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## MAGNITUDE OF DEPRESSION AND ITS ASSOCIATED FACTORS AMONG PEOPLE DIAGNOSED WITH TYPE II DIABETES

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### ABSTRACT

**Introduction:** Studies show that depression and diabetes may be linked. In addition, possibly increasing the risk for depression, diabetes may make symptoms of depression worse. Depressed individuals are likely to comply with diabetes self-care recommendations. It is evident that active case finding and management of depression can assist in alleviating patient suffering, and contribute to improved metabolic control, clinical outcomes and reducing the costs of patient management. Then, it is important to estimate the magnitude of depression and its associated factors amongst people with diabetes, thereby to initiate early treatment.

**Objective:** To assess magnitude of depression and its associated factors among people diagnosed with type II diabetes mellitus attending at Mekelle and Ayder referral hospitals, Mekelle city.

**Methods:** Cross-sectional study design and systematic random sampling technique were used. Data were collected using questionnaire, entered and analyzed using SPSS Version 20.0. Descriptive statistics was used to characterize the data. The multivariable analysis was carried out to evaluate the combined effect of factors associated.

**Result:** A total of 414 study subjects were included in the study but 14 study participants were excluded due to gross incompleteness of questionnaires. Hence, then 400 participants were included in the analysis. Accordingly, 253 (63.25 %) respondents showed depressive symptoms. Marital status [AOR = 3.079 (0.744-12.740)], education [AOR = 1.757 (0.803-3.843)] and monthly income [AOR = 0.556 (0.277-1.115)] were found to have statistically significant association. Regarding treatment parameters, insulin was associated with development of depression symptom [AOR = 0.659 (0.398-1.092)]. Patients with retinopathy [AOR = 1.694 (1.077-2.666)], sexual dysfunction [AOR = 5.026 (2.291-11.026)], comorbidity [AOR = 0.219 (0.119-0.402)], physical disability [AOR = 0.490 (0.268-0.893)], negative life event [AOR = 4.916 (1.610-15.015)], care of DM complication [AOR = 2.892 (1.758-4.756)] and high health cost [AOR = 0.511 (0.310-0.843)] showed statistical association with development of depression.

**Conclusion:** Magnitude of depression among Type 2 diabetes mellitus patients was more than sixty percent. Marital, Education, monthly, insulin. Patients with retinopathy, sexual dysfunction, comorbidity, physical disability, negative life event, Care of DM complication and high health cost showed statistical association with development of depression.

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### INTRODUCTION

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both (Diabetes care, 2007). High rates of acute complications have also been found in people with diabetes in LICs (Low income countries) and

LMICs (Low middle income countries). Mortality rates for diabetic ketoacidosis (DKA) have been found to range from 10–30 % in Nigeria and Ghana (Gill *et al.*, 2009). Diabetes was the fourth most common condition leading to critical illness after malaria, pneumonia, or influenza and respiratory diseases in the Solomon Islands (Westcott *et al.*, 2012). Globally the number of adults with diabetes increased from 108 million (a prevalence of 4-7%) in 1980 to 422 million

(8.5%) in 2014. Notably, diabetes prevalence in the African region increased by 129.0% (from 3.1% in 1980 to 7.1% in 2014). The number of people with diabetes will increase to 55% by 2035 (Atun *et al.*, 2007). Although the prevalence of diabetes in Ethiopia is estimated to be 2% nationally, evidence suggests that the prevalence could be >5% in those older than 40 years of age in some settings. More than one-third of diabetic patients in Ethiopia receive standard diabetes care (Nigatu, 2012). A study done on urban Commercial Bank employees in Ethiopia showed a 6.5% prevalence of DM (Abebe *et al.*, 2014). Studies show that depression and diabetes are linked and possibly increasing the risk for depression, diabetes may make symptoms of depression worse. The stress of managing diabetes every day and the effects of diabetes on the brain may contribute to depression. At the same time, some symptoms of depression may reduce overall physical and mental health, not only increase the risk for diabetes but make diabetes symptoms worse. Studies have shown that people with diabetes and depression have more severe diabetes symptoms than people who have diabetes alone (National Institute of Mental Health, 2011).

According to statistics, depression affects people with diabetes more often than people without it up to 15 percent compared with 6.7 percent in the general population. When depression occurs along with a chronic illness like type 2 diabetes, the symptoms tend to hit harder and be more severe (Marijke Vroomen, 2015). People who are depressed have elevated levels of stress hormones such as cortisol, which can lead to problems with glucose metabolism, increased insulin resistance, and the accumulation of belly fat. There are numerous reasons why the diabetes-depression connection is so urgent. Symptoms of depression can often make it more difficult to successfully manage diabetes, and studies suggest that people with diabetes who have depression symptoms often have consistently higher blood glucose levels than non-depressed patients. Additionally, patients who have both conditions are 52 percent more likely to suffer a heart attack or stroke (Denise Mann, 2015). In addition to possibly increasing the risk for depression, diabetes may make symptoms of depression worse. The stress of managing diabetes everyday and the effects of diabetes on the brain may contribute to depression. Treating depression can help to manage diabetes and improve overall health. Scientists report that for people who have diabetes and depression, treating depression can raise mood levels and increase blood glucose control (National Institute of Mental Health, 2015). Prevalence of depression among individuals with diabetes mellitus appears to vary by type of diabetes mellitus, race/ethnicity, and among developed and developing nations. Therefore, screening for depression among diabetic patients is important in our setting. A study done in Palestine and result revealed that one hundred and twenty patients (40.2%) scored  $\geq 16$  on BDI-II scale (Waleed *et al.*, 2014). Depressed individuals are also less likely to comply with diabetes self-care recommendations and more likely to follow sedentary lifestyles, remain physically inactive, indulge in smoking and a high-fat diet, eventually leading to poor diabetes control and clinical outcomes. However, it is evident that active case finding and management of depression can assist in alleviating patient suffering, and contribute to improved metabolic control and clinical outcomes, while reducing the costs of patient management (Ali Khan Khuwaja *et al.*, 2012). Various studies to assess depression and their associated factors among diabetic patients have been reported from developed countries.

Recent studies suggest that psychological disorders remain often undiagnosed and therefore not appropriately treated among people with diabetes. This issue is particularly relevant in Africa where health care infrastructures have mainly focused on infectious diseases rather than on non-infectious disease like DM (Alioune Camara *et al.*, 2014). So, it is important for developing countries to estimate the prevalence of depression and its associated factors amongst people with diabetes, thereby to initiate early treatment so as to improve clinical outcomes and decrease the associated resource utilization and costs. So far, there is limited information regarding these conditions in developing countries, especially in Ethiopia. Therefore, this study was conducted with the aim of to assess the depression prevalence and its associated factors among people diagnosed with type II diabetes mellitus attending at Ayder referral and Mekelle hospitals of Mekelle city.

## METHODS AND MATERIALS

Study design was institutional based cross-sectional study design. The study areas were in Ayder referral hospital and Mekelle hospital found in Mekelle City. The study period was from Oct. 2015-June 2016 and data collection period was Jan. the 1st week to April 4th week, 2016. Source population was all adult diabetes mellitus patients attending in diabetes mellitus clinics of the study area during the study period. Study population: was all sampled diabetes mellitus patients on which the actual study is to be conducted.

**Inclusion criteria:** was all patients Age greater than 30 years and made follow-up for at least six months were included in the study (this is because at early time of diagnosis/ follow up patients may not develop depressive symptoms and may not be well familiarized with the self-care managements).

**Exclusion criteria:** All patients diagnosed with any other psychiatry disorder and cognitive impairment were excluded.

**Sample size determination:** The actual sample size for the study was determined using the formula for single population proportion by assuming 5% marginal error (d), 95% confidence interval ( $\alpha=0.05$ ), and the proportion or prevalence of depression among type 2 diabetic patient was 34% ( $P=0.34$ ) (Joseph *et al.*, 2013). Based on the above information a total of 414 diabetes patients were included in the study. Proportional location was employed to allocate the sample size among the two hospitals.

**Sampling technique:** Systematic random sampling technique was utilized and first patient of our participants was selected based on lottery method.

**Data collection procedure:** Data collection method (tool) was interviewer administered standardized questionnaire and two nurses with previous experience of data collection were recruited as data collectors. Continuous follow-up and supervision regarding the quality of data collection process were made by senior mental health expert and principal investigator throughout the data collection period. Data collection was conducted from January 1<sup>st</sup> week to April 4<sup>th</sup> week 2016. All patients were evaluated and privately interviewed.

**Data collection Tool:** Structured questionnaire: Interviewer -

administered data collection tool was used, it contains three parts, Part I was used to collect socio-demographic data, part II was used to collect clinical status data of the study subjects, Part III was used to assess depression level which is the Patient Health Questionnaire-9 (PHQ-9). The reliability and validity of the tool was: inter rater reliability (intra class correlation [ICC] 0.98, 95% CI [0.96, 0.99]), test-retest reliability ( $\rho$  (Sp) = 0.75,  $p < .001$ ), and internal consistency (Cronbach's  $\alpha = 0.79$ ) were good (34)

**Anthropometric and other Measurements:** Overweight and obesity was classified according to WHO criteria, based on Body Mass Index (BMI) measurements, with cutoff values based on BMI. Cutoff points are a projection of the criteria proposed by WHO for diagnosing overweight (BMI between 25 and 29.9) and obesity (BMI of 30 or more). The analysis is, therefore, with recent fasting blood glucose (FBG) value (within the last 7 days), which was available for all patients. Moreover, the value of FBG is more easily understood by the patient, rather than the interpretation of HbA1c. The following variables are included in the study: demographic variables: Age, sex, religion, ethnicity, height, weight, educational status, marital status, monthly family income, occupation. Clinical variables: Age of diabetes onset, Duration of the disease, Family history of diabetes, Complications of diabetes, Treatment intensity diabetes treatment regimen, physical disability, co-morbid disease, body mass index, fasting blood sugar level, BP, Psychosocial data: Negative life event, poor social support, medication burden, fear of diabetic complication and death, smoking habit, high health care cost, physical activity and outcome variable: depression. The questionnaire was pretested prior to the actual data collection on 10 respondents in Quha hospital two weeks before actual data collection period and necessary amendment was done on the questionnaire according to pretest result.

