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International Journal of Collaborative Research on Internal Medicine & Public Health
Vol. 3 No. 1 (January 2011)

Special Issue on “Chronic Disease Epidemiology”
Lead Guest Editor: Professor Dr. Raymond A. Smego
Coordinating Editor: Dr. Monica Gaidhane

International Journal of Collaborative Research on Internal Medicine & Public Health (IJCRIMPH)

ISSN 1840-4529 | Journal Type: Open Access | Volume 3 Number 1

Journal details including published articles and guidelines for authors can be found at:

<http://www.iomcworld.com/ijcrimph/>

To cite this Article: Rahman M, Rahman MA, Flora MS, Rakibuz-Zaman M. Depression and associated factors in diabetic patients attending an urban hospital of Bangladesh. *International Journal of Collaborative Research on Internal Medicine & Public Health*. 2011; 3:65-76.

Article URL: <http://iomcworld.com/ijcrimph/ijcrimph-v03-n01-07.htm>

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Paper publication: 20 February 2011

International Journal of Collaborative Research on Internal Medicine & Public Health

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Depression and associated factors in diabetic patients attending an urban hospital of Bangladesh

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ABSTRACT

Introduction: Diabetes mellitus is frequently associated with co-morbid depression, contributing double burden to the individual and society.

Aims & Objectives: To find out the proportion of depression among patients with type 2 diabetes mellitus and to determine factors associated with it.

Methods: A cross sectional study was conducted among 178 patients with type 2 diabetes mellitus attending Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM), Dhaka. Data were collected through face-to-face interview and reviewing documents. Depressive symptoms were measured using Centre for Epidemiological Studies Depression Scale; considering score 16-21 as mild to moderate depression and score ≥ 22 as severe depression.

Results: The proportion of depression among the study population was 34.8% which included 14.6% with mild to moderate depression and 20.2% with severe depression. Both mild to moderate and severe depression were more common in females and among singles. Insulin users were six times more likely to develop severe depression (OR, 6.33 with 95% CI, 1.75 to 22.89) than users of oral anti-diabetic agents. Glycemic status measured by HbA1c was the best predictor. Both poor and fair glycaemic control were associated with any level of depression. Patients with poor glycemic control had odds ratio of 4.75 for mild to moderate depression (95% CI=1.37-16.41) and 10.39 for severe depression (95% CI,=3.66-29.43) in reference to good glycemic control. Patients with fair glycemic control were four times more likely to have mild to moderate depression (OR, 4.31 with 95% CI, 1.57 to 11.85) and severe depression (OR, 3.77 with 95% CI, 1.42 to 10.02) than patients with good glycemic control.

Conclusion: Depression was identified as a significant health problem among patients with type 2 diabetes mellitus. Both diabetes and depression should be considered simultaneously during treatment plan.

Keywords: Bangladesh, depression, HbA1c, type 2 diabetes mellitus

Introduction

Diabetes mellitus is being increasingly recognized as a serious global health problem.

In 2000, Bangladesh had 3.2 million people with diabetes and was listed globally at 10th, which would occupy the 7th position with 11.1 million in 2030.¹ The prevalence of type 2 diabetes in Bangladesh was 5.2% (rural 4.3%,

urban 6.9%) in 1994-95² and increased to 11.2% (urban)³ and 6.8% (rural) in 2003-04.⁴ Diabetes mellitus is frequently associated with co-morbid depression, contributing double burden to the individual and society.⁵ These associations may be related to increased risk of depressive symptoms in individuals with diabetes, increased risk of type 2 diabetes in individuals with depressive symptoms, or both.⁶ At any single point in time, approximately one-third of diabetic patients have symptoms of depression severe enough to warrant treatment.⁷ However, depressed adults have 37% increased risk of developing type 2 diabetes mellitus.⁸

Depression plays an important role in non-adherence to medical treatment. Therapeutic compliance, especially diligence in maintaining dietary restrictions and exercise, often declines in depressed patients for their irregular life styles and loss of interest in health.⁹ This further leads to poor glycaemic control, increased diabetes-related complications, increased diabetic symptoms burden¹⁰⁻¹² and ultimately increased health care use and costs.¹³ Both minor and major depression are strongly associated with increased mortality in patients with type 2 diabetes.^{14,15} On the other hand, support to encourage psychological well-being would be expected to reduce not only the occurrence of psychological problems but also metabolic problems and complications.¹²

Despite the specific relevance of depression to diabetes and its serious impact on the disease and health care system, it is estimated that only one-third of people with both diabetes and major depression are recognized and appropriately treated for both disorders.¹⁶ Clearly identifying diabetic patients with co-morbid depression, knowledge about effective psychological support and improving access to effective treatments should be public health and research priorities. This important association between type 2 diabetes mellitus and depression and its consequences on the

outcome of diabetes mellitus were observed by studies, conducted in western populations^{5,7,9}. A few studies were done in Asia.¹⁷ Data on depression in the general population in South Asia, including Bangladesh are inadequate and so in type 2 diabetic patients. So far reviewed, only one such study was found which was done in rural Bangladeshi.¹⁸ Diabetes is more prevalent in urban than in rural population² and they are frequently exposed to a number of unfavorable conditions which make them vulnerable to depression. Therefore, this study was designed to explore the situation in urban population of Bangladesh.

Subjects and Methods

A cross-sectional study was undertaken from January to June 2009 in the Outpatient Department (OPD) of Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM), which is the largest tertiary diabetic care hospital in Dhaka and provides services to large number of patients with diabetes mellitus. Adult patients (age ≥ 18 years) with type 2 diabetes mellitus selected by convenient sampling were invited to participate in the study and 93% agreed. Patients were diagnosed as diabetic by the attending physicians of BIRDEM as per American Diabetic Association guidelines. Those who had psychiatric problems before diagnosis of diabetes, family history of depression, been taking anti-depressant drugs and seriously ill were excluded from the study. Estimated sample size taking predicted prevalence 29.7%¹⁸ at 95% confidence level with 7% absolute precision and considering 10% non response rate was 181. Three samples were excluded during data analysis for having missing data. Finally, data of 178 patients with type 2 diabetes mellitus were analyzed.

The protocol was approved by the Ethical Committees of National Institute of Preventive and Social Medicine (NIPSOM) and BIRDEM. Informed written consent was obtained from each individual prior to data collection. Data were collected by interview, record review and anthropometry. A semi-structured questionnaire was developed based on Centre for Epidemiological Studies Depression (CES-D) scale. The CES-D contains 20-items using a four-point rating scale. Scores range from 0 to 60, with higher score indicating more severe depressive symptoms.¹⁹ CES-D has 61.4% sensitivity and 81.0% specificity. Positive and negative predictive values of the scale were 57.5% and 83.3%, respectively.²⁰ A score of 16 or greater differentiated depressed from non-depressed adults¹⁹ and cut-off 22 was used to distinguish severity of depression; a score 16-21 for mild to moderate depression and ≥ 22 for severe depression.^{15,21} Cronbach's α of Bangla version of CES-D was calculated 0.89, which indicated sufficient internal consistency. Each questionnaire took approximately 35 to 40 minutes to fill up.

Depression score was constructed by summation of all 20 items of depression score. As depression score did not follow normal distribution, for statistical analysis log transformation of the depression score was done and geometric mean was used for comparison. To determine glycemic status, HbA_{1c} level was categorized as HbA_{1c} level < 7% as good glycemic control, 7 to 8 fair glycemic control and > 8% considered as poor glycemic control. Statistical comparisons between different groups were made using t-test, ANOVA for mean scores and chi-square tests for level of depression. The odds ratio (OR) with 95% confidence interval (CI) for risk factors was calculated. All the tests were two tailed and $p < 0.05$ was considered to be statistically significant. Multiple logistic regressions were performed to adjust for potential confounding factors.

Results

Among 178 respondents, 51% were male. Their mean age was 54.96 years (SD 9.76 years). Most of them were from urban area (72%) and married (82%). Average duration since detection of diabetes was 10.10 ± 6.15 years. Mean BMI of the patients was 25.22 (SD 3.25). Majority of them were treated with oral anti-diabetic agents (60.5%). Average HbA_{1c} level (%) was 7.2 ± 0.97 and 36.5% of the respondents presented with complications of diabetes (Table 1).

Mean depression score was calculated 10.50 with SD 9.08. The proportion of depression among the study population was 34.8% (CES-D score ≥ 16) which included 20.2% with severe depression (CES-D score ≥ 22) and 14.6% with mild to moderate depression (CES-D score 16 to 21).

