

# PREVALENCE OF DEPRESSION AND ITS ASSOCIATED FACTORS IN ADULTS WITH DIABETES MELLITUS: A CROSS-SECTIONAL STUDY IN A TERTIARY CARE CENTRE

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## ABSTRACT

*The prevalence of Diabetes Mellitus has been rising steadily owing to several factors such as sedentary lifestyle, obesity and an aging population. The prevalence of diabetes is predicted to double globally from 171 million in 2000 to 366 million in 2030 with a maximum increase in India with up to 79.4 million individuals in India. Depression occurs frequently with diabetes but there are not many studies in India to estimate its prevalence and associated factors. This study was done with the aim of estimating the prevalence of depression among diabetes patients using the validated Patient Health Questionnaire-9 and also its associated factors. A cross sectional study was done on 100 consecutive patients with Diabetes Mellitus (both type 1&2) attending the Outpatient Endocrinology clinic from September 2015 to November 2015. The Patient Health Questionnaire diagnostic algorithm was used to identify major depression. The covariates studied were age, gender, duration of diabetes, presence of hypertension and glycaemic control. Chi-square test was done to find the association of demographic and clinical characteristics of depression. Multiple logistic regression analysis was done to identify the statistically significant variables. The prevalence of major depression was found to be 35%. People with hypertension were found to have a significantly higher prevalence of depression (adjusted odds ratio=3.02, 95% CI: 1.17 to 7.7, P=0.022). Also, employed people were at a lower risk for depression when compared to the unemployed /retired population (adjusted odds ratio=0.319, 95% CI: 0.11-0.85, P=0.023). Interestingly age, duration of diabetes and glycaemic control were not significantly associated with depression. Over one-third of the patients with diabetes mellitus had depressive symptoms. The prevalence varied by demographic and clinical characteristics.*

## KEYWORDS

*Diabetes, Depression, Patient Health Questionnaire- 9, Hypertension.*

## 1. INTRODUCTION

The prevalence of Diabetes Mellitus has been rising steadily owing to several factors such as sedentary lifestyle, obesity and an aging population. The prevalence of diabetes is predicted to double globally from 171 million in 2000 to 366 million in 2030 with a maximum increase in India with up to 79.4 million individuals in India.<sup>[1]</sup>

Depression occurs frequently with diabetes and has been found to be associated bidirectionally with diabetes mellitus.<sup>[2,3]</sup> However, it was observed that the reported prevalence in the studies varied tremendously in terms of definition, study design, source of subjects, time frame and measurement methods.<sup>[4-6]</sup> Moreover, with the predicted rise of diabetes in India, and risk factors

for depression such as low socioeconomic status, financial constraints being rampant here it is quintessential to establish regional studies as a guideline to aid in a holistic patient approach.<sup>[7]</sup>

Apart from this, most of these studies used self-administered questionnaires which cannot directly establish a diagnosis of depression.<sup>[4,5,6,8]</sup> Standard interviews, such as the Structured Clinical Interview for DSM Disorders (SCID)<sup>[9]</sup> and the Composite International Diagnostic Interview (CIDI)<sup>[10]</sup> can yield a clinical diagnosis according to the Statistical Manual of Psychiatric Disorders, 4th edition (DSM-IV)<sup>[11]</sup>; however, lengthy assessments and high costs preclude the extensive use of such structured diagnostic interviews in large population-based surveys.

The Patient Health Questionnaire (PHQ) can establish provisional diagnoses of major and minor depression as well as evaluate the severity of depressive symptoms.<sup>[12]</sup>; The PHQ-9 diagnosis of major depression yielded acceptable sensitivity and specificity. The present study aims to estimate the prevalence of depression among diabetes patients using the validated Patient Health Questionnaire-9 and its associated factors.

The variables taken into consideration for association with depression in this region include age, gender, duration of diabetes, glycaemic index and presence of hypertension. This stems from previous studies which show significant correlations between the above variables and depression<sup>[6,13,14]</sup>

## 2. MATERIALS AND METHODS:

This study is a cross-sectional study on 100 consecutive patients presenting at a tertiary care centre, aged >18yrs diagnosed with Type 2 diabetes mellitus by a certified Endocrinologist. The study was carried out after obtaining institutional ethics committee clearance. Written informed consent was obtained from the study participants and the PHQ-9 questionnaires were distributed. Those subjects that couldn't read were assisted in filling the questionnaires by an interpreter (Figure 1). During multivariate analysis we have combined the scores 0-9 (none, minimal and mild depression categories) as "no major depression" and scores of 10-27 (moderate, moderately severe and severe categories) as "major depression".<sup>[15,16]</sup>

Patients with complications from diabetes (retinopathy, neuropathy, nephropathy), previous history of mental illness, previous illnesses known to increase a risk for depression (CAD,CVA), and patients already on antidepressants for other symptoms were excluded from the study.

The demographic variables considered were age, gender, duration of diabetes, glycaemic index and presence of hypertension. Age was measured in completed years. Duration of diabetes and glycaemic control were taken from the patients' case records. Hypertension was defined in the study as systolic BP level of  $\geq 140$ mmHg and diastolic BP of  $\geq 90$ mmHg, or current treatment for hypertension with prescription medication.<sup>[17,18]</sup>

Data were analysed using SPSS(19). Chi-square test was done to find the association of demographic and clinical characteristics of depression. Further, multiple logistic regression analysis was done to identify the statistically significant variables. *P* value of <0.05 was considered as statistically significant

PATIENT HEALTH QUESTIONNAIRE (PHQ-9)

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

Over the last 2 weeks, how often have you been bothered by any of the following problems?  
(use "✓" to indicate your answer)

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself—or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead, or of hurting yourself	0	1	2	3

add columns  +  +

(Healthcare professional: For interpretation of TOTAL, TOTAL:   
please refer to accompanying scoring card).

10. If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?	Not difficult at all	_____
	Somewhat difficult	_____
	Very difficult	_____
	Extremely difficult	_____

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Figure 1: The Patient Health Questionnaire -9

3. RESULTS:

Among the 100 patients studied, 35 were found to have major depression (Figure 2). In the univariate analysis, those who were having hypertension and those who were unemployed were significantly associated with depression ( $P < 0.05$ ). In the multiple regression analysis (Table I), people with hypertension were found to have a significantly higher prevalence of depression (adjusted odds ratio=3.02, 95% Confidence Interval :1.17 to 7.7,  $P=0.022$ ) (Figure 3). Also, employed people were at a lower risk for depression when compared to the unemployed /retired population (adjusted odds ratio=0.319, 95% Confidence Interval :0.11-0.85,  $P=0.023$ ) (Figure 4) that bar graph has nothing written on x axis. Interestingly age, duration of diabetes and glycaemic control were not significantly associated with depression.

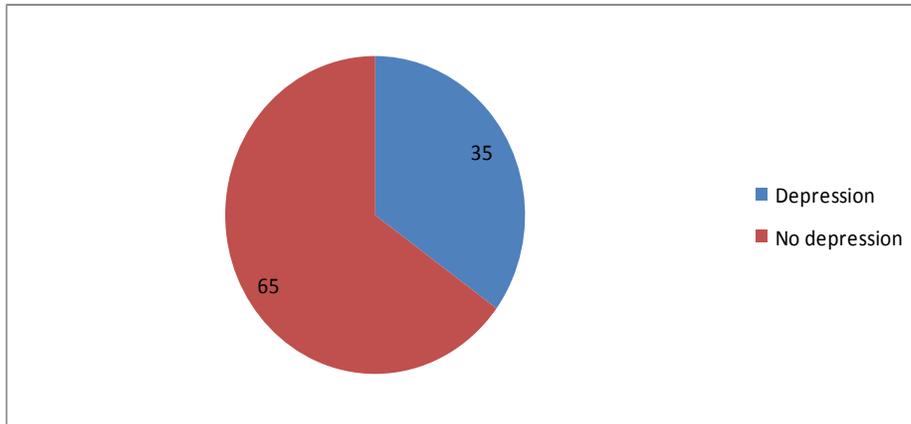


Figure 2. Percentage of patients with and without depression among the study group.

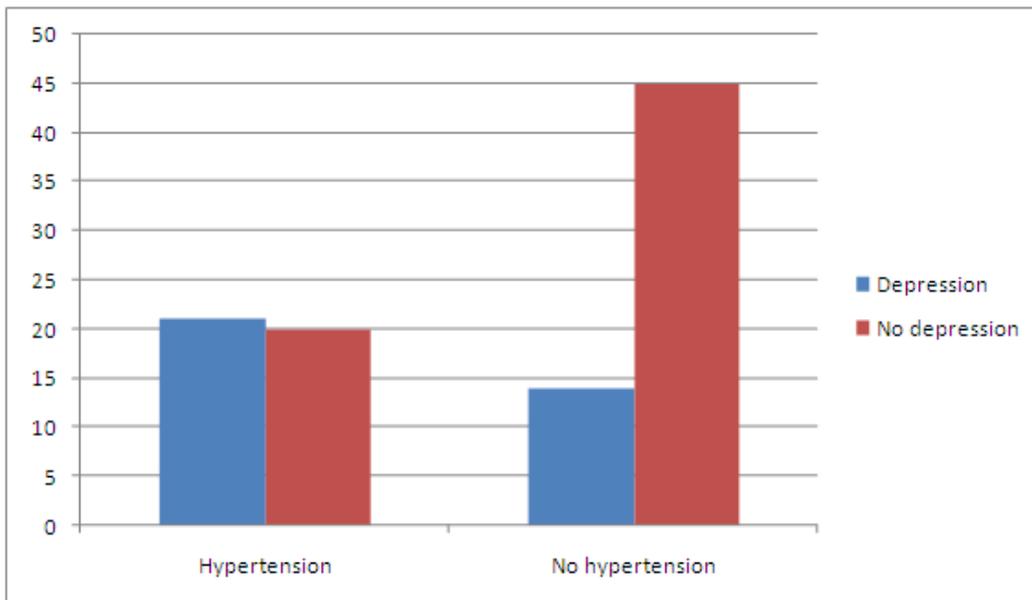


Figure 3. Comparison of the prevalence of Depression in patients with and without Hypertension

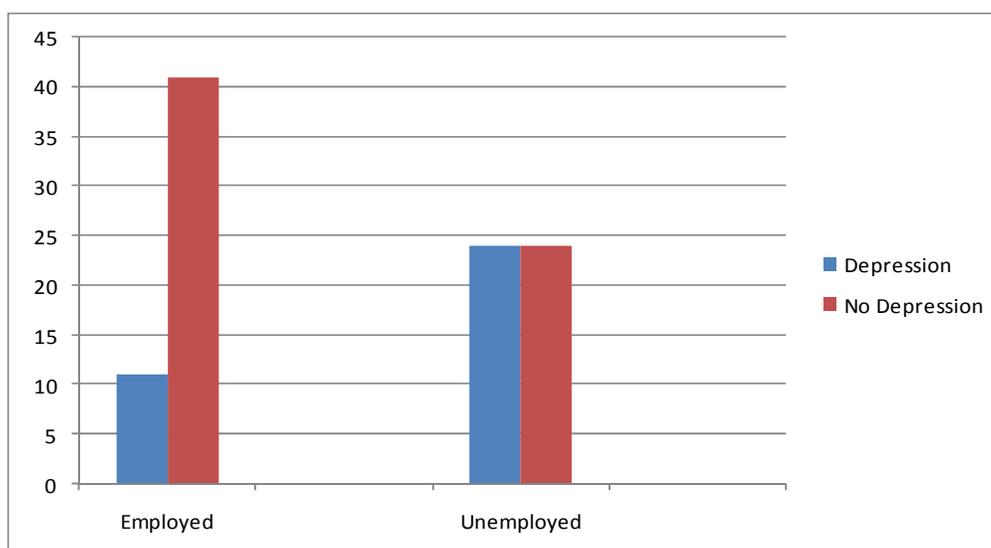


Figure 4. Prevalence of depression among employed and unemployed study participants

Table 1. Regression analysis of the associated factors of depression

Variable	Number studied	Percentages with depression	Adjusted odds ratio	P value*
Age				
<40 years	11	36.4	1	
More than 40 years	89	34.8	0.40(0.08-1.91)	0.251
Gender				
Male	51	27.5	1	
Female	49	42.9	1.32 (0.51-3.41)	0.513
Duration				
Less than 5 years	31	32.3	1	
More than 5 years	69	36.2	1.03(0.36-2.96)	0.946
Glycemic control				
<7	45	26.7	1	
>7	55	41.8	2.34(0.91-6.04)	0.077
Employment				
Unemployed/Retired	48	50.0	1	
Employed	52	21.2	0.31(0.11-0.85)	0.023*
Hypertension				
No	59	23.7	1	
Yes	41	51.2	3.02(1.17-7.77)	0.022*

#### 4. DISCUSSION:

In the present study the prevalence of depression among patients with diabetes mellitus was found to be 35% which was slightly smaller than the prevalence in a study conducted by Joseph N et al., in an adjoining area that reported a prevalence of 45.3%.<sup>[13]</sup> It was also found to be more than twice as common as depression in the general population of our region.<sup>[7,19]</sup>

This leads us to ask the more imposing question, “Why is depression more prevalent in people with diabetes mellitus?”. The study by Talbot F et al., suggested that the extent to which diabetes intrudes in life, rather than diabetic complications per se or personal control, is a key factor in

relation to depressive symptomatology in individuals with diabetes.<sup>[20]</sup> In an animal model, Wang and colleagues demonstrated that experimentally induced type 1 diabetes impairs hippocampal neurogenesis, which may contribute to diabetes-related depression.<sup>[21]</sup> Another study demonstrated decreased plasma brain-derived neurotrophic factor (BDNF) in patients with type 2 diabetes compared to controls, which has been hypothesized to play a role in learning and memory and has also been implicated in the pathogenesis of depression.<sup>[22]</sup>

Among the risk factors, depression was found to be significantly associated with hypertension. This is in line with the findings of Saeed AK et al., where the prevalence of depression in hypertensive people with diabetes mellitus was 57% whereas in people with diabetes alone it was 40%. (P is less than 0.05).<sup>[23]</sup> There are also other studies which showed that depression is common in patients with uncontrolled hypertension irrespective of presence of diabetes and may interfere with blood pressure control.<sup>[24, 25]</sup> Studies have shown that plasma noradrenaline, as an indirect marker of sympathetic tone, was elevated in patients with essential hypertension.<sup>[26]</sup> There is also reported evidence showing abnormal autonomic nervous system function in depression, specifically regarding increased sympathetic activity and poor vagal control. Several studies have examined cerebrospinal fluid (CSF), plasma or urinary levels of norepinephrine (NE) and its major central nervous system metabolite, 3-methoxy-4-hydroxyphenylglycol (MHPG). Plasma NE and/or MHPG levels have been reported to be elevated in depressive patients.<sup>[27,28]</sup> Thus, the existing relationship between hypertension and depression by itself could have contributed to the statistically significant presence of depression among hypertensive people with diabetes mellitus.

Also, we found that depression among diabetes was significantly associated with employment status with a higher prevalence in the unemployed population. This is in line with other studies which showed a higher prevalence of depression in the unemployed population.<sup>[13,29,30]</sup> The unemployed individuals lack sociological functions such as time structure, status and identity, social contacts, participation in collective purposes and regular activity which could predispose them to depression.<sup>[30]</sup>

A methodological innovation of our study was the application of the PHQ-9<sup>[12]</sup> which was developed for clinical use, scoring each of the DSM IV criteria on grades from 0-3 based on the frequency of the symptoms<sup>[31]</sup> Scores of 20-27,15-19,10-14,5-9 and 1-4 represent severe, moderately severe, moderate, mild and minimal depression respectively.<sup>[11]</sup>

Our results indicate that a substantial number of people with diabetes are at an increased risk of having major depression, and those who care for patients with diabetes should routinely screen them for major depression using the PHQ-9 or other such instruments. Among the umpteen methods to screen for depression, the PHQ-9 is a promising tool with its ease of administration, convenient scoring system, brief and simple questions. Most importantly, the use of PHQ-9 can serve in comparisons of depressive symptomatology on an international basis given its worldwide validation.<sup>[32,33]</sup>

This study has some limitations. The study was conducted in a tertiary care hospital, so a possible selection bias cannot be excluded. This could be because the patients coming to the tertiary care hospital belong to the relatively higher socioeconomic status of the community. A large sample community based study could throw more light on this relationship. Since this study is a cross-sectional study, temporal relationship between depression and diabetes cannot be determined.

## 5. CONCLUSIONS

Over one-third (35%) of the patients with diabetes mellitus had depressive symptoms. It is widely associated with unemployment and co-existent hypertension in this population.

This emphasizes that the mind/body dualism is a false dichotomy and there is an increasing need to integrate mental health services in these patients. We recommend routine screening of diabetic patients with PHQ-9 to identify those at risk as it is a quick and easy tool to identify depression and refer patients appropriately for further counselling and support.

In addition, the issue of depression in association with socioeconomic factors such as unemployment is to be addressed by the health policy to aim for an overall betterment of the welfare of the people in this region.

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## REFERENCES

- [1] Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes-estimates for the year 2000 and projections for 2030. *Diabetes Care* 2004;27:1047–53.
- [2] Katon WJ. The Comorbidity of Diabetes Mellitus and Depression. *Am J Med* 2008;121(11, Suppl 2):S8–15.
- [3] Golden SH, Lazo M, Carnethon M, Bertoni AG, Schreiner PJ, Diez Roux AV, et al. Examining a bidirectional association between depressive symptoms and diabetes. *JAMA* 2008;299:2751-9.
- [4] Anderson RJ, Freedland KE, Clouse RE, Lustman PJ. The prevalence of comorbid depression in adults with diabetes: a meta-analysis. *Diabetes Care* 2001;24:1069-78.
- [5] Ali S, