the diagnosis of type 2 DM[15-16] and regular eye checkups should be undertaken at least yearly in both cases of diabetes types[14].

DR is a microvascular complication of DM in which 100% of type 1 and 60% of type 2 diabetic patients develop some form of DR after 20y if early screening and eye checkups are not in place[6]. There are no more studies in Ethiopia as well as in the study area regarding the factors affecting DR screening and eye checkup practices among DM-diagnosed patients. Therefore, this study aimed to identify factors associated with DR screening and eye checkup practice among DM patients attending Felege Hiwot Specialized Hospital.

SUBJECTS AND METHODS

Ethical Approval Ethical clearance was taken following the protocols and Declarations of Helsinki. The ethical process was approved by the University of Gondar, College of Medicine and Health Sciences Ethical Review Committee (reference VP/RTT/05/534/2019). After explaining the purpose of the study and getting permission to conduct the study, written informed consent was taken from each participant. Confidentiality of the participants was kept by avoiding identifiers like the names of the participants.

Study Setting, Area, and Period An institution-based cross-sectional study was conducted from October 4, 2019, to January 12, 2020, at Felege Hiwot Specialized Hospital. The hospital is located in Bahir Dar city, Northwest Ethiopia located 545 kilometers away from Addis Ababa capital city of Ethiopia. It has an outpatient department for chronic follow-up patients and diabetic treatment has been provided two days per week. The hospital serves more than 7500 diabetic patients with different follow-up times[17].

Study Population and Inclusion Criteria All diabetic patients attending Felege Hiwot diabetic clinic were the source population and all diabetic patients attending Felege Hiwot diabetic clinic during the study period were the study population. All adult diabetic patients who were attending the diabetic clinic during the study period were included in the study and pregnancy-related diabetic patients and other patients who were severely ill to carry out the interview were excluded from the study.

Sample Size Determination and Sampling Technique The sample size was determined using Epi info 7 Stat CAL with the assumptions of power as 80%, 95% confidence interval (CI), proportion (P=0.5) since there was no previous study, and 5% margin of error (d). Finally, the minimum sample size was 384 and after considering a 10% non-response rate, the total sample size was 424.

A systematic random sampling technique was used to select the study participants after calculating the interval K by dividing the total diabetic patients attending the diabetic by the sample size.

Data Collection Tool and Procedure The data was collected by qualified 4 Bachelor of Science (BSc) holder Nurses and one Master of Science (MSc) holder Optometrist as a supervisor. A semi-structured questionnaire was used for a face-to-face interview to collect data on sociodemographic characteristics, medical history, economic, and behavioral characteristics, knowledge, attitude, and practice toward DR. The interview was just carried out as the participants had finished their examination. The practice of eye screening and eye checkups were assessed using a standardized questionnaire adapted from similar studies[5,8,18-19]. The participants were given full advice about the complications of DR and the advantages of eye screening and eye check-up practices at the end of the face-to-face interview.

Operational Definition DR screening was considered as "evaluated" when participants reported "yes" to the question "have you ever had an eye examination for diabetic related eye complications since you were diagnosed as DM[5,20]?".

Regular eye checkup practice was considered good when participants answered the median and above of the questions related to regular eye checkups.

Knowledge of DR was assessed with 12 questions and respondents who gain median and above of the questions were considered as having good knowledge[1].

Attitude towards DR was taken as "positive" when participants respond to the mean and above of the attitude-related questions[21-22].

Data Quality Assurance The questionnaire was translated to the local language (Amharic) for data collection and back to English by language professionals. The training was given to the data collectors on how to approach study participants and ways of data collection before the actual data collection period. A pretest was done on 22 diabetic patients attending Addis Hiwot Hospital which is 2 km away from the study area to confirm its face validity and modification were made accordingly. Close supervision and checking of the collected data were made on each day of the data collection time.

Data Processing and Analysis After cleaning, the data were entered into Epi Info software version 7 and then exported to SPSS software version 24 for statistical analysis. The summary statistics were presented with a mean (standard deviation), frequency (percentage), tables, and graphs. The reliability of the tool was checked with Cronbach alpha (α) which was found as 0.7. The model goodness of fit was checked with the Hosmer-Lemeshow goodness of fit test. A binary logistic regression statistical model was fitted between sociodemographic, medical, economical, knowledge, attitude, and practice-related variables, behavioral characteristics, and trends of eye screening/eye check-up practice. All variables with a *P*-value of less than 0.2 in bi-variable logistic regression were included in multivariable logistic regression. Finally, the strength of the statistical association between independent variables and the outcome variable was shown by the odds ratio (OR) with a 95%CI, and variables with a *P*-value of less than 0.05 were taken as statistically significant.

RESULTS

A total of 406 study subjects participated with a response rate of 95.7% and a mean age of 47±11.5y. More than half 238 (58.6%) of the participants were males and slightly higher than one-third 157 (38.7%) of the participants were in the age group of 53-62y. Only 42 (10.3%) of the participants had health insurance and 151 (37.2%) of them had a monthly income of 1501-2500 Ethiopian Birr (ETB). More than two-thirds of 283 (69.7%), and 282 (69.5%) of the study subjects were urban residents and married respectively (Table 1).

Table 1 Sociodemographic characteristics of study participants attending Felege-Hiwot Referral Hospital, Northwest Ethiopia, January 2020

Variables	Frequency	Percentage
Age group in years		
18-34	38	9.4
35-52	128	31.5
53-62	157	38.7
≥63	83	20.4
Sex		
Male	238	58.6
Female	168	41.4
Educational status		
Unable to read and write	56	13.8
Able to read and write	91	22.4
Primary school	88	21.7
Secondary school	103	25.4
College/university	68	16.7
Residence		
Rural	123	30.3
Urban	283	69.7
Marital status		
Single	40	9.9
Married	282	69.5
Divorced	56	13.8
Widowed	28	6.9
Occupation		
Employed	100	24.6
Farmer	67	16.5
Merchant	112	27.6
Retired	89	21.9
Others[a]	38	9.4
Monthly income in Ethiopian Birr		
≤1500	79	19.5
1501-2500	151	37.2
2501-4000	126	31.0
≥4001	50	12.3
Use of health insurance		
Yes	42	10.3
No	364	89.7
Transportation mechanism to the hospital		
Drive own self	2	0.5
Bus/taxi	329	96.6
By walk	63	15.5
With the aid of someone	12	3.0

[a]Others: Housewives, beggars.

Medical and Behavioral Characteristics of Study Participants Nearly half of 201 (49.5%) of the participants had type 2 DM and half of 203 (50.0%) of the participants had DM with a duration of 5-10y. More than two-thirds of 276 (68.0%) of the participants had gotten health education about DM or its complication. More than three-fourths of 338 (83.7%) of the participants had not any known systemic diseases other than DM and 138 (34.0%) of them had either distance or near vision-related problems (Table 2).

Diabetic Retinopathy Screening and Regular Eye Checkup Practice Almost three-fourths 308 (75.9%) of the study participants got eye examination/screening for DM complications in the eye. Among those participants who had undergone DR screening, 180 (26.6%) of them adhere to their regular eye checkups in retinal ophthalmic clinics and 81 (26.3%) of them

Table 2 Medical and behavioral characteristics of study participants attending Felege-Hiwot Referral Hospital, Northwest Ethiopia, January 2020

Variables	Frequency	Percentage
Duration of diabetes in years (y)		
<5	62	15.3
5-10	203	50.0
11-15	87	21.4
>15	54	13.3
Type of DM		
Type 1	172	42.4
Type 2	201	49.5
Not known	33	8.1
Family history of DM		
Yes	226	55.7
No	132	32.5
Not known	48	11.8
Do you have any known eye disorders/problems?		
Yes	86	21.2
No	320	88.8
Have you gotten an examination/screening for diabetes complications?		
Yes	308	75.9
No	98	24.1
Advised as having some form of DR manifestation (n=308)		
Yes	81	26.3
No	227	73.7
What is the reason for not getting an eye examination? (n=98)		
Not informed by a physician	24	24.5
Not aware of the complication	34	34.7
Fear of eye examination	12	12.2
Long waiting time	22	22.4
Perceived as no need, depression	6	6.1
Frequency of eye checkups for diabetic complications? (n=308)		
Every 12mo	109	35.4
Every 6-9mo	151	49.0
Every 1-3mo	48	15.6
Have you missed your regular eye checkup in the past year?		
Yes	128	41.6
No	180	26.6
What factors/barriers affect your schedule for eye checkups? (n=128)		
Long-distance	46	35.9
High cost	36	28.1
Lack of transportation	22	17.2
Lack of time	18	14.1
Lack of escord, forgetting the appointment	6	4.7
Do you have known systemic disorders other than DM?		
Yes	68	16.7
No	338	83.7
Do you have any vision-related problems in identifying things/reading materials?		
Yes	138	34.0
No	268	66.0
Did you get an education/information related to diabetes and its complication?		
Yes	276	68.0
No	130	32.0
Have you heard that diabetes has some form of complication related to visual loss?		
Yes	262	64.5
No	144	35.5
Where do you get the information? (n=262)		
Health care professional	129	49.2
Mass media	29	11.1
Friends	56	21.4
From reading material	48	18.3

DM: Diabetes millets.

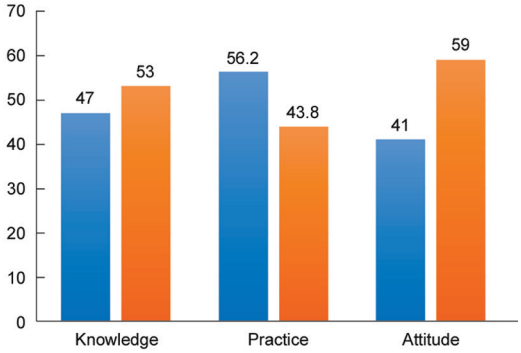

Figure 1 Knowledge, attitude and practice towards DR among study participants attending Felege-Hiwot Referral Hospital, Northwest Ethiopia, January 2020 DR: Diabetic retinopathy.

got advice as having some form/stages of DR. Long distance 46 (35.9%) and high cost 36 (28.1%) were the most common barriers that affect the regular eye checkups of participants (Table 2).

Knowledge, Attitude, and Practice Toward Diabetic Retinopathy Most of the participants 215 (53.0%) had poor knowledge about DR and 168 (41.0%) of the participants had a positive attitude towards DR (Figure 1).

Factors Associated with DR Screening Variables including: educational status, duration of DM, getting health education, knowledge about DR, awareness of DR, presence of vision-related problems, family history, residence, and marital status were associated with having screened for DR in bi-variable logistic regression with a *P*-value of <0.2 whereas variables including educational status of college/university, having good knowledge about DR, and family history of DM were significantly associated with the DR screening. Participants who had an educational level of college/university were 3.25 times more likely to undergo DR screening as compared to those who had an education level of unable to read and write [AOR=3.25 (1.40, 8.78)]. The odds of having screened for DR among participants who had good knowledge about DR was 2.50 times more as compared to those who had poor knowledge about DR [AOR=2.50 (1.55, 4.46)]. In addition, participants who had a positive family history of DM were 2.15 times more likely to undertake DR screening as compared to those who had no positive family history of [AOR=2.15 (1.41, 3.85); Table 3].