Mean depression score found higher among females ($p < 0.001$), singles ($p < 0.001$), less educated ($p < 0.005$) and housewives ($p < 0.005$) (Table 1). Duration since detection of diabetes mellitus showed positive correlation with depression score ($r = 0.171$, $p < 0.05$). Depression score was also higher among insulin users than those orally treated ($p < 0.005$) and in those used syringe for insulin administration than pen users ($p < 0.05$). Presence of diabetic complications was also associated with higher depression score ($p < 0.05$). Moderate positive correlation was found between glycemic status of the respondents and depression score ($r = 0.331$, $p < 0.001$). For each unit increment of HbA_{1c} level, depression score was increased by 3.345 unit ($b = 3.345$). Respondents having good glycemic control had least mean depression score, whereas those with poor glycemic control showed highest depression score (Table 1). BMI was not correlated with depression score. Multiple linear regression analysis model was constructed to identify predictors of depression score. Glycemic status (HbA_{1c} %) was the best predictor of

depression score, followed by marital status, gender and use of insulin device (Table 2).

Higher percentage of both mild to moderate and severe depression were found among female respondents ($p < 0.001$), singles ($p < 0.001$) and respondents with up to secondary level of education ($p < 0.05$). Housewives suffered more from severe depression and retired persons from mild to moderate depression ($p < 0.05$) (Table 3).

Treatment with oral anti-diabetic drugs and insulin together was associated with mild to moderate depression, while only insulin use was associated with severe depression ($p < 0.01$). Both mild to moderate and severe depression were found prevalent among patients with poor glycemic control ($p < 0.001$) (Table 4).

Logistic regression model was constructed which identified HbA_{1c} level, marital status and gender as the best three predictors of depression. Diabetic individuals with fair glycemic control were six times and poor glycemic control were seven and half times more likely to develop depression than individuals with good glycemic control. Single respondents were five times and female were three times more likely to develop depression than their counterparts (Table 5).

Discussion

In this study, high proportion of depression (34.8%) was found, which was much higher than that in adult general population of Bangladesh (4.6%)²² and it supported the link between diabetes and depression. Most of the earlier studies supported the higher prevalence of depression among patients with type 2 diabetes mellitus^{5,23} except a few.²⁴ The current study proportion was also higher than that in rural diabetic population (29.7%).¹⁸ This difference might be accountable to urban - rural difference in sample characteristics. Moreover, rural prevalence

data were community-based while the current study was done in a hospital. Earlier studies found that prevalence of co-morbid depression was higher in clinical than in community samples.⁵ A recent study done in United Arab Emirates found that 12.5% of diabetic patients obtained a score of 19 or above on the K6, indicating possible mental health concerns.¹⁷

This lower prevalence might be attributed to the differences in socio-demographic characteristics of the samples. Nationalities other than Emirati in the same study showed higher rates of scores of 19 or above. Further, although K6 is an efficient screening tool for "serious mental illness" (SMI) with a sensitivity of 0.36 and specificity of 0.96,²⁵ but its efficiency as a screening tool for depressive symptoms is yet to be explored.

Mean depression score among females was found significantly higher than males. After controlling for other socio-demographic variables, gender still was significantly associated with presence of depressive symptoms [OR = 5.107, 95% CI (1.197-21.792)]. This finding was supported by most of the other previous studies^{18,23} but not all.²⁶

The mean age of the respondents was 54.96 years and 60% of them were in the 45 to 64 years age group and age distribution was comparable with that of type 2 diabetes in developing countries.²⁷ No statistical significant relation was found between age and depression. It is consistent with other studies.^{26,28} One study found that major depressive disorder was more common in 31-59 year old group.²⁹ Current study found 40-49 years age group suffered most from severe depression, although 60 – 69 years group had highest percentages of overall depressive symptoms.

