Depression Among Older Adults with Diabetes in Israel: Pattern of Symptoms and Risk Factors

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ABSTRACT: **Background:** Diabetes is a complex metabolic disease that is growing in prevalence worldwide. Depressive disorder is one of the most serious health co-morbidities associated with this disease, with a range of factors known to increase risk.

Objectives: To explore the pattern of depression symptoms characterizing Israeli patients with diabetes who are 50 years of age and older and to identify sociodemographic factors and behavioral risks that may influence this risk of diabetes patients who suffer from depression symptoms.

Methods: Symptoms of depression were examined using a sample of 2332 Israeli respondents (age ≥ 50 years) who participated in the third Israeli wave of the Survey of Health, Ageing, and Retirement in Europe study. Among them, 561 reported that they were diagnosed with diabetes. Multiple logistic regressions were conducted to examine the influence of sociodemographic and behavioral factors on the risk for developing depression in this population.

Results: Results showed different patterns of depressive symptoms, which were significantly higher among older adults with self-reported diabetes compared to those without self-reported diabetes. In multiple regression models, it was found that women were twice as likely to suffer from depression. In addition, financial distress and activity limitation due to health were found to be major risks for developing depression among this population.

Conclusions: The study findings emphasize the importance of using focused clinical strategies aimed at reducing specific symptoms of depression while addressing sociodemographic factors and health risks among older adults with diabetes.

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KEY WORDS: diabetes, depression, Euro-Depression (Euro-D), co-morbidity, aging

Diabetes is a complex metabolic disease, which according to the International Diabetes Federation, is expected to affect 642 million adults worldwide by 2040 [1]. In Israel, the number of adults 20 to 79 years of age suffering from type 2 diabetes in 2015 was 420,000, with more than 150,000 estimated cases of diabetes remaining undiagnosed. This total is approximately 38% of the adult population [1].

Individuals living with either type of diabetes are at increased risk for mental health co-morbidities, one of the most serious being major depressive disorder [2]. The lifetime prevalence of depression among the general population varies between 2% and 15%, and is growing. It has been shown that people with chronic physical illnesses or long-term conditions are 2–3 times more likely to suffer from depression than people without physical health problems [3].

There is a bidirectional relationship between diabetes and depression: diabetes increases the risk for depression just as symptoms of depression can increase diabetes risk [4]. A recent meta-analysis [5] found a significant hazard ratio and relative risk for occurrence of depression associated with diabetes, and a greater cumulative incidence of depression among people with this disease. This research supports the hypothesis that diabetes is a "depressogenic" condition. These findings are of concern because depression among diabetes patients may lead to suicidal tendencies and behavior [6].

Patients with diabetes and depression may experience feelings of hopelessness, may be more socially isolated and lack support, and may struggle with limited concentration and energy, all of which may influence their judgment and adherence to medical treatment [3]. In addition, depression symptoms in the context of diabetes are associated with poor self-care with respect to diabetes treatment, poor glycemic control, more long-term complications, and decreased quality of life [4].

A range of factors is known to be associated with the risk of developing depression among diabetes patients. Women have been found to have higher rates of depression compared to men [7,8]. While several studies have reported an increased prevalence of depression among young patients [7,9], another study reported older age as a risk factor for higher prevalence of depression [10]. Depression is also associated with higher body mass index (BMI) and with unhealthy behaviors [10,11]. In addition, other characteristics found to increase the prevalence of depression among the general population, as well as among diabetes patients, are living alone, poor social support, and low socioeconomic status [12]. A negative impact was found among diabetes patients suffering not only from severe depression, but also from mild to low levels of depression [13]; therefore, depression diagnosis followed by proper treatment among diabetes patients is crucial because treatment of this condition can

decrease co-morbid complications and death rates, and prevent depression deterioration of health [14]. Unfortunately, in many countries, there is not yet a systematic process of depression screening among diabetes patients [15].

The current study aimed to explore patterns of depression symptoms characterizing diabetes patients 50 years of age and older in Israel, and to identify sociodemographic factors and behavioral risks that may influence their risk of depression.

PATIENTS AND METHODS

POPULATION TARGET AND DATA COLLECTION

The study population was comprised of non-institutionalized individuals aged 50 years and older who participated in the third Israeli wave of the Survey of Health, Ageing, and Retirement in Europe (SHARE). The survey encompassed sociodemographic, physical, mental, and economic variables among other data [16-19]. The sample included 2332 Israeli respondents who participated in the 2013–2014 survey, among whom 561 reported to have been diagnosed with diabetes.

Data were collected during face-to-face interviews, which took place in the respondent's home and were conducted by trained interviewers using computer-assisted personal interviewing programs. Further details on the SHARE survey can be found in Malter and Börsch-Supan [18].

VARIABLES

Detection of self-reported type 2 diabetes mellitus was made based on responses to two survey questions:

- Has a doctor ever told you that you had any of the conditions on this card (diabetes or high blood sugar)?
- Do you currently take medications at least once a week for problems mentioned on this card (drugs for diabetes)?

Respondents were considered to have a diagnosis of diabetes if they answered "yes" to either of the two questions. Respondents who reported diagnosis of diabetes before 20 years of age (2.2%) were considered more likely to be affected by type 1 diabetes and were excluded from the study.

Depression was measured using the Euro-Depression (EURO-D) instrument, a scale of depression symptoms validated for the European population. This scale covers 12 symptom domains: depressed mood, pessimism, suicidality, guilt, sleep difficulties, lack of interest in general activities, irritability, changes in appetite, fatigue, difficulty with concentration, decreased enjoyment, and tearfulness. Each item is scored 0 (symptom not present) or 1 (symptom present), and item scores are summed to produce a scale with a minimum score of 0 and a maximum of 12 [20]. A score higher than 3 is indicative of a depressive symptomatology [21] and was used to dichotomize this variable in the current analysis. In the current sample, EURO-D was internally consistent with a Cronbach's alpha of 0.79.

Basic demographics included age (continuous and age-squared), gender, and marital status (married or living together with spouse, other). Socioeconomic status was measured by years of education, job status (working, retired, or other), and economic strain, which is a subjective indicator of financial distress (make ends meet with great difficulty, with some difficulty, fairly easily, easily). Smoking status (former smoker, current smoker, never smoked regularly) and frequency of sport or vigorous activities (less than once a week, once a week or more) were also considered. Height and weight were collected to calculate BMI, which was divided into three categories: underweight/normal weight (BMI < 25.0 kg/m^2), overweight (BMI 25.0–29.9 kg/m^2), and obese (BMI > 30 kg/m^2). Data on the frequency of social activity (participating in any kind of social activity: yes/no) and limitations in activity due to health (not limited, limited but not severely, severely limited) were also collected.

RESULTS

Table 1 presents descriptive statistics of the survey respondents with self-reported diabetes, in SHARE Israel Wave 3, with and without depression caseness in addition to survey respondents without self-reported diabetes. As presented in Table 1, the average age of the respondents with self-reported diabetes was 71 years. Depression affected 42.6% of the women and 24.8% of the men with diabetes. In relation to job status, the share of those with depression rose significantly from workers (18.5%) to retired persons (35.4%) and further to others others who were not yet retired but not working (46.4%). Moreover, the share of respondents with self-reported diabetes and depression increased along the financial distress scale from 51% among those with great difficulty, to 28.7% for those with some difficulty, to 29.9% in the fairly easy category, and to 26.5% among those who responded "easily." The share of depression among those participating in sports or rigorous physical activity at least once a week was less than half compared to those who did not exercise (21.2% vs. 44.8%, respectively). A similar pattern emerged across the categories of social activity: 24.1% of the socially active respondents were depressed, while the equivalent figure among the non-active group was 34.9%. In addition, the share of respondents with self-reported diabetes plus depression fell from 67.5% among the severely limited to 35.9% among the non-severely limited and to 12.4% among those reporting no limitations.