Factors Associated with Regular Eye Checkup Practice Variables including: educational level, monthly income, family history of DM, knowledge toward DR, attitude towards DR, other systemic disorders, residence, occupation, and duration of DM were associated in bi-variable logistic regression with a *P*<0.20, and then only variables; rural residence and negative attitude towards DR were significantly associated with poor regular eye checkup practice with a *P*<0.05. Rural

Table 3 Factors associated with DR among study participants attending Felege-Hiwot Referral Hospital, Northwest Ethiopia, January 2020

Variables	Screening status for DR		COR (95%CI)	AOR (95%CI)	*P*
	Yes	No			
Education					
Unable to read and write	37	19	1.00		
Primary school	133	46	1.49 (0.78, 2.84)		
secondary school	81	22	1.89 (0.91, 3.91)		
College/university	58	10	2.98 (1.25, 7.11)	3.25 (1.40, 8.78)	0.01
Duration of DM, y					
<5	42	20	1.00		
5-10	199	55	1.72 (0.93, 3.17)		
≥11	67	23	1.39 (0.68, 2.83)		
Health education/information about DM complication					
Yes	195	67	0.80 (0.50, 1.30)		
No	113	31	1.00		
Knowledge about DM					
Good	163	28	2.81 (1.72, 4.60)	2.50 (1.55, 4.46)	0.001
Poor	145	70	1.00		
Awareness of DR					
Yes	205	57	1.43 (0.90, 2.28)		
No	103	41	1.00		
Presence of vision-related problem					
Yes	98	40	0.68 (0.42, 1.10)		
No	210	58	1.00		
Family history of DM					
Yes	188	38	2.47 (1.55, 3.94)	2.15 (1.41, 3.85)	0.0001
No	120	60	1.00		
Residence					
Rural	90	33	1.00		
Urban	218	65	1.23 (0.76, 1.99)		
Marital status					
Married	196	86	0.67 (0.41, 1.09)		
Unmarried	96	28	1.00		

DM: Diabetes Miletus; DR: Diabetic retinopathy; COR: Crude odds ratio; AOR: Adjusted odds ratio.

residents were 3.11 times more likely of having poor regular eye checkup practice [AOR=3.11 (1.89, 5.02)] and the odds of having poor regular eye checkup practice among participants with undesirable attitudes towards DR were 5.65 times more as compared to those with a positive attitude [AOR=5.65 (3.14, 8.76); Table 4].

DISCUSSION

Increasing eye care service utilization by early screening and regular eye checkups is a public health prevention priority among patients with DM to reduce visual impairment/blindness as well as improve quality of life. The proportion of participants who had screened for DR among DM patients was 308 (75.9%, 95%CI: 71.5, 79.8). This result is higher than a study done in China 56.8%[11], Tanzania 59.1%[23], South Africa 49.0%[10], Saudi 61.15%[19], Bangladesh 32%[5], California 55%[8], the United States 59.2%, 65%[24] and lower than a study carried out in the United States 82%[25]. Furthermore, the proportion of participants with good regular eye checkup practice was 180 (44.3%, 95%CI: 39.6, 49.2). This finding is lower than studies done in the United States 50.1%[26], Saudi Arabia 95%[27], France 50%[9], and Switzerland 70.5%[28], and higher than a study done in Ethiopia 39.6%[1]. Differences in economic status, study design, educational level of participants, and level of health setting might be the main reasons for variations in the proportion of results observed in different studies. The present study was conducted on DM patients who were having a better chance of getting counseling for DR screening which might increase the proportion of DR screening in this study. Unavailability of sufficient eye care centers might affect the regular eye checkups even after screening and this could reduce the proportion of eye checkups in the present study.

Table 4 Factors associated with poor regular eye checkups among study participants attending Felege-Hiwot Referral Hospital, Northwest Ethiopia, January 2020