Single respondents had shown higher depression score than their married counterparts [OR = 4.183, 95% CI (1.589-11.010); $p < 0.01$] which was consistent with other study findings.^{13,28}

Educational status of this study sample was much better than the national figure.³⁰ Selection of urban health centre and residence of the respondents might explain this. Although mean depression score was found higher in lower education group, after adjustment for other sociodemographic variables the association did not exist. Association of education with depression was revealed by most other studies^{24,31,32} except a few.²⁸

Mean depression score found highest among housewives and lowest among businessmen and this was because depression associated with female gender and females were most commonly housewives in Bangladesh and so in this study. Miyaoka et al. detected correlation of unemployment with depression score in their study.²⁸

Average monthly incomes of depressed and non-depressed group were almost equal in this study which is not consistent with other study findings of higher prevalence of depression in low income individuals.^{13,28,33}

Mean BMI among the depressed respondents was 25.78 ± 3.59 , which was close to the findings of study among rural population of Bangladesh.¹⁸ No significant association could be found between BMI and depression, which was supported by most of the other studies^{18,31}, while some other studies found the association.¹⁴

On average, duration of diabetes in depressed group was two years longer than in non-depressed group. Depression score was correlated with duration of diabetes mellitus. Other studies did not detect this relationship.^{26,28}

In this study more than 90% of the respondents received pharmacological treatment in addition to diet and discipline. Respondents with pharmacological treatment had higher depression score. Treatment with oral agent revealed lowest depression score and higher score was found when insulin was used. Patients viewed oral treatment as the

least and insulin as the most burdensome treatment³⁴ and insulin was associated with higher frequency of depression.^{35,36} Those who used conventional method (syringe) for insulin administration had higher mean depression score than pen device users. Pain of injection might be the reason for higher prevalence of depression among insulin-treated patients.

Depression is significantly associated with a variety of diabetic complications (diabetic retinopathy, nephropathy, neuropathy, macrovascular complications, and sexual dysfunction).^{26,28,37} In this study mean CES-D scores in diabetic patients with complications were found higher than in patients without complications. But no relation was found.

HbA_{1c} has been considered as the direct indicator of glycemic status of a diabetic individual and its estimation as the most accurate way of monitoring how well a diabetic patient is being controlled.³⁸ Moderate correlation was revealed between depression score and HbA_{1c} level, which was supported by other studies^{29,37,38}, while Engum et al. found no significant association between them.²⁴

Although the present study was not based upon a representative sample, it provided a broader basis for the estimation of proportion of depression and factors associated with it among patients with type 2 diabetes mellitus. Within limitations, the researchers tried to have the best possible sample by choosing BIRDEM, which is the largest service provider for diabetic patients in Bangladesh. Cross-sectional design of the current study prevented the researcher to infer about the causality between depression and diabetes. Further, assessment of depression was based on self-report, using a screening tool, rather than a gold-standard diagnostic tool. However, CES-D is a widely used, well validated measure for depressive symptoms, particularly suited for epidemiological studies, both in general population and in diabetes patients. To

minimize recall bias, some data were validated by reviewing the documents.

Conclusion

This study has identified depression as a significant health problem among patients with type 2 diabetes mellitus and highlighted some of the factors associated with depression among them. This association need to be further studied in depth and finding of the current study should be replicated in order to formulate effective intervention program.

Acknowledgements

We acknowledge authorities of Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) for their support. We are also grateful to all the respondents for their sincere cooperation.

Disclosure: None to declare any competing interest.

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Table 1: Depression (CES-D) score and socio-demographic and clinical characteristics of the respondents

Characteristics	Number	Percentage	Depression score		p for the differences of mean values	
			Mean (Geometric)	SD		
Gender	Male	91	51.1	8.15	7.17	<0.001
	Female	87	48.9	13.70	9.69	
Age (years)	< 40	10	5.6	7.80	5.06	ns [†]
	40-49	46	25.9	11.37	10.79	
	50-59	60	33.7	9.24	8.04	
	60-69	52	29.2	12.37	9.16	
	≥ 70	10	5.6	9.04	5.90	
Residence	Urban	128	71.9	10.83	8.94	ns [†]
	Semi-urban	50	28.1	9.71	9.47	
Marital status	Married	146	82.0	18.39	8.87	<0.001
	Single [‡]	32	18.0	9.29	8.38	
Educational status	Illiterate	7	3.9	14.60	11.21	<0.005
	Primary	25	14.1	13.78	10.20	
	Secondary	57	32.0	12.48	9.60	
	Higher secondary Graduate & above	26	14.6	7.12	7.34	
Main occupation	Service holder	63	65.4	9.11	7.25	<0.005
	Housewife	38	21.5	9.25	7.76	
	Retired	73	41.2	13.18	10.17	
	Businessman	41	23.2	10.44	7.77	
Drug treatment	Oral	25	14.1	6.74	6.56	<0.005
	Insulin	101	60.5	9.20	8.22	
	Oral + Insulin	14	8.4	15.64	7.77	
Insulin device	Syringe	52	31.1	12.76	9.75	<0.05
	Pen	42	15.52	9.37	42	
Diabetic complications	Absent	24	10.20	8.29	24	<0.05
	Present	113	63.5	9.59	9.02	
HbA _{1c} level	Good (< 7)	65	36.5	12.30	9.06	<0.001
	Fair (7 to 8)	87	48.9	8.01	7.30	
	Poor (> 8)	57	32.0	12.35	9.28	
BMI (Kg/m ²)	Normal (<25)	34	19.1	16.04	9.60	ns [†]
	Overweight (25 to <30)	86	48.3	10.46	8.52	
	Obese(≥ 30)	79	44.0	10.51	9.65	
		13	7.3	10.72	9.61	

[†] ns = not significant; BMI = Body Mass Index

[‡] Single included widow/widower and separated

Table 2: Factors associated with depression score

Variables	Unadjusted			Adjusted for other potential variables				
	p - value	95% CI [§]		Beta [¶]	F-change	p - value	95% CI [§]	
		Lower	Upper				Lower	Upper
Gender	<0.001	-0.319	-0.132	0.161	4.527*	<0.05	0.008	0.202
Marital status	<0.001	-0.394	-0.199	0.197	7.384**	<0.01	0.045	0.284
Secondary education	<0.05	-0.215	-0.005	0.021	0.086	ns [†]	-0.082	0.111
Higher secondary education	<0.01	0.060	0.336	-0.129	3.705	ns [†]	-0.247	0.003
Business man	<0.005	0.077	0.374	-0.135	3.456	ns [†]	-0.262	0.008
Housewife	<0.005	-0.264	-0.068	-0.021	0.025	ns [†]	-0.184	0.157
Drug treatment	<0.005	-0.260	-0.062	1.761	3.101	ns [†]	-0.010	0.172
Insulin device	<0.05	0.033	0.331	-0.220	5.007*	<0.05	-0.259	-0.015
Glycemic status (HbA _{1c} %)	<0.001			0.283	16.541****	<0.001	0.049	0.142

[§] CI = Confidence Interval for un-standardized regression co-efficient

[¶] Beta = Standardized regression co-efficient

[†] ns = not significant; *p <0.05, **p <0.01, ***p <0.005, ****p <0.001

Table 3: Level of depression and socio-demographic characteristics of the respondents

Characteristics	Level of depression							p value	
	No depression	Mild to moderate depression			Severe depression				
	n (%)	n (%)	OR	95% CI	n (%)	OR	95% CI		
Gender	Male	73(80.2)	10(11.0)	Referent		8(8.8)	Referent		<0.001
	Female	43(49.4)	16(18.4)	2.72	1.13-6.52	28(32.2)	5.94	2.49-14.20	
Age (Years)	< 40	9(90.0)	1(10.0)			0(0.0)			ns [†]
	40-49	27(58.7)	5(10.9)			14(30.4)			
	50-59	43(71.7)	8(13.3)			9(15.0)			
	60-69	30(57.7)	9(17.3)			13(25)			
	≥ 70	7(3.9)	3(1.7)			0(0)			
Marital status	Married	107(73.3)	19(13.0)	Referent		20(13.7)	Referent		<0.001
	Single [‡]	9(28.1)	7(21.9)	4.38	1.46-13.18	16(50)	9.51	3.69-24.50	
Educational status	Illiterate	4(57.1)	1(14.3)	1.79	0.17-18.35	2(28.6)	4.17	0.63-27.73	< 0.05
	Primary	11(44)	6(24.0)	3.90	1.09-13.89	8(32.0)	6.06	1.75-21.02	
	Secondary	31(54.4)	10(17.5)	2.30	0.80-6.68	16(18.1)	4.30	1.52-12.17	
	Higher secondary	20(76.9)	2(7.7)	0.71	0.14-3.74	4(15.4)	1.67	0.43-6.54	
	Graduate & above	50(79.4)	7(11.1)	Referent		6(9.5)	Referent		
Main occupation	Service holder	28(73.7)	5(13.2)	1.96	0.35-11.11	5(13.2)	3.93	0.43-36.12	<0.05
	Housewife	38(52.1)	11(15.1)	3.19	0.65-15.70	24(32.9)	13.90	1.76-109.91	
	Retired	27(65.9)	8(19.5)	3.26	0.63-16.95	6(14.6)	4.89	0.55-43.71	
	Businessman	22(88.0)	2(8.0)	Referent		1(4.0)	Referent		

[†] ns = not significant; BMI = Body Mass Index

[‡] Single included widow/widower and separated

Table 4: Level of depression and clinical characteristics of the respondents

Characteristics	Level of depression							p value
	No depression	Mild to moderate depression			Severe depression			
	n (%)	n (%)	OR	95% CI	n (%)	OR	95% CI	
Drug treatment	Oral	76(75.2)	13(12.9)	Referent		12(11.9)	Referent	
	Insulin	6(42.9)	2(14.3)	1.95	0.35-10.72	6(42.9)	6.33	1.75-22.89
	Oral + Insulin	27(51.9)	10(19.2)	2.17	0.85-5.51	15(28.8)	3.52	1.46-8.46
Insulin device	Syringe	17(40.5)	8(19.0)			17(40.5)		
	Pen	16(66.7)	4(16.7)			4(16.7)		ns [†]
Diabetic complications	Absent	77(68.2)	17(15.0)			19(16.8)		
	Present	39(60.0)	9(13.8)			17(26.2)		ns [†]
HbA _{1c} level	Good (< 7)	72(82.8)	7(8.0)	Referent		8(9.2)	Referent	
	Fair (7 to 8)	31(54.4)	13(22.8)	4.31	1.57-11.85	13(22.8)	3.77	1.42-10.02
	Poor (> 8)	13(38.2)	6(17.6)	4.75	1.37-16.41	15(44.1)	10.39	3.66-29.43
BMI (Kg/m ²)	Normal (<25)	62(72.1)	10(11.6)			14(16.3)		
	Overweight (25 to <30)	47(59.5)	14(17.7)			18(22.8)		
	Obese(≥ 30)	7(53.8)	2(15.4)			4(30.8)		ns [†]

[†] ns = not significant; BMI = Body Mass Index

Table 5: Risk factors associated with depression

Variables	Categories	Unadjusted			Adjusted for other potential variables		
		p - value	OR	95% CI	p - value	OR / Exp (B)	95% CI for Exp (B)
Gender	Male ^ψ						
	Female	<0.001	4.15	2.13 - 8.07	<0.01	3.12	1.32 - 6.84
Marital status	Married ^ψ						
	Single [‡]	<0.001	7.01	2.99 - 16.46	<.005	5.15	1.94 - 13.66
Education	Graduate & above ^ψ	ns [†]	2.89	0.57 - 14.53	ns [†]	0.56	0.068 - 4.67
	Illiterate	<0.005	4.90	1.80 - 13.28	ns [†]	3.09	0.87 - 10.99
	Primary	<0.005	3.23	1.45 - 7.20	ns [†]	2.09	0.78 - 5.58
	Secondary	ns [†]	1.15	0.39 - 3.46	ns [†]	1.06	0.24 - 4.64
Occupation	Higher secondary						
	Businessman ^ψ						
	Service holder	ns [†]	2.62	0.64 - 10.68	ns [†]	1.60	0.32 - 7.96
	Housewife	<0.005	6.75	1.86 - 24.56	ns [†]	2.32	0.34 - 15.77
Drug treatment	Retired/aged	ns [†]	3.80	0.97 - 14.94	ns [†]	2.82	0.60 - 13.28
	Oral ^ψ						
Glycemic status (HbA _{1c} %)	Insulin	<0.005	3.04	1.57 - 5.89	ns [†]	2.06	0.91 - 4.66
	Good <7 ^ψ						
	Fair 7-8	<0.001	4.03	1.88 - 8.63	<0.001	5.96	2.49 - 14.26
	Poor >8	<0.001	7.75	3.19 - 18.84	<0.001	7.27	2.67 - 19.79

^ψ Referral group; [‡] Single included widow/widower and separated

OR = Odds Ratio; CI = Confidence Interval for Exp (B)

[†] ns = not significant