Table 2 presents the depression symptom rates among respondents with self-reported diabetes and those with no self-reported diabetes. As mentioned previously, the EURO-D scale comprises 12 known symptoms of depression. A score higher than 3 is considered indicative of a depressive symptomatology [21]. Of the respondents with self-reported diabetes, 29% earned

Table 1. Descriptive statistics for demographic, socioeconomic, and behavioral risk variables among respondents with no self-reported diabetes and among respondents with self-reported diabetics with and without depression caseness

		No self-reported diabetes	Self-reported diabetes with depression	Self-reported diabetes without depression
Demographics	**Age, years**	66.9 ± 10.32	71.9 ± 9.75	68.2 ± 8.69
	Gender			
	Male	72.5%	24.8%	75.2%
	Female	78.2%	42.6%	57.4%
	Marital status			
	Married or living together	76.5%	31.2%	68.8%
	Other	73.6%	43.8%	56.3%
Socioeconomics	**Years of education**	12.8 ± 4.2	10.4 ± 4.94	12.3 ± 4.55
	Job status			
	Working	84.9%	18.5%	81.5%
	Retired	70.8%	35.4%	64.6%
	Other	68.5%	46.6%	53.4%
	Meet expenses			
	With great difficulty	65.5%	51%	49%
	With some difficulty	71.9%	28.7%	71.3%
	Fairly easily	78.7%	29.9%	70.1%
	Easily	83.0%	26.5%	73.5%
Behavioral risks	**Smoking**			
	Current smoker	76.7%	26.9%	73.1%
	Former smoker	75.1%	31.5%	68.5%
	Never smoked	76.0%	36.7%	63.3%
	Sports or vigorous activities			
	Once a week or more	68.6%	21.2%	78.8%
	Less than once a week	31.4&	44.8%	55.2%
	BMI category			
	Normal/underweight	84.2%	33.3%	66.7%
	Overweight	71.2%	30.9%	69.1%
	Social activity			
	Active	81.3%	24.1%	75.9%
	Not active	71.3%	39.4%	60.6%
	Activities limited due to health			
	Severely limited	60.9%	67.5%	32.5%
	Limited, but not severely	64.8%	35.9%	64.1%
	Not limited	83.8%	12.4%	87.6%

Table 2. Depression symptom rates among respondents with self-reported diabetes and respondents with no self-reported diabetes

	Self-reported diabetes	No diabetes	Chi-square
Sleep disturbances	41%	24%	24.798***
Depression	36%	25%	10.942***
Fatigue	34%	21%	43.208***
Irritability	29%	19%	16.791***
Concentration problems	27%	14%	36.001***
Pessimism	23%	16%	15.959***
Tearfulness	23%	21%	0.062
Interest lacking	20%	7%	30.692***
Enjoyment lacking	20%	9%	26.056***
Appetite changes	12%	6%	16.756***
Suicidal	10%	4%	8.825**
Guilt	8%	7%	2.103

**$P < 0.01$

***$P < 0.001$

Table 3. Multiple logistic regression model of the association between depression and independent variables

	B	SE	OR
Intercept	-2.91	0.93	
Age	0.01	0.01	1.01
Gender (female/male)	0.82	0.24	2.27***
Meet expenses (with some difficulty/ with great difficulty)	-0.75	0.30	0.47*
Meet expenses (fairly easily/with some difficulty)	0.39	0.33	1.48
Meet expenses (easily/fairly easily)	0.01	0.38	1.01
Activity limited due to health (limited but not severely/ not limited)	1.31	0.30	3.71***
Activity limited due to health (severely limited/limited but not severely)	1.25	0.28	3.49***
Entropy R square			0.209
N			452