Variables	Poor regular eye check practice		COR (95%CI)	AOR (95%CI)	*P*
	Yes	No			
Education					
Unable to read and write	26	30	0.64 (0.32, 1.32)		
Primary school	97	82	0.88 (0.51, 1.55)		
High school	64	39	1.22 (0.65, 2.28)		
College/university	39	29	1.00		
Monthly income in ETB					
≤1500	45	34	1.98 (0.84, 4.67)		
1501-2500	91	70	1.95 (0.88, 4.31)		
2501-4000	78	58	2.01 (0.90, 4.51)		
≥4001	12	18	1.00		
Attitude					
Positive	52	116	1.00		
Negative	174	64	6.06 (3.93, 9.37)	5.65 (3.14, 8.76)	0.0001
Systemic disorders other than DM					
Yes	35	33	1.00		
No	191	147	1.22 (0.72, 2.06)		
Residence					
Rural	92	31	3.30 (2.10, 5.28)	3.11 (1.89, 5.02)	0.0001
Urban	134	149	1.00		
Occupation					
Employed	95	94	1.00		
Farmer	64	41	1.54 (0.95, 2.51)		
Merchant	67	45	1.47 (0.91, 2.36)		
Duration of DM, y					
<5	39	23	1.62 (0.88, 2.99)		
5-10	115	88	1.25 (0.81, 1.92)		
≥11y	72	69	1.00		

ETB: Ethiopian Birr; COR: Crude odds ratio; AOR: Adjusted odds ratio.

This study established that having good knowledge about DR was statistically significant with the status of having DR screening. This is supported by studies done in China[11], Tanzania[23], Saudi[19], and Bangladesh[5]. This might be because having good knowledge about DR initiated the participants to decide on DR screening to know the status of their eye for DM complications. People with lower educational status are less likely to participate in health care practices including DR screening[29].

Having a positive family history was significantly associated with DR screening in this study which is supported by a study done in Rural Bangladesh[5]. This could be justified as those participants with a positive family history of DM have a better chance of getting knowledge/information that might enable them to carry out eye screening practices. A family history of DM is pointing toward a genetic and epigenetic basis for DR which might give memories and trends to the participants to participate easily in the screening of diabetic-related complications including DR[29].

Furthermore, the present study showed that higher educational status was significantly associated with the status of having eye screening for DR complications. Individuals with higher educational status have a higher tendency to acquire a better knowledge regarding health-related services like DR screening[28] and might have a better chance to read, listen and follow social media which might lead them to participate in DR screening in a better way as compared to those with low educational status[18].

This study indicated that participants with rural residency were significantly associated with poor regular eye checkup practice which was supported by a similar study done in China[11]. The unavailability of sufficient eye care services and eye care professionals in Ethiopia could be the main barrier to attending regular eye checkups for DM patients. Long-distance of rural residents from the institution, high cost, and extended waiting time were the main barriers raised by participants in low and middle-income countries including Ethiopia[18,30-31]. Poor economic conditions for both transport and other accommodations

might affect rural residents to follow their eye checkups regularly. Whereas a study carried out in the United States[25] contradicts this finding which states rural residency is a significant factor for regular eye checkups. This might be due to differences in educational and economical differences between the two study areas.

Besides, in line with a study done in China[11] and Tanzania[23], the present study confirmed that participants with undesirable attitudes towards DR were significantly associated with the practice of poor regular eye checkups. Undesirable attitude towards DR and other ocular complications might affect the practice of eye checkups even after gaining sufficient counseling about the risks of losing follow-ups. It is through addressing the modifiable factors by changing the attitudes and practices of DM patients that we can stop the complications of DM including DR[15]. Worrying about losing vision might affect participants to develop a positive attitude toward DR and its complication. This intern might initiate/obligate participants to adhere to their regular eye checkups[11]. Education is the main weapon that changes humans' attitude towards health care practices including DR screening and regular checkups[30]. Health insurance, duration of DM, type of DM, and age were the most common factors associated with DR screening and eye checkup practice in different studies. These variables were not associated with DR screening in this study. Different study designs and varied environmental and economic conditions might affect the factors manifested as significant in different studies.

In conclusion, more than three-fourths (75.9%) of participants were screened for DR in this study. Higher education, family history, and good knowledge were associated with DR screening. In addition, rural residence, and undesirable attitude toward DR were associated with regular eye checkup practice.

There were limitations of the study. Most of the administer-based interviews were based on self-reported responses which may be subject to social desirability and recall bias. The attitudes and practices of health care providers towards DR screening and regular eye checkups were not included in this study.

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