

# Influence of perceived social support on depression among Type 2 diabetes patients: a concurrent cross-sectional mixed-method study

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## Abstract

**Background:** There is an established relationship between the concept of social support (SS) and depression among Type 2 diabetes mellitus (T2DM) patients, however, the magnitude, direction, and outcomes of the relationship are not well established in Ghana.

**Objective:** This study was conducted to assess the factors influencing social support and further quantify its association with depression among Type 2 diabetic patients.

**Methods:** Three hundred and seven adults diagnosed with T2DM were sampled from four public healthcare facilities in Ghana. Ten respondents from the sample were further selected for in-depth interviews using the convenience sampling technique. A modified negative binomial model was used to determine significant factors influencing SS scores, while the influence of SS on scores for depression was assessed using a modified generalized negative binomial model. All analyses were performed using Stata 15. The qualitative arm of the study was also analyzed using thematic inductive analyses.

**Results:** Overall, the mean [ $\pm$  standard deviation (SD)] of SS scores among participants was 46.24 ( $\pm$  20.57), while SS domains had mean ( $\pm$  SD) values of 17.69 ( $\pm$  9.23), 11.57 ( $\pm$  8.93), and 16.97 ( $\pm$  9.88) respectively for family support, friends support and significant others. The SS equality of variance test indicated a significant mean difference by sex, educational background, and self-reported income differentials [F-test = 6.46, 6.64, and 4.23 respectively;  $p < 0.05$ ]. A unit increase in SS score had a significant negative relationship with depression across all domains. For the focus model, social support significantly decreased the log count score by 0.002 [ $\beta$  [95% confidence interval (CI)] = -0.002 (-0.002 - 0.000). A unit increase of SS significantly decreased the probability count of depression. Themes from the qualitative data also revealed that participants received SS from family and significant others, but not from friends. Support received from family included emotional support and financial aid.

**Conclusion:** Among T2DM patients with depression, SS had a significant decremental association that could contribute to improved health outcomes. Sex, marital status, educational level, working status, and self-rated income level influenced the SS. We recommend routine screening for psychological symptoms and the involvement of psychologists and counselors in T2DM patient management.

**Keywords:** Diabetes patients, social support, depression

## INTRODUCTION

Globally, it has been estimated that a total of 463 million adults were living with diabetes mellitus in 2019 with a prevalence of 9.3% reported [1]. In Sub-Saharan Africa, 15.5 million adults are estimated to be living with diabetes mellitus (prevalence rate of 6%) and it

is expected to increase by 145% by 2045 [1, 2]. In Ghana, the pattern is similar as nearly 281,000 Ghanaians are now living with diagnosed diabetes mellitus [3] and an overall prevalence rate of 6.46% which is expected to reflect the current burden of diabetes mellitus among the adult population[4]. Diabetes mellitus is a group of metabolic disorders characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. It is classified into 3 categories: type 1 diabetes mellitus (T1DM), gestational diabetes, and type 2 diabetes mellitus (T2DM) with the latter being predominant among adults [5] with an estimated 40.7 million adults living with it [6]. Type

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2 diabetes is defined according to the WHO International Classification of Diseases, 10th revision for T2DM [7]. Fasting Blood Sugar (FBS)  $\geq 7.0$  mmol/l or Random Blood sugar (RBS)  $\geq 11.1$  mmol/L are the thresholds for diagnosis [8]. Type 2 diabetes is associated with obesity, inadequate diet, sedentary lifestyle and increasing urbanization and has significant implications on the psychological health (mainly on depression) of patients and families [9, 10]. Depression is a major psychological condition which occurs in diabetes mellitus and other chronic health conditions and has been associated with negative health outcomes [11, 12]. It is among the top ten leading causes of disability-adjusted life years (DALYs) lost globally and regionally and is projected to be among the top three causes of DALYs lost by 2030 [13]. Evidence suggests that diabetes mellitus interferes with daily self-management which predisposes the individual to develop depression as compared to non-diabetics [14]. Persons with diabetes mellitus may have an approximately 3-fold chance of having depression compared to the general population [15]. The presence of depression in diabetic patients has been linked to several detrimental outcomes including poor glycemic control, increased risk of diabetes mellitus complications, poor dietary compliance and adherence to medications, increased health care expenditures, and increased mortality. It also has a significant impact on the quality of life of patients [11, 14, 16, 17]. In a study carried out in Nigeria, depression was less amongst T2DM patients with social support and clinicians were thus encouraged to explore social support in their management for good health outcome [18]. Amankwah-Poku and colleagues also emphasized the need for psychosocial care to be incorporated into diabetes management in Ghana [19].

Social support is a key component in the life of diabetic patients, and generally for people suffering from chronic diseases. Social support is a broad construct comprising both the social structure of an individual's life and the specific functions served by various interpersonal relationships. The structural aspect of support is determined by assessing social integration, indicating the extent to which the individual is a part of social networks while the functional part is categorised into two domains: perceived support (people's subjective construal of the support they believe to be available to them) and received support (aid rendered by others) [20]. Social support affects health in three ways: regulating thoughts, feelings and behaviour, promoting healthy living fostering an individuals' sense of meaning in life [1] and by facilitating good physical and mental health [21]. The availability of social support plays a major role in the psychosocial adjustment of the patient towards chronic disease. People usually turn to the wider social environment to seek available assistance to cope with the stressful demands of their disease. The perception of a patient, on the availability of social support for his problems, can work therapeutically not only short term, but long term, and makes him feel real support from people who are close to him, even in periods of depression [22].

The Relational Regulation Theory (RRT) seeks to explain the frequently-observed independent effects of social support [23]. It proposes that the effects of social support are exerted in everyday social interactions and that individuals need ongoing relationships to maintain wellbeing (stress-buffering hypothesis) and quality social interactions should predict better wellbeing irrespective of stress levels.

The psychosocial needs of patients with diabetes mellitus are largely unmet with greater emphasis placed on the biological model of treatment in Ghana. The ministry of health standard treatment guidelines places little or no emphasis on the role of psychologist and counsellors in the management of diabetes as part of the multidisciplinary team [24]. Though some efforts have been made to employ psychologist at the regional level, the same cannot be said for the district and community-level interventions. Despite the abundance of national and global research on the concept of social support and depression among diabetic patients, the magnitude, direction and outcome(s) of social support on depression are not well established in Ghana. This present study was conducted to assess the factors influencing social support and further quantify its association with depression among patients with T2DM in four public healthcare facilities across Ghana.

## MATERIALS AND METHODS

### Study design

A mixed-method (both quantitative and qualitative) and cross-sectional study involving patients diagnosed with T2DM was conducted in four public healthcare facilities.

### Study setting and participants

The four facilities [Cape Coast Teaching Hospital, Agona Swedru District Hospital, Winneba Government Hospital and St. Luke's Hospital, Apam] were purposively selected since they are the major health facilities within the region with specialized diabetes clinics. Cape Coast Teaching Hospital runs 3 clinics a week with an average monthly attendance of about 300 patients. The other 3 health facilities run clinics once a week with an average monthly attendance of 150 to 200 patients per facility. The population involved in this study comprised diabetics who were registered with the Diabetic Clinic of the Cape Coast Teaching Hospital, Agona Swedru District Hospital, Winneba Government Hospital, and St. Luke's Catholic Hospital, Apam for the treatment of T2DM. The total population registered in the various diabetic clinics within the period was 1,542. At the Agona Swedru District Hospital and Cape Coast Teaching Hospital, 315 and 737 patients were recorded respectively, 291 patients were recorded at the Winneba Government hospital and 199 patients for St. Luke's Catholic Hospital at Apam.

### Sample size estimation

The study adopted Yamens formula as cited by Adam [25] for calculating sample size from a finite population. It was

Table 1: Sample size stratification and response rate involved in the study

Name of hospital	Total registered diabetic patients	Estimated sample size	Total response	Response rate	In-depth response
Agona Swedru District Hospital	315	65	63	96.9	2
Cape Coast Teaching Hospital	737	151	147	97.3	4
Winneba Government hospital	291	60	58	96.7	2
St. Luke's Catholic Hospital	199	41	40	97.6	2
Total population	1542	316	307	97.2	10

calculated using the formula  $\frac{N}{1+N(e^2)}$  where  $N$  is the known population size ( $n = 1542$ ),  $e$  is the acceptable margin error of 5%. By using the formula, the estimated sample size was 317. However, Montesinos-López and colleagues proposed that, sample size correction factor must be used to calculate true sample size if the finite population size is  $< 10000$  [26]. This was applied by adopting the formula  $\frac{n}{1+\frac{n}{N}}$  where  $n$  is the calculated sample size ( $n = 317$ ) and  $N$  is the finite population. The actual sample size using the formula was 263. Meanwhile, 20% non-response rate was added to have a population sample size of 316. But the overall response rate was approximately 97% accounting for 307 participants involved in this study. The final sample size was 307 participants, out of which 10 participants were selected for in-depth interviews using convenience sampling (Table 1).

### Data collection

Patients were screened during clinic visits and those meeting the criteria were invited to participate in the study. Patients who were willing to participate in the study signed a written consent form after receiving general information about the study. Each participant was interviewed by trained research assistants in English and was indicated in their local dialects. The survey questionnaire comprised 26 items divided into two sections. The first section collected information on the socio-demographic characteristics of the sample. The second section also collected information on the psychosocial variables of depression and social support (SS). A pre-test was conducted before the main study to determine the reliability of the scales employed. This was conducted by administering the questionnaire to T2DM patients ( $n = 25$ ) receiving outpatient care at the Cape Coast Teaching Hospital. The Cronbach alpha for the depression and diabetes scale, the multidimensional scale of perceived social support and diabetes were 0.71, 0.75 and 0.82, respectively. For the in-depth interview, a semi-structured interview guide was used to interview participants across the four clinics. After explaining the rationale for the study, permission was sought from participants to record and save the information. Those who agreed were taken through the interview process. They could express themselves in Fanti,

Two or English language. Questions were asked based on the items on the semi-structured interview guide. Each interview took approximately 15–20 minutes to complete.

### Study variables

Two outcomes referred to as the primary and secondary outcomes were studied. The primary outcome was depression. Depression in the diabetes mellitus self-rating scale developed by Kokoszka [27] was used to measure depression in T2DM patients. The scale is made up of six items and respondents were asked to rate how much they agree with the statements on a five-point Likert scale response format. The scores range from “1 = I fully agree”, “2 = I partially agree”, “3 = Hard to say”, “4 = I partially disagree”, and “5 = I fully disagree”. The overall depression score ranged from 6 - 26 with a Cronbach's alpha test of reliability 0.78. Scores from 0 to 2 indicate low severity of depression, 3 to 10 indicate moderate severity of depression and scores from 11 to 24 is interpreted as high severity of depression [28]. The secondary outcome was social support measured on a multi-dimensional scale developed by Zimet et al. [29] to assess the adequacy of perceived support. The scale has 3 domains (family, friends and significant others social support) with each of the domains having 4 standard questions.

Respondents were asked to rate how much they agree with the statements on a seven-point Likert scale. The scores ranged from “1 = very strongly disagree” to “7 = very strongly agree”. An index variable was generated with a score ranging from 12 - 84. For reliability and internal consistency, Cronbach's alpha test of reliability for SS was very high and of good quality ( $\alpha = 0.89$ ) [30]. Covariate variables involved sex, age group, marital status, educational status, working status, self-rated income, years of illness and complications. Detailed variable definition, type of variable, measurement, and scale of measurement used in this study has been clearly defined in Supplementary Table 1. The semi-structured interview guide was designed to elicit responses to the qualitative part of the study. Since SS is a subjective concept and individual views are nested in context, using the qualitative approach to complement the responses from the quantitative data was essential. The semi-structured interview guide was

designed in themes in line with the purpose of the study. The themes were perceived social support, support from friends, family and significant others as well as themes of their experience of depression.

### Data analysis

Three approaches to data analysis were carried out to analyze the quantitative part of this study. First, bivariate descriptive statistics with equality of variance for testing of the mean difference between covariate variables with the continuous outcome variable. Social support attains statistical significance by reporting the F-test statistic. The second part of the analysis involved estimating the factors that significantly influence the overall SS and component

domains for holistic understanding using a Modified Negative Binomial (NB) model. The NB was applied on the assumptions as proposed by Long and Freese in 2001 [31], by considering the over-dispersed nature of the raw scores of SS and the component domains, where the variance exceeds the mean ( $\sigma^2$  vs  $\mu$  = Overall SS = 423.1 vs 46.2; family support = 85.3 vs 17.7; friends' support 79.7 vs 11.6 and significant others = 97.7 vs 17.0) and a significant p-value Goodness of Fit from Poisson estimation ( $p < 0.0001$ ). This model provided an improved fit to the SS raw score and accounted better for over-dispersion. Last, a Generalized Negative Binomial (GNB) was applied to depression raw scores (as our focus model) due to the dispersion nature where the mean exceeds the variance ( $\mu$

Table 2: Descriptive characteristics and social support equality variance test among diabetic patients with depression

Co-variate	Respondents n (%)	Social support		Social support domains					
		Mean (SD)	F-test	Family support		Friends support		Significant others	
				Mean (SD)	F-test	Mean (SD)	F-test	Mean (SD)	F-test
Overall		46.24(20.57)		17.69(9.23)		11.57(8.93)		16.97(9.88)	
Sex			6.46*		3.72		8.84**		1.29
Male	70(22.80)	51.88(21.47)		19.47(8.61)		14.28(8.63)		18.13(9.59)	
Female	237(77.20)	44.57(20.04)		17.16(9.36)		10.77(8.87)		16.63(9.96)	
Age group			1.24		0.33		1.49		0.60
<50	52(16.94)	49.29(21.91)		18.35(8.94)		13.04(9.63)		17.90(9.43)	
≥50	255(83.06)	45.62(20.27)		17.56(9.31)		11.27(8.77)		16.78(9.98)	
Marital status			2.45		3.19*		0.92		1.78
Never married	24(7.82)	43.33(20.44)		14.96(9.48)		10.83(9.16)		17.54(9.43)	
Married	168(54.72)	49.03(20.79)		18.71(9.10)		12.33(9.11)		17.98(9.87)	
Divorced	33(10.75)	41.30(19.31)		14.09(8.87)		10.87(8.21)		16.33(10.31)	
Widowed	82(26.71)	43.35(20.10)		17.84(9.21)		10.51(8.75)		15.00(9.72)	
Educational status			6.64***		4.53***		4.80***		2.84*
None	81(26.38)	38.94(19.22)		15.30(9.51)		8.87(8.01)		14.76(10.27)	
Basic	84(27.36)	49.12(19.45)		17.67(9.18)		13.16(9.26)		18.31(9.34)	
Secondary	103(33.55)	46.43(20.88)		18.25(9.20)		11.47(8.89)		16.71(10.23)	
Tertiary	39(12.70)	54.61(20.70)		21.23(7.69)		14.00(8.91)		19.38(8.52)	
Working status			1.23		7.67***		1.04		0.93
Unemployed	99(32.25)	43.30(20.19)		15.26(9.31)		10.51(8.83)		17.53(10.00)	
Self-employed	138(44.95)	46.64(20.63)		17.70(9.37)		12.05(9.12)		16.88(9.59)	
Public servant	37(12.05)	51.0(21.00)		19.67(7.75)		13.13(8.75)		18.19(9.61)	
Other	33(10.75)	48.03(20.55)		22.70(7.60)		11.00(8.57)		14.33(10.98)	
Self-rated income			4.23*		5.70**		1.94		2.26
Low	161(52.44)	43.06(20.47)		16.45(9.28)		11.09(8.80)		15.91(9.75)	
Medium	140(45.60)	49.52(20.15)		19.40(8.86)		11.84(9.01)		18.28(9.85)	
High	6(1.95)	55.00(23.47)		21.83(9.30)		18.17(8.93)		15.00(12.10)	
Duration of disease			0.83		1.69		0.00		0.79
≤1	37(12.05)	49.84(23.98)		20.00(9.31)		11.51(9.91)		18.32(10.31)	
2-10	194(63.19)	45.12(20.43)		17.06(9.26)		11.61(8.74)		16.45(9.99)	
≥11	76(24.76)	47.34(19.10)		18.17(9.04)		11.51(9.02)		17.66(9.43)	
Complications			0.53		3.17*		1.20		1.15
Other conditions	84(27.36)	47.82(21.59)		16.67(9.37)		12.90(9.42)		18.23(9.25)	
Eye condition	144(46.91)	44.98(20.77)		17.14(9.52)		11.09(8.61)		16.75(10.06)	
Loss of feeling	79(25.73)	46.85(19.15)		19.77(8.31)		11.04(8.91)		16.04(10.20)	

\*p value notation: \*<0.05, \*\*<0.005, \*\*\*<0.001; SD, standard deviation

Table 3: Covariates influencing social support among diabetic patients with depression

Co-variate	Combined domains β [95% CI]	Social support domains		
		Family support β [95% CI]	Friends support β [95% CI]	Significant others β [95% CI]
Sex				
Female	Ref	Ref	Ref	Ref
Male	0.15[0.03-0.26]**	0.13[0.001-0.25]*	0.28[0.11-0.46]**	0.09[-0.06-0.23]
Age group				
<50	Ref	Ref	Ref	Ref
≥50	-0.08[-0.21-0.05]	-0.04[-0.19-0.10]	-0.14[-0.36-0.07]	-0.06[-0.22-0.09]
Marital status				
Married	Ref	Ref	Ref	Ref
Never married	-0.12[-0.31-0.07]	-0.22[-0.48-0.03]	-0.13[-0.47-0.22]	-0.02[-0.25-0.20]
Divorced	-0.17[-0.34--0.00]*	-0.28[-0.51--0.06]*	-0.12[-0.40-0.15]	-0.10[-0.32-0.13]
Widowed	-0.12[-0.25--0.00]*	-0.05[-0.18-0.08]	-0.16[-0.37-0.05]	-0.18[-0.34--0.01]*
Educational status				
None	Ref	Ref	Ref	Ref
Basic	0.23[0.09-0.37]***	0.14[-0.03-0.31]	0.39[0.15-0.64]**	0.21[0.02-0.40]
Secondary	0.17[0.04-0.31]*	0.18[0.01-0.34]*	0.26[0.01-0.50]*	0.12[-0.07-0.31]
Tertiary	0.34[0.18-0.50]***	0.33[0.15-0.50]***	0.46[0.18-0.73]***	0.27[0.07-0.47]**
Working status				
Public servant	Ref	Ref	Ref	Ref
Unemployed	-0.16[-0.32--0.00]*	-0.25[-0.42--0.08]**	-0.22[-0.49-0.05]	-0.04[-0.24-0.16]
Self-employed	-0.09[-0.23-0.06]	-0.11[-0.25-0.05]	-0.09[-0.33-0.16]	-0.07[-0.27-0.12]
Other	-0.06[-0.25-0.13]	0.14[-0.02-0.31]	-0.18[-0.51-0.16]	-0.24[-0.54-0.07]
Self-rated income				
Low	Ref	Ref	Ref	Ref
Medium	0.14[0.04-0.23]**	0.19[0.07-0.31]***	0.06[-0.11-0.24]	0.14[0.01-0.26]*
High	0.24[-0.07-0.56]	0.31[-0.02-0.63]	0.49[0.11-0.87]**	-0.06[-0.66-0.53]
Years of illness				
≤1	Ref	Ref	Ref	Ref
2-10	-0.10[-0.26-0.07]	-0.16[-0.32-0.01]	0.01[[-0.28-0.30]	-0.11[-0.31-0.09]
≥11	-0.05[-0.23-0.13]	-0.09[-0.28-0.09]	-0.00[-0.32-0.32]	-0.04[-0.25-0.18]
Complications				
Other conditions	Ref	Ref	Ref	Ref
Eye condition	-0.06[-0.18-0.06]	0.03[-0.12-0.18]	-0.15[-0.35-0.05]	-0.09[-0.23-0.06]
Loss of feeling	-0.02[-0.15-0.11]	0.17[0.02-0.32]*	-0.16[-0.39-0.08]	-0.13[-0.30-0.05]

\*β, normalized coefficient from Negative Binomial regression; *p* value notation, \* ≤ 0.05, \*\* ≤ 0.005, \*\*\* ≤ 0.001; Ref, reference category; all estimates at 95% confidence level; CI, confidence interval.

vs  $\sigma^2 = 16.3$  vs 12.7) by adjusting for significant factors influencing SS. Jain and Consul in 1971 proposed that, when a variance is less than the mean, GNB is appropriate to apply (14). For model 2, due to the dummy nature of the variable, Poisson, Logistic and Probit Regression were applied to have a holistic understanding of influencing factors. Model 3 adopted Ordinal Logistic Regression based on the ordinal nature of the variable. Robust standard error estimations were highly considered in our analytical procedure to address the problem of errors that are not independent and identically distributed. This method of analysis does not change the normalized coefficient;

however, the standard errors and significance tests were modified. Stata 15 was used to perform the analyses and a  $p \leq 0.05$  was deemed significant. Inductive thematic analysis was used in analyzing the in-depth interview data. It emphasizes pinpointing, examining, and recording patterns (or themes) within data. Themes are patterns across data set that are important for the description of a phenomenon. The analysis consisted of the following stages: transcribing and familiarization with the data, reading, re-reading and noting down initial ideas, searching for themes, and producing the report [33].



## RESULTS

Most of the patients involved in the study were females (77.19%,  $n = 237/307$ ), with the majority of respondents aged  $\geq 50$  yr. (86.06%,  $n = 255/307$ ). Majority were married (54.7%,  $n = 168/307$ ), attained secondary level education (33.5%,  $n = 103$ ), and were self-employed (44.9%,  $n = 138$ ). Most participants rated their income as low (52.4%). Duration of T2DM within 2 - 10 years was reported by 63.20% ( $n = 194/307$ ) of participants (Table 2). Overall, the mean ( $\pm$  SD) of SS among participants was 46.24 ( $\pm 20.57$ ) while the component SS domains had mean [ $\pm$  standard deviation (SD)] scores of 17.69 ( $\pm 9.23$ ), 11.57 ( $\pm 8.93$ ) and 16.97 ( $\pm 9.88$ ) respectively for family support, friends support and significant others (Table 1).

Social support equality of variance test indicated a significant mean difference for sex, educational background, and self-reported income categories [F-test = 6.46, 6.64 and 4.23 respectively;  $p < 0.05$ ]. The results showed that males received more SS compared to females [Males vs Females = 51.88 (21.47%) vs 44.57 (20.04%)]. Higher educational status had a higher SS score compared with other levels of education and higher self-rated income depicted higher SS compared with other ratings (Table 2).

Table 4: Pairwise biserial correlation assessing the relationship between social support and depression

Depression model	Social support	P value
Depression-Focus model	-0.151	0.008
Depression-Mean category	-0.175	0.002
Depression-Ordinal scale	-0.171	0.003

\* $p, p$  value

Specific domains of SS indicated that the mean difference in scores for marital status, level of education, working status, self-rated income, and complications of illness for family support were statistically significant, while the mean difference in scores for sex and level of education was significant for friends to support. For significant others, only the level of education showed a significant difference in mean scores for depression (Table 2). Negative binomial estimation showed that sex, marital status, educational level, working status, and self-rated income level significantly influenced the overall SS. Sex depicts an increased probability score of 0.15 among males compared with females [ $\beta$  (95% CI)] = 0.15 (0.03 - 0.26). The tertiary

Table 5: Generalized negative binomial showing the association between social support and depression among diabetic patients with depression

Co-variate	Model 1: Focus model	Model 2: Mean category			Model 3: Ordinal
	Modified GNB a $\beta$ [95%CI]	Modified Poisson a $\beta$ [95%CI]	Modified Logistic aOR[95%CI]	Modified Probit a $\beta$ [95%CI]	Modified Ordinal Logistic aOR[95%CI]
Social support	-0.002[-0.002--0.000]**	-0.01[-0.01--0.003]**	0.98[0.97-0.99]**	-0.01[-0.02-0.003]**	0.98[0.97-0.99]**
Sex					
Female	Ref	Ref	Ref	Ref	Ref
Male	0.04[-0.01-0.09]	0.16[-0.07-0.38]	1.47[0.82-2.66]	0.24[-0.12-0.61]	1.47[0.85-2.56]
Marital					
Married	Ref	Ref	Ref	Ref	Ref
Single	0.01[-0.07-0.11]	0.02[-0.36-0.3]	1.04[0.41-2.66]	0.02[-0.54-0.59]	1.41[0.55-3.61]
Divorced	-0.08[-0.18-0.02]	-0.07[-0.41-0.26]	0.84[0.37-1.89]	-0.11[-0.61-0.39]	0.81[0.37-1.76]
Widowed	-0.02[-0.08-0.04]	-0.08[-0.33-0.17]	0.83[0.45-1.51]	-0.11[-0.48-0.26]	0.97[0.54-1.75]
Education					
None	Ref	Ref	Ref	Ref	Ref
Basic	-0.07[-0.14-0.01]	-0.33[-0.61--0.05]*	0.44[0.22-0.86]*	-0.50[-0.91--0.09]*	0.43[0.23-0.81]**
Secondary	-0.07[-0.14--0.001]*	-0.31[-0.57--0.05]*	0.45[0.23-0.88]*	-0.49[-0.49--0.08]*	0.47[0.25-0.89]**
Tertiary	-0.08[-0.17-0.01]	-0.33[-0.72-0.05]	0.42[0.15-1.20]	-0.53[-1.17-0.11]	0.33[0.54-1.75]
Occupation					
Public sector	Ref	Ref	Ref	Ref	Ref
Unemployed	-0.03[-0.11-0.05]	-0.25[-0.61-0.12]	0.53[0.19-1.42]	-0.39[-0.99-0.21]	0.54[0.20-1.46]
Self employed	-0.09[-0.15--0.01]*	-0.26[-0.59-0.07]	0.52[0.21-1.31]	-0.40[-0.96-0.16]	0.42[0.17-1.02]
Other	-0.02[-0.10-0.05]	-0.08[-0.45-0.29]	0.83[0.28-2.42]	-0.12[-0.76-0.52]	0.83[0.31-2.20]
Self-rated income					
Low	Ref	Ref	Ref	Ref	Ref
Medium	0.01[-0.03-0.07]	0.11[-0.12-0.34]	1.29[0.75-2.23]	0.15[-0.18-0.48]	1.29[0.77-2.17]
High	-0.02[-0.25-0.20]	0.03[-0.91-0.96]	1.05[0.14-7.77]	0.02[-1.14-1.19]	1.21[0.17-8.51]

\*GNB, Generalized Negative Binomial regression;  $p$  value notation, \* $\leq 0.05$ , \*\* $\leq 0.005$ , \*\*\* $\leq 0.001$ ; Ref, reference category; all estimates at 95% confidence level

level of education shows higher advantage with an increased probability count of 0.34 [ $\beta$  [95% confidence interval (CI)] = 0.34 (0.18 - 0.50)]. Meanwhile, divorced and widowed participants have a significantly decreased probability count of 0.17 and 0.12 respectively [ $\beta$  (95% CI) = -0.17 (-0.34 - 0.00) and -0.12 (-0.25 - 0.00)] respectively (Table 3).

The higher level of education had a significant influence on all SS domains. Sex had a significant influence on family and friends' support. Males had a significantly increased probability count of 0.13 and 0.28 for family and friends support [ $\beta$  (95% CI) = 0.13 (0.001 - 0.25) and 0.28 (0.11 - 0.46) respectively. Individuals with a tertiary level of education had a significant probability count of 0.33 on family support, 0.46 on friends support and 0.27 on significant others. Meanwhile, the self-rated income also had a significant influence across all SS domains. Participants with low self-rated income were at disadvantage (Table 3). Association between depression and social support was assessed using pairwise and biserial correlation test statistics. The estimate showed that from the focus model to ordinal scale measurements of depression, there was a significant negative relationship between depression and SS ( $p < 0.05$ ) (Table 4). Adjusting for a

potential confounding effect on the influence of SS on depression, estimates indicate that SS has a significant association with depression across all categories of depression. An increased unit of SS score had a significant negative outcome on depression across all domains. For the focus model depression score, social support had a significantly decreased log count score of 0.002 [ $\beta$  (95% CI) = -0.002 (-0.002 - 0.000)]. In all the other categories of depression, a unit increase in SS significantly decreased the probability count of depression (Table 5). The themes from qualitative data reveal that participants received social support from family and significant others, but not from friends. Support received from family included emotional support and financial aid (Table 6). The support received from significant others was encouragement in coping with their condition as well as advice and guidance on their dietary recommendations. These support the findings from the quantitative analysis and throws more light on the mechanism underpinning such findings. Additionally, it was observed that the diabetic clinics were seen not only as a place to receive medical care for their treatment but also as a supportive environment where they socialized with other people living with T2DM (Table 6). All the respondents stated that they did not receive any support from their friends. The majority ( $n = 7$ ) of them asserted

Table 6: Themes from the in-depth interviews on sources of social support received by diabetics (T2DM) with depression

Theme	Emergent Codes/Sub- codes	Meaning	Evidence/Extracts
Family support	Emotional needs	Participants indicated receiving emotional support from their children.	"My children are very supportive, for my son I don't know how he is able to tell when I am worried; he will sit by me and crack jokes and before I realize am laughing uncontrollably and all my worries are gone" (Respondent 5).
	Financial needs	Participants received financial assistance from their family to help them cater to their medical bills	"I am a retired worker all my bills are catered for by my children, sometimes I feel I am worrying them" (Respondent 3)
Friends' support	Lack of support from friends	Participants noted that friends are less dependable in offering support	"no man can help you more than you can help yourself; human beings can deceive you but for God, he has always been there for me" (Respondent 6).
Spiritual belief/value	Dependence on God	Others affirmed they would depend on God	"My source of support comes from God; in Him, I have hope and believe that I will be healed" (Respondent 7).
Significant others	Support from community members		"I get help from other people in the community especially with the diet: I have people in the community who sell food and they have family members who have diabetes so they give me directions on the type of food that will be helpful" (Respondent 1)
Support groups			"We interact with each other and the nurses also provide us with useful information which helps us a lot." (Respondent 8)
			"I get to relate with other people who are having the same condition" (Respondent 4)

that they do not have friends. Those who had friends did not share their concerns with them and do not receive any support from them. They rely on God for emotional support and healing, believing that “He is All Sovereign” (Table 6). They ascribed to “God as their Comforter” in all their difficult times and asserted that “No man can help you more than you can help yourself; human beings can deceive you but for God, he has always been there for me” (Respondent 6). Therefore, the theme ‘Spiritual belief/value’ was an emergent theme, resulting from lack of or inadequate support expected from friends which did not materialize. God was regarded as reliable and able to bring healing as indicated by one of the respondents: “My source of support comes from God; in Him, I have hope and believe that I will be healed” (Respondent 7).

## DISCUSSION

This study demonstrates that patients with a confirmed diagnosis of T2DM received some form of social support and experienced depression. Social support was seen to be significantly influenced by sex, marital status, educational level, working status, and self-rated income level of diabetics. Interestingly, males received more social support compared to females. This is consistent with the study by Tol et.al. [34] who found significant relationships between sex, marital status, age and family social support. Educational status and self-reported income levels of study participants also determined the type of social support received. Those with higher education received support from friends, family and significant others, while study participants who reported high levels of self-rated income [ $> 1500$  Ghana cedis (GHC) a month — \$358.8 at a rate of 1 \$ to GHC 4.1798] received support from family and friends. Patients with low self-rated income ( $< \text{GHC } 500$  a month — \$ 119.6 at a rate of \$ 1 to GHC 4.1798) received low social support from family, friends and significant others. This finding reaffirms that among socio-economically disadvantaged persons, poor social networks and social support are more frequent [35].

Similar findings were reported in a study in Europe that investigated social support and health in diabetes mellitus [36]. This is considerably significant as about half (52%,  $n = 161/307$ ) of the respondents and majority of Ghanaians fall within this low-income bracket. This is in consonance with the findings of the 2015 Ghana living standards survey [37] which indicates that apart from the Greater Accra and Ashanti region all other regions in Ghana have per capita expenditure lower than the national average. Most of the study participants had been diabetic for 2 - 10 yr. and had developed ocular complications. This could be attributed in part to lack of financial support for treatment which resulted in their inability to cope with the requirement of care. Similarly, easy access to diabetic clinics also influenced their decision not to attend clinics early, leading to most of them reporting to the health care facility late when complications had already set in. This study found that SS had a significant association with depression across all

categories of depression and that an increased unit of SS score had a significant decreased impact on depression across all domains. This finding was consistent with findings from other studies within Ghana and South Africa [38–40]. In a systematic review to examine the impact of social support on clinical outcomes in adults with T2DM, participants having higher social support levels experienced fewer depressive symptoms and diabetes-related symptoms [41]. Also, an inverse relationship has been observed between social support for disease management and depression [42].

Although research consistently indicates that chronically-ill patients report more depressive symptoms than healthy individuals, those who receive considerable social support have a lower risk for the development of subsequent depression [43]. Additionally, another study suggested a bi-directional relationship between social support and depression among diabetics. In a study that examined three possible models of the interrelationship among depression, social support and diabetes-related medical symptoms, significant relationships were revealed between depression, social support and diabetes-related outcome with mediation analysis indicating that social support provided in the management of diabetes-related medical symptoms fully accounted for the adverse effect of depression [44]. A bi-directional relationship between SS and depression was further suggested noting that while both diabetes-related medical symptoms and social support independently contributed to depression, depression in diabetics also contributed to lower social support. This current study, however, did not establish that and may be explored in future studies.

Additionally, findings from the qualitative arm of this study revealed that the supportive environment (found in the Diabetic clinics) was a source of social support and helped to improve the emotional states of the patients. They were provided basic education on the condition and self-care or management practices and how to cope with complications. Additionally, they engaged with their peers and shared experiences and best practices in coping with their conditions. However, no professional counselor or clinical psychologist was available to provide professional psychosocial support for them. This finding is congruent with the major premise of the symbolic interactionist perspective on social support that the regularization of social interaction, rather than the provision of support per se, is responsible for the maintenance of well-being [45]. Thus, according to the symbolic interactionist perspective, our social environments directly promote health and wellbeing by providing people with a way of making sense of the self and the world. The argument that two broad categories of supporters; significant others and experiential similar others, who specialize in supplying different types of support to distressed individuals is implied [46]. Furthermore to this, the finding is in consonance with RRT which suggest that people regulate their affect, thought and action through ordinary yet affectively consequential



conversations and shared activities, rather than through conversations about how to cope with stress [47]. Type 2 diabetes patients sharing stories of their daily engagements during their treatment provides this positive effect on psychological well-being.

Though the study did not seek to assess the role of spirituality, the theme ‘Spiritual belief/value’ was emergent, apparently resulting from lack of or inadequate support expected from friends. God was regarded as reliable and able to bring healing. This finding agrees with a study by Salehi and colleagues [48] who found that resorting to Imams, God inflicting disease as a reward, fear of God’s punishment, believing in miracles, being closer to God, believing in the mercy of God, returning to religious practice, feeling of enjoying life, and knowing that the disease is the atonement of sins were the contributing factors to the healing process. Type 2 diabetes patients’ belief in God was reinforced by their experience of unreliable support from friends and significant others. The limitations to the present study include the facility-based setting, which self-selects the participants as those who might have access to healthcare. However, this was done to maximize the opportunity of attaining the sample size required for the study. A community-based study might have escalated logistics required for the study, although it might have identified potential patients who need to receive either non-pharmacological or pharmacological treatment. It is hoped that this can be explored in future studies. Additionally, the measures of depression used is a screening tool hence could only suggest levels of severity of depressive symptoms but cannot be used as a clinical tool for diagnostic purposes. Further, the duration of the disease was self-reported and may not reflect the status as captured in their folders.

### Conclusion

This study corroborates the general assertion that there is a significant association between SS and depression among patients with T2DM. Among diabetics with depression, an increase of SS was associated with a reduced risk of depression, which could contribute to better health outcomes. Social support was influenced by sex, marital status, educational level, working status, and self-rated income level of patients. These findings have implications for the management of T2DM patients in Ghana. Exploring opportunities for social support could have a potentially positive impact on treatment, preferably within the clinic setting or related support groups. This should help avert the psychological trajectory of the condition and improve clinical outcomes. There is a need for the involvement of clinical psychologist in the treatment and management of T2DM at the district level to assist in early identification and management of psychological symptoms among T2DM patients.

**Supplementary Table 1:** Variable description, measurements, and scale of measurements  
(Find attached below)

## DECLARATIONS

### Ethical considerations

Ethical approval was obtained from the Ethical Review Board of the University of Cape Coast (Approval ID No: ED/CHP/14/00 12) and clearance to conduct the study was also obtained from the various hospitals involved in the study. Informed consent was obtained from all participants before data collection.

### Consent to publish

All authors consented to the publication of the manuscript.

### Funding

None

### Competing Interests

No conflict of interest was reported by the authors.

### Author contributions

GE-F and JT developed the concept. JT and GE-F analyzed the data. JT, GE-F, EAU, AD, SMS and SM contributed to writing the first draft manuscript. AEY reviewed the manuscript for intellectual content. All the authors reviewed the final version of the manuscript before submission.

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### Availability of data

Data is available upon request to the corresponding author.

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Supplementary Table 1: Variable description, measurements, and scale of measurements

Variable	Type of variable	Description	Measurement	Scale of measurement
Depression	Primary outcome variable	Respondent were asked to rate how much they agrees with the statements on a five-point likert scale response format	“1 = fully agree”, “2 = partially agree”, “3 = hard to say”, “4 = I partially” “disagree”, and “5 = fully disagree” Index variable with raw scores	Discrete Binary Ordinal
Social support	Primary outcome variable	Respondent were asked to rate how much they agrees with the statements on a seven- point likert scale response format	“1 = very strongly disagree” to “7 = very strongly agree” Index variable with raw scores	Discrete Binary Ordinal
Sex of participant,	Explanatory variable	Sex definition of the participant	Male or Female	Binary
Age group	Explanatory variable	Age group of participants as at data collection	<50 and >50 yr.	Categorical
Marital status	Explanatory variable	Current marital status of participants	Married, never married, divorced, and widowed	Categorical
		marital status, educational status, working status, self-rated income, years of illness and complications		
Educational level	Explanatory variable	Highest educational level of participants	None, primary, secondary, and tertiary	Categorical
Working status	Explanatory variable	The type of work participants is engaged in	Public servant, unemployed, self-employed, and other	Categorical
Self-rated income	Explanatory variable	Respondents were asked to rate their income status	Low, medium and high	Categorical
Years of illness	Explanatory variable	Respondents were asked how long they have lived with their illness	Raw ages	Discrete Categorical
Complications	Explanatory variable	Complications of diabetes condition	Categorized into eye condition, loss of feeling and others (hypolycaemia, hyperglycaemia ulcers and kidney problems)	Categorical