**Data quality assurance:** To assure data quality, training and orientation were given for the data collectors by the principal investigators. The questionnaire was initially prepared in English and then translated into Tigrigna version. The Tigrigna version was again translated back to English to check for consistency of meaning. This translation process was done by a certified translator. However, since the dominant ethnic group is Tigrian with Tigrigna language the study subjects were interviewed with Tigrigna version questionnaire. Moreover, the questionnaire was pre-tested and necessary corrections and amendment were considered. The collected data was reviewed and checked for completeness and consistency by principal investigators on daily Basis at the spot during the data collection time.

**Data entry and analysis:** The data was entered into, cleaned and analyzed using Statistical Package for Social Sciences (Version 20.0). Descriptive statistics were used to characterize the sample and numerical data was presented as mean  $\pm$  standard deviation, proportion or percentages. Bivariate was employed to examine the relationship or statistical association between the outcome variable and selected independent variables. The multivariable analysis was carried out to evaluate the combined effect of several factors associated with depression among people living with diabetes after adjusting for confounding variables and multicollinearity was checked. The Results are presented as adjusted odds ratios (AOR) with 95% CI, which express the magnitude of the effect of each category on the outcome relative to the reference category. The

significance level was set at P-value ( $<0.05$ ). The results were presented using tables, figures, and texts.

**Ethical consideration:** Ethical clearance was secured from the Mekelle University-College of Health Science IRB (research committee). Official permissions were obtained from Tigray Regional Health Bureau, Ayder referral Hospital and Mekelle hospital medical director office and respondents were informed about the purpose of the study. The information was collected after obtaining verbal informed consent from each participant. The respondents were allowed to refuse or discontinue participation at any time they want. The information was recorded anonymously and confidentiality and beneficence were assured throughout the study period. Operational definitions

**Scoring method:** Recognizing signs of mental health disorders is not always easy. The Patient Health Questionnaire (PHQ) is a diagnostic tool for mental health disorders used by health care professionals that is quick and easy for patients to complete (Kroenke *et al.*, 2001). On the basis of participant response to the frequency of any particular symptom (0=not a tall, 1=several days, 2=morethan $\frac{1}{2}$  of the days, 3=nearly every day), a total score ranging from 0 to 27 was obtained. The arbitrary division of PHQ-9 scores into ratings of minimal (0-4), mild (5-9), and moderate to severe depression ( $\geq 10$ ) was used in this study. Those who had moderate to severe depression based on cut-off points in PHQ 9  $\geq 10$  was referred to Psychiatry Department for further management.

## RESULTS

**Socio demographic characteristics of the respondents:** A total of 414 study subjects were included in the study but 14 subjects were excluded due to incompleteness. Thus 400 participants' questionnaires were included in the analysis. So, the response rate was 96.62%. Out of the total respondents, 225(56.3%) were males while 175(43.7%) were females. Meanage of patients was 53.86 $\pm$ 11.21 years [(95% CI) (42.65-65.07)]. The minimum age of respondents was 30 with the frequency of 1(0.3%) and the maximum was 89 with the frequency of 1(0.3%). But, the minimum age at which DM occurred was 22 with the frequency of 2 1(0.3%) and the maximum was 80 with the frequency of 1(0.3%). Most of the respondents 314 (78.5%) were married and 53 (13.3%) were widowed. The principal religion of the participants was orthodox (336(84%)) followed by Muslim 63(15.8%). Themajority of the participants 379 (94.8%) were from Tigray, 18(4.5%) were from Amhara and the rest 3(0.8%) were from Afar. Asfar as educational status and occupation information was concerned, 117(29.3%) had college or university experience and 115(28.8%) can't read and write. Around 107(26.8%) were housewives and 106 (26.5%) were civil servants. On the other hand, concerning participants estimated monthly income, majority of the respondents (249(62.3%)) earned greater than 1400 birr per month, 87 (21.8%) earned 651-1400 birr per month and the rest 64(16%) earned less than 650 birrs per month (Table 1).

**Clinical and psychosocial characteristics of the respondents:** The oral hypoglycemic agent was taken by 226 (56.5%) of the participants as a treatment for DM. Insulin injection only and combination insulin and oral hypoglycemic agents use were reported by 128 (32%) and 46 (11.5%) of respondents respectively.

**Table 1. Socio-demographic characteristics of people diagnosed with type 2 diabetes mellitus in Ayder Referral and Mekelle Hospital, Mekelle City, Ethiopia, 2016 (N=400)**

S. No	Variable	Category	Depression status(PHQscore)		Total	
			Not depressed <=4, n=147			Depressed >=, n=253
			No (%)	No(%)		
1	Sex/Gender	Male	88(22.0)	137(34.2)	225 (56.2)	
		Female	59 (14.8)	116 (29.05)	175(43.8)	
2	Current age	30-44 years	51(12.8)	42(10.5)	93(23.2)	
		45-59 years	69(17.2)	101(25.2)	170(42.5)	
		60-74 years	27(6.8)	98(24.5)	125(31.2)	
		75-89 years	0(0.0)	12(3.0)	12(3.0)	
3	Age at which the diabetic mellitus occurred	20-34years	21 (5.3)	26(6.5)	47(11.8)	
		35-49 years	77(19.3)	95(23.8)	172(43.1)	
		50-64 years	47(11.8)	118(29.6)	165(41.4)	
		65-80 years	2 (0.5)	13(3.3)	15(3.8)	
4	Marital status	Single	6 (1.5)	5 (1.2)	11 (2.8)	
		Married	126 (31.5)	188 (47.0)	314 (78.5)	
		Divorced	4 (1.0)	18(4.5)	22(5.5)	
		Widowed	11 (2.8)	42 (10.5)	53 (13.2)	
5	Religion	Orthodox	124(31.0)	212(53.0)	336(84.0)	
		Muslim	22(5.5)	41(10.2)	63(15.8)	
6	Ethnicity	Protestant	1(0.2)	0(0.0)	1(0.2)	
		Tigrrian	138(34.5)	241(60.2)	379(94.8)	
		Amhara	8(2.0)	10(2.5)	18(4.5)	
7	Educational status	Afar	1(0.2)	2(0.5)	3(0.8)	
		Can't read & write	29(7.2)	86(21.5)	115(28.8)	
		Read and write only	18(4.5)	40(10.0)	58(14.5)	
		Primary school(1-8)	16(4.0)	47(11.8)	63(15.8)	
		Secondary( 9-12)	20(5.0)	27(6.8)	47(11.8)	
8	Occupation	College/University	64(16.0)	53(13.2)	117(29.2)	
		Farmer	7(1.8)	15(3.8)	22(5.5)	
		Civil servant	63(15.8)	43(10.8)	106(26.5)	
		Merchant	12(3.0)	17(4.2)	29(7.2)	
		House wife	24(6.0)	83(20.8)	107(26.8)	
		Private worker	21(5.2)	33(8.2)	54(13.5)	
		Pensioned	4(1.0)	30(7.5)	34(8.5)	
		No employment	16(4.0)	32(8.0)	48(12.0)	
9	Monthly family income (ETB)	<=650	25(6.2)	39(9.8)	64(16.0)	
		651-1400	27(6.8)	60(15.0)	87(21.8)	
		>=1401	95(23.8)	154(38.5)	249(62.2)	

**Table 2. Bivariate analysis result of people diagnosed with type 2 diabetes mellitus in Ayder Referral and Mekelle Hospital, Mekelle City, Ethiopia, 2016 (N=400)**

Sr. No	Variable	Category/ continuous	Depression status		COR	95% CI	AOR	95%CI
			Not depressed	Depressed				
			No	No				
1.	Sex	Male	88	137	1.00			
		Female	59	116	1.263	(0.836-1.907)		
2.	Current age	30-89 Years	147	253	1.062	(1.041-1.084)*	1.111	(1.057-1.168)**
3.	Age at which the DM occurred	22-80 years	147	253	1.042	(1.020-1.064)	0.932	(0.885-0.981)**
4.	Marital status	Single	6	5	1.00			
		Married	126	188	1.790	(0.535-5.993)	1.338	0.281-6.383
		Divorced	4	18	5.400	(1.083-26.93)*	0.932	0.404-2.150
		Widowed	11	42	4.582	(1.176-17.84)*	3.079	(0.744-12.740)**
5.	Education al status	Can't read & write	29	86	1.00			
		Read & write only	18	40	0.749	(0.373-1.505)	1.712	(0.629-4.662)
		Primary school	16	47	0.991	(0.489-2.007)	1.473	(0.588-3.690)
		Secondary	20	27	0.455	(0.223-0.931)*	1.950	(0.826-4.606)**
		College	64	53	0.279	(0.160-0.487)*	1.757	(0.803-3.843)**
6.	Occupation	Farmer	7	15	1.059	(0.350-3.202)		
		Civil servant	63	43	0.240	(0.108-0.534)*	1.328	0.406-4.346
		Merchant	12	17	0.517	(0.189-1.417)	0.631	0.235-1.696
		House wife	24	83	1.650	(0.763-3.566)	0.806	0.261-2.487
		Private worker	21	33	0.565	(0.235-1.355)	2.125	0.911-4.957
		Pensioned	4	30	3.556	(1.059-11.944)	1.055	0.380-2.929
		No employment	16	32	1.00		3.226	0.910-11.438
7.	Monthly income (ETB)	<=650	25	39	1.00			
		651-1400	27	60	1.513	(0.730-3.134)	0.433	(0.204-0.921)**
		>=1401	95	154	2.310	(1.175-4.541)*	0.556	(0.277-1.115)**

In this study, the duration of DM ranges from the minimum of 0.5 years to maximum of 30 years. The majority of the respondents 286 (71.5%) had less or equal to 8 years' duration of DM. Eighty-two (20.5%) and 32 (8%) of participants had 9-16 years and  $\geq 17$  years' duration of DM respectively.

In addition, the duration of DM treatment ranges from the minimum of 0.33 year to the maximum of 30 years. Most of the respondents 288 (72%) had less than or equal to 8 years' duration of DM treatment. Eighty-one (20.3%) and 31 (7.8%) of respondents had 9-16 and  $\geq 17$  years' duration of DM

**Table 3. Bivariate analysis result of people diagnosed with type 2 diabetes mellitus in Ayder Referral and Mekelle Hospital, Mekelle City, Ethiopia, 2016 (N=400)**

Sr. No	Variable	Category/ Continuous	Depression status		COR	95% CI	AOR	95%CI
			Not depressed No	Depressed No				
1	Diabetes treatment regimen	Insulin	56	72	1.00		0.659	(0.398-1.092)**
		Insulin+ OHA	9	37	3.198	(1.426-7.172)*	1.229	(0.492-3.073)
		Pills (OHA)	82	144	1.366	(0.878-2.125)	1.00	
2	Duration of diabetes	0.5-30 years	147	253	1.105	(1.057-1.155)	1.694	(1.077-2.666)**
3	Co-morbid disease *	Yes	74	86	0.508	0.335-0.769*	0.490	(0.268-0.893)**
		No	73	167	1.00		1.00	
	CVD	Yes	30	107	1.00			
		No	117	146	0.489	(0.296-0.808)		
	Respiratory disease	Yes	7	24	1.00			
		No	140	229	0.519	(0.211-1.281)		
	Renal disease	Yes	7	36	1.00			
		No	140	217	0.373	(0.158-0.884)*	1.728	(0.658-4.542)
	Neurologic disease	Yes	14	64	1.00		1.00	
		No	133	189	0.428	(0.223-0.822)*	1.492	(0.660-3.373)
	Other co- morbid	Yes	30	23	1.00		1.00	
		No	117	230	1.968	(1.068-3.626)*	0.328	(0.153-0.700)**
4	Cxn of DM	Yes	85	130	0.905	(0.400-2.048)		
		No	62	123	1.00		1.00	
	Diabetic retinopathy	Yes	10	71	6.193	(2.734-14.027)*	5.026	(2.291- 11.026)**
		No	137	182	1.00			
	Diabetic nephropathy	Yes	3	16	2.619	(0.667-10.280)		
		No	144	237	1.00			
	Diabetic neuropathy	Yes	12	48	2.504	(1.059-5.920)*	1.204	(0.506-2.867)
		No	135	205	1.00		1.00	
	Sexual dysfunction	Yes	48	39	0.251	(0.116-0.544)*	0.219	(0.119-0.402)
		No	99	214	1.00		1.00	

treatment respectively. Two hundred four (51%) of respondents had at least one or more comorbidity. Generally, 137 (34.3%), 78 (19.5%), 43 (10.8%), 31 (7.8%), and 53 (13.3%) had CVD, neurologic diseases, renal diseases, respiratory diseases and other comorbidity respectively. In addition, 185 (46.3%) of participants had at least one or more DM complications. Eighty-seven (21.8%), 81 (20.3%), 60 (15%), and 19(4.8%) respondents had sexual dysfunction, diabetic retinopathy, diabetic neuropathy and diabetic nephropathy respectively. In this study, the BMI of participants was recorded with the minimum and maximum value of 14.96 kg/cm<sup>2</sup> and 35.96 kg/cm<sup>2</sup>. Two hundred sixty-two (65.5%) of them had BMI in the range of 18.5-24.9kg/cm<sup>2</sup> while 84(21%) of the m had BMI in within 25-29.9kg/cm<sup>2</sup>. Twenty-eight (7%) and 26 (6.5%) of the participants had  $\leq 18$  kg/cm<sup>2</sup> and  $\geq 30$  kg/cm<sup>2</sup> consecutively. Similarly, fasting blood glucose level was also recorded from 53g/dl to 400g/dl. Two hundred twenty-six (56.5%) of participants had FBG  $\geq 127$  g/dl and 105 (26.3%) of them had 101-126g/dl of FBG Only 69 (17.3%) of them had FBG $\leq 100$ g/dl. More than half (230 (57.5%)) interviewed individuals practice physical activity. On the other hand, only 52 (13%) individuals had the physical disability. However, 173 (43.3%) and 150 (37.5%) had negative life event and poor social support respectively. Around three fourth (301(75.3%)) participants had high health care cost. However only one (0.3%) individual didn't know his/her health care cost.

**Depression Prevalence of the respondents:** The criteria to classify the respondents in to different category of depression is explained as the arbitrary division of PHQ-9 scores into ratings of minimal (0-4), mild (5-9), and moderate to severe depression ( $\geq 10$ ) was used in this study. (35) The finding revealed that 161 patients (40.4%) scored 10 or more on the PHQ-9 scale. However, 92 (23%), 69 (17.25%), 61 (15.25%) and 31(7.75%) had mild, moderate, moderately severe and severe depression respectively. Of the total study participants,

92(23.1%) met the criteria for major depression, 69 (17.3%) for moderate depression and the remaining 239 (59.75%) had no clinically significant depression. The number of participants with clinical depression ( $\geq 10$ PHQ-9 score) was 161 (40.25%) of the total sample. Of the total, 253 (63.25%) participants showed depressive symptoms. Among depressed patients 34.2.25% were male and 29.0% were female.

**Bivariate analysis result of the respondents:** In the multivariable regression analyses, socio-demographic, economic, clinical and psychosocial parameters were significantly associated with PHQ-9 score (depression symptom severity) (See Tables 1, and 2). An increase of one year in current age was associated with a PHQ-9 score increase of 1.111 [P<0.025, AOR (95% CI) = 1.111 (1.057-1.168)]. Participants with an increase of one year in age at which DM occurred showed a protective effect of depression [AOR(95%CI)=0.932(0.885- 0.981)] compared to the counterpart. Marital status, education, and monthly income were found to have statistically significant association with the occurrence of depression symptoms. Those who widowed were three times have the risk to develop depression when compared with those who are single [AOR (95% CI) = 3.079 (0.744-12.740)], Those respondents who attended college/university education were two times have the chance to show depressive symptoms [AOR (95% CI) = 1.757 (0.803-3.843)] and those who are with monthly income of greater than 1401 Birr were 40% protected from developing depression symptoms than counterpart [AOR (95% CI) = 0.556(0.277-1.115)]. Regarding treatment parameters, insulin use compared to the oral hypoglycemic agent (OHA) only or a combination of insulin and OHA was associated with the development of depression symptom. Those who were taking their insulin injection were 35 % protected from developing depression symptoms than their counterparts [AOR(95%CI)=0.659(0.398-1.092)].As the duration of diagnosis of diabetes increased, The PHQ-9 score also increased [AOR (95% CI) = 1.694 (1.077-

2.666)], i.e. persons who were further along in the disease course, patients reported more depression symptoms. Patients with retinopathy diabetic complication were 5.06 times depressed than the counterpart [AOR (95% CI) = 5.026 (2.291-11.026)] and patient with sexual dysfunction had less PHQ-9 scores [AOR(95% CI) = 0.219 (0.119-0.402)]. Other significant characteristics were co-morbidity [AOR (95%CI) = 0.490 (0.268-0.893)], physical disability [AOR (95% CI) = 4.916 (1.610-15.015)], negative life event [AOR (95% CI) = 2.892 (1.758-4.756)], care of DM complication and high health cost [AOR (95% CI) = 0.511(0.310-0.843)]. BMI [AOR (95% CI) = 1.316 (0.362-4.783)] was not significant in bivariate comparisons (Table 2 and 3).

## DISCUSSION

It is difficult to accurately estimate the potential medical care needs and public health burdens of depression in the general diabetic population. However, in spite of the huge impact of co-morbid depression and diabetes on the individual and its importance as a public health problem, little is known about the existence of depression in people with diabetes in Ethiopia. This study has tried to address this issue. The aim of this study was to identify the prevalence of depression and its associated factors including life events among patients with type 2 diabetes attending at Mekelle and Ayder referral hospitals, Mekelle city, Tigray region. This study investigated the prevalence of depression among adult Palestinian type II diabetic patients and identified demographic and disease-related risk factors for depression. Our study showed that 63 % of the screened patients are potential cases of depression. It should be emphasized that high PHQ-9 scores presented in this study are not diagnostic of depression. Rather, high scores are indicative of the presence of depressive symptoms and further clinical consultation to establish a definitive diagnosis of depression is needed. The results of this study showed that overall almost two-thirds of patients reported having depressive symptoms. Of the total study patients, 92(23.1%) met the criteria for major depression, 69(17.3%) for moderate depression and the remaining 147(37%) had no clinically significant depression and the prevalence of moderate to severe depression was significantly higher among male compared to female (34.2% vs 29.0%). Our study reported a much higher prevalence of depression than another study in 33.3 % Bahrain, 34.4% Guinea, 40.2% Palestine, 34% Saudi Arabia, 41% India, 33.1 % Morocco, 40.3 % Nepal (17,19,20,21,22, 23, 24 ) and almost similar with study done in 56% USA (18). This difference might be due to selection of our study participants who might be relatively new cases diagnosed with diabetes, the study settings, and sociocultural difference. In this study, the prevalence of depression was significantly associated with age, marital status, low educational level, no current job, low monthly income, duration of diabetes, diabetes treatment regimen, complication of DM, physical disability, negative life event, care DM complication, co-morbidity. However, a study conducted in Bahrain, USA, Guinea, Palestine, Saudi Arabia, India, Morocco, USA, Nepal the prevalence of depression was significantly associated with gender, BMI, diabetes complication, diabetes treatment, low socioeconomic status, educational level, occupation, co-morbidity, duration of DM, marital status, monthly income, psychological and social relationship (Chaoyang *et al.*, 2008; Igwe *et al.*, 2013; Waleed *et al.*, 2014; Al-Ghamdi, 2004; AmitRaval *et al.*, 2010; Salma Bensbaa *et al.*, 2004; Kahn *et al.*, 2008; KiranNiraula *et al.*, 2013). Moreover, earlier published articles reported the

prevalence rates of depression were significantly higher in females with type 2 diabetes mellitus compared with males with type 2 diabetes mellitus (El Mahalli, 2015)

## Limitation and Strength

The strengths of this study include a high response rate and the inclusive nature of this research as individuals could participate regardless of literacy level. Including patients from different ethnic backgrounds in Mekelle city and outside Mekelle was a further strength. Additionally, rather than having to rely on self-report, health-related information was collected from patients' medical records. Even though the association was temporary, depression and type 2 diabetes mellitus were causally related and deserves attention from clinicians to ensure better management. Also, a reasonable sample size and ascertaining depression with culturally standardized questionnaires are strengths of this study. Since it was the first study in type, it will provide basic information for those who are interested. However, an important limitation of this study was that a psychiatric diagnostic interview which is considered as the gold standard for the diagnosis of depression was not used. Above and beyond, there was the absence of similar study done in Ethiopia health care setting to compare the finding. Due to cross-sectional nature of the study, causal relationships between depression and type 2 diabetes mellitus could not be assumed. Moreover, the translated questionnaires were pre-tested on 10 respondents only this limits validity of the questionnaires used in the studied population.

## Conclusion

This study conclude that the prevalence of depression is higher than reported in other communities like in Bahrain, Guinea, Palestine, Saudi Arabia, India, Morocco, and Nepal. Age, marital status, low educational level, no current job, low monthly income, duration of diabetes, diabetes treatment regimen, complication of DM, physical disability, negative life event, care DM complication, co-morbidity were associated with development of depressive symptoms.

## Recommendation

Based on the finding, it is highly recommended that Health care providers need to focus their efforts on diagnosing, referring and effectively treating co-morbid depression. The hospital is better to prepare/adopt a standardized depression screening tool and inform clinician that they are responsible for screening and treating promptly. There is need of introducing the psychosocial aspect component in the diabetic care plan to reduce the number of depressed or the misrecognized depressed diabetic patients and consequently offer them a better quality of life.

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## REFERENCES

- Abebe, S. M., Berhane, Y., Worku, A. and Assefa, A. 2014. Diabetes mellitus in North West Ethiopia: a community based study. *BMC Public Health*, 14: 97. <http://doi.org/10.1186/1471-2458-14-97>
- Agbir T M, Audu M D, Adebowale T O, Goar S G. 2010. Depression among medical outpatients with diabetes: A cross-sectional study at Jos University Teaching Hospital, Jos, Nigeria. *Ann Afr Med.*, 9:5-10
- Ahamada Safna Mariyam, Mubarak Ali, 2015. A pilot study to assess the prevalence of depression among diabetic patients. *Journal of hospital pharmacy*, 10(3)
- Al-Ghamdi AA. 2004. A high prevalence of depression among diabetic patients at a teaching hospital in Western Saudi Arabia. *Neurosciences (Riyadh)*, 9(2):108-12.
- Ali Khan Khuwaja, Saima Lalani, Raheem Dhanani, Iqbal Syed Azam, Ghazala Rafique and Franklin White, 2010. Anxiety and depression among outpatients with type 2 diabetes: A multicenter study of prevalence and associated factors. *Diabetology & Metabolic Syndrome*, 2;72
- Alioune Camara, Naby Balde, Sostanie Enoru, J. Bangoura, Eugene Sobngwi, et al. 2014. Prevalence of anxiety and depression among diabetic African patients in Guinea: Association with HbA1c levels. *Diabetes and Metabolism, Elsevier Masson*, 4;1 (1), pp.62-
- Amit Raval, Ethiraj Dhanaraj, Anil Bhansali, Sandeep Grover and Pramil Tiwari, 2010. Prevalence & determinants of depression in type 2 diabetes patients in a tertiary care centre. *Indian J Med Res.*, pp195-200
- Atun, R, Davies, JI, Gale, EA et al. 2017. Diabetes in sub-Saharan Africa: from clinical care to health policy. *Lancet Diabetes Endocrinol.* [http://dx.doi.org/10.1016/S2213-8587\(17\)30181-X](http://dx.doi.org/10.1016/S2213-8587(17)30181-X)
- Camara A, Baldé NM, Enoru S, Bangoura JS, Sobngwi E, Bonnet F. 2015. Prevalence of anxiety and depression among diabetic African patients in Guinea. *Diabetes*, 41(1):62-8.
- Chaoyang Li, Earl S. Ford, Tara W. Strine and Ali H. Mokdad, 2008. Prevalence of Depression among U.S. Adults with Diabetes. *Diabetes care*, volume 31, number 1.
- Denise Mann, 2010. Depression and Diabetes Risk. WebMD. Accessed on: Sept. 24, 2015. Available at: <http://www.webmd.com/depression/news>
- Denise Mann. Depression and Diabetes Risk. WebMD. Nov. 22, 2010. Accessed on: Sept. 24, 2015. Available at: <http://www.webmd.com/depression/news>
- Diabetes care. Diagnosis and Classification of Diabetes Mellitus. Available at: <https://doi.org/10.2337/diacare.27.2007.S5>
- El Mahalli AA. 2015. Prevalence and Predictors of Depression among Type 2 Diabetes Mellitus Outpatients in Eastern Province, Saudi Arabia. *International Journal of Health Sciences*, 9:2
- Gill GV, Mbanya JC, Ramaiya KL, Tesfaye S. 2009. A sub-Saharan African perspective of diabetes. *Diabetologia*, 52(1):8-16. doi:10.1007/s00125-008-1167-9. CrossRef Pub MedGoogle Scholar
- Habtewold TD, Mulugeta S and Gebreegziabhere Y. 2015. Associated Factors of Depression among Type 2 Diabetic Outpatients in Black Lion General Specialized Hospital, Addis Ababa, Ethiopia. *Austin J Endocrinol Diabetes.*, 2(1):1032
- Ibrahim A., B. Mubi, B. Omeiza, M. Wakil, I Rabbebe, M Jidda, A Ogunlesi, 2013. An Assessment of Depression and Quality of Life among Adults with Diabetes Mellitus in the University of Maiduguri Teaching Hospital. *The Internet Journal of Psychiatry*, Volume 2 Number 1.
- Igwe MN, R Uwakwe, CA Ahanotu, GM Onyeama, MO Bakare, and AC Ndukuba, 2013. *Afr Health Sci.*, 13(1):68-77.
- Jameel Nasser, Fatima Habib, Majeda Hasan, and Najah Khalil, 2009. Prevalence of Depression among People with Diabetes Attending Diabetes Clinics at Primary Health Settings Bahrain Medical Bulletin, Vol. 31, No.3.
- Joseph N, Unnikrishnan B, Raghavendra Babu Y P, Kotian M S, Nelliyanil M. 2013. Proportion of depression and its determinants among type 2 diabetes mellitus patients in various tertiary care hospitals in Mangalore city of South India. *Indian J EndocrMetab*, 17:681-8
- Kahn LS1, Fox CH, McIntyre RS, Tumieli-Berhalter L, Berdine DE, Lyle H. 2008. Assessing the prevalence of depression among individuals with diabetes in a Medicaid managed-care program. *Int J Psychiatry Med.*, 38(1):13-29.
- Karl Peltzer and Nancy Phaswana-Mafuya, 2013. Depression and associated factors in older adults in South Africa. *Glob Health Action* 6:<http://dx.doi.org/10.3402/gha.v6i0.18871>
- Kiran Niraula, Brandon A Kohrt, Meerjady Sabrina Flora, Narbada Thapa, Shirin Jahan Mumu, Rahul Pathak et al. 2013. Prevalence of depression and associated risk factors among persons with type-2 diabetes mellitus without a prior psychiatric history: a cross-sectional study in clinical settings in urban Nepal. *BMC Psychiatry*, 13:309 <https://doi.org/10.1186/1471-244X-13-309>
- Kroenke K, Spitzer R, Williams W. The PHQ-9: Validity of a brief depression severity measure. *JGIM*, 2001, 16:606-616. Available at: <http://www.agencymeddirectors.wa.gov/Files/depressooverview.pdf>
- Lloyd, Cathy. Depression: screening tools. 2014; Diapedia 61047161602 rev. no. 9. Available from: <http://dx.doi.org/10.14496/dia.61047161602.9>
- Marijke Vroomen-Durning. Type 2 Diabetes and Depression. Every day health. 2012 Accessed on Sept. 24, 2015. Available at: <http://www.everydayhealth.com/type-2-diabetes/type-2-diabetes-and-depression.aspx>
- National Institute of Mental Health, 2011. Depression and diabetes. Science Writing, Press & Dissemination Branch. Accessed on Sept. 24, 2015. Available at: <http://www.nimh.nih.gov/health/publications/depression-and-diabetes/index.shtml>
- National Institute of Mental Health. How are depression and diabetes linked?. NIH Publication. No. 11-50032011. Accessed on Sept. 2015. Available at: <http://www.nimh.nih.gov/health/publications/depression-and-diabetes/index.shtml>
- Nigatu. T. 2012. Epidemiology, complications and management of diabetes in Ethiopia: a systematic review. *J Diabetes*, 4(2):174-80.
- Patient health Questionnaire screener. Screener Overview. Available at: <http://www.phqscreeners.com/select-screener>
- Roy, Tapash Lloyd, Cathy E. Parvin, Masuma Mohiuddin, Galib B. 2012. Rahman, Mosiur. Prevalence of co-morbid depression in out-patients with type 2 diabetes in Bangladesh. *BMC Psychiatry*, 12: 123.
- Salma Bensbaa, Loubna Agerd, Saïd Boujraf, Chadya Araab, Rachid Aalouane, Ismail Rammouz, and Farida Ajdi, 2014. Clinical assessment of depression and type 2 diabetes in Morocco. *J Neurosci Rural Pract*, 5(3):250-253.
- Waleed M Sweileh, Hanadi M Abu-Hadeed, Samah W Al-Jabi and Sa'ed H Zyoud, 2014. Prevalence of depression among people with type 2 diabetes mellitus: a cross sectional study in Palestine. *BMC Public Health*, 14:163
- Waleed M Sweileh, Hanadi M Abu-Hadeed, Samah W Al-Jabi and Sa'ed H Zyoud, 2014. Prevalence of depression among people with type 2 diabetes mellitus: a cross sectional study in Palestine. *BMC Public Health*, 14:163
- Westcott M, Martiniuk AL, Fowler RA, Adhikari NK, Dalipanda T. 2012. Critical care resources in the Solomon Islands: a cross-sectional survey. *BMC Int Health Hum Rights*, 12:1. doi:10.1186/1472-698X-12-1.