B = regression coefficient, OR = odd ratio, SE = standard error

*$P < 0.05$, ***$P < 0.001$

a EURO-D score higher than 3, compared to 16% of respondents with no self-reported diabetes. The figure shows a different picture of depression symptoms among respondents with self-reported diabetes compared to those who claimed not to have the disease. Depression among respondents with self-reported diabetes was characterized more by sleeping disturbances (41%), depressive mood (36%), fatigue (34%), and irritability (29%). Depression among respondents without diabetes was characterized by similar symptomatology, but at significantly lower rates: depressive mood (25%), sleeping disturbances (24%), and tearfulness (21%). Depressive symptomatology was higher among respondents with self-reported diabetes compared to respondents with no self-reported diabetes.

To assess the relationship between depression and the independent variables among patients with self-reported diabetes, multiple logistic regressions were performed, including sociodemographic variables and behavioral risk variables, separately. In the first stage, all variables were included in the model. In the next stage, the model included only variables that were found significant in a stepwise method. Calibrated sampling weights were designed to adjust for the complex sampling design and non-response. Table 3 presents a model including only variables that were found significant in formerly tested models. It shows that the probability of depression among women is 2.27 times greater than among men. In addition, financial distress and limitation in activity because of health are major risks for depression among people with diabetes. The probability for depression decreased almost by half among respondents who declared some level of financial distress compared to those with high financial distress. The probability of people with diabetes with a severe limitation in activity related to health suffering from depression symptoms was 3.49 times

higher compared to those who are limited but not as severely, and 3.71 times higher compared to those who are not limited.

DISCUSSION

In this study, I analyzed symptoms of depression among older Israeli adults with diabetes and identified risk factors associated with depression among this population. Results showed different patterns of depressive symptoms among older adults with self-reported diabetes compared to older adults without self-reported diabetes. Depressive symptomatology was significantly higher among respondents with self-reported diabetes compared to others. In addition, 29% of the respondents with self-reported diabetes received a EURO-D score higher than 3, which indicates a case of depression, compared to 16% of respondents without self-reported diabetes. These findings provide further evidence of the relationship between diabetes and depression already reported in several studies [3,4,22,23]. Nouwen and colleagues [22] examined the relationship between diabetes and depression through a meta-analysis of longitudinal studies and found that people with type 2 diabetes had a 24% increased risk of developing depression. Another systematic review aimed to estimate the prevalence of depression in adults with type 2 diabetes compared to those without the disease, finding that the prevalence rate of depression was nearly twice as high in those with diabetes compared to those without (odds ratio = 1.6, 95% confidence interval 1.5–1.7) [23].

The findings in the current study also showed that there are a range of risk factors for developing depression among older adults with self-reported diabetes. Gender is a one of the most known factors associated with depression among the general population as well as among diabetic patients. Previous studies found a higher prevalence of depression in women with diabetes compared to men in a range of datasets [7,8,13,23]. A systematic review of more than 1000 research studies that examined the epidemiology of depression and diabetes also found poor social support and low socioeconomic status associated with the risk of developing depression in this population, as well as in the general population [12]. Furthermore, previous studies reported the negative association between physical activity and depressive symptoms among people with diabetes [24,25]. In agreement with results from other studies, in the current study, analyses showed that even a "not severe" limitation in activity significantly increased the risk for depressive symptoms. This new information adds to the literature regarding depressive symptoms and risks for developing them among older adults with diabetes. However, the results of this study need to be interpreted based on the following limitations. First, this study relied on self-reported cases of diabetes and a self-reported dichotomized scale to define depression caseness. In addition, the survey used a single measure of depression, which is a mental health status that may vary with time. It is possible that using self-reported dichotomized instrument to indicate depression may have caused our data to included respondents who did not meet the diagnostic criteria of depression in the Diagnostic and Statistical Manual of Mental Disorders, fifth Edition (DSM-V), meaning the scale may be indicative of depressive symptomatology, not necessarily depression. Nevertheless, the EURO–D and its cut-off point have been validated against relevant clinical assessments in previous studies, which demonstrated its strong validity and high internal consistency [21]. Regardless of the use of self-reported diabetes in the current study, the condition was determined by a physician's diagnosis and/or was being treated with diabetic drugs, thus, increasing the validity of this tool in identifying people with the disease.

CONCLUSIONS

Although the literature on diabetes and depression is rich, in clinical practice, under-detection of co-morbid depression is common in patients with diabetes. Many patients interpret depression as a normal consequence of physical illness; moreover, there is a misconception among professionals who consider depression to be difficult to manage in older adults [3]. The current findings may help elucidate the specific symptoms of depression and their patterns among older adults with diabetes, and has important implications for clinical practice. Sleep disorders, depressive mood, fatigue, and irritability were the most prevalent symptoms found among older adults with diabetes in the current study. A primary clinical implication of these findings is the importance of focusing clinical strategies aimed at reducing specific symptoms of depression, while addressing sociodemographic and health risks among older adults with diabetes. Additional related efforts should examine clinical interventions designed to improve the ability of people with diabetes to cope with mental co-morbidities.

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Capsule

Understanding the antibody repertoire in neuropsychiatric systemic lupus erythematosus and neuromyelitis optica spectrum disorder

IgG anti-DWEYS antibodies cross-reactive with DNA, and the *N*-methyl-d-aspartate receptor subunits GluN2A and GluN2B are known to be associated with neuropsychiatric systemic lupus erythematosus (NPSLE). IgG anti-DWEYS have not been investigated in demyelinating NPSLE or in another demyelinating disorder, neuromyelitis optica spectrum disorder (NMOSD), which is a disease also found mainly in young women and associated with aquaporin 4 (AQP-4) or myelin oligodendrocyte glycoprotein (MOG) antibodies. **Mader** and co-authors investigated the frequency of all of these brain-reactive antibodies in patients with NPSLE, those with demyelinating NPSLE and those with NMOSD. Sera were positive for IgG anti-AQP-4 antibodies in 27 (82%) of 33 patients with NMOSD and 3 (27%) of 11 patients with demyelinating NPSLE, whereas all sera from patients with non-demyelinating NPSLE, patients with SLE, and healthy controls were negative for IgG anti-AQP-4. IgG anti-MOG were detected at high titers in 3 (50%) of 6 patients with NMOSD who were negative for IgG anti–AQP-4, and at low titers in 2 (18%) of 11 patients with demyelinating NPSLE and 1 (1%) of 97 patients with non-demyelinating NPSLE. IgG antibodies to dsDNA were present in 11 (33%) of 33 patients with NMOSD. Only 4 (12%) of 33 patients with NMOSD were positive for IgG anti-DWEYS, compared to 11 (29%) of 38 patients with SLE, and 59 (55%) of 108 patients with NPSLE. IgG anti-DWEYS antibodies were present in 56 (58%) of 97 patients with non-demyelinating NPSLE and 3 (27%) of 11 patients with demyelinating NPSLE. Serum IgG brain-reactive antibodies were present at a similar frequency in patients with non-demyelinating NPSLE (72 [75%] of 96), those with demyelinating NPSLE (9 [82%] of 11), and those with SLE (32 [84%] of 38), but were less frequent in patients with NMOSD (20 [61%] of 33). The authors conclude that patients with demyelinating NPSLE should be tested for IgG antibodies to AQP-4, MOG, and DWEYS. IgG anti-AQP-4 can be considered diagnostic for NMOSD, whereas none of these antibodies appear to be diagnostic for demyelinating NPSLE. Moreover, IgG anti-dsDNA are present in patients with NMOSD but are not cross-reactive with IgG anti-DWEYS, indicating that the antigenic stimulus and mechanisms of tissue damage are potentially different between demyelinating NPSLE and NMOSD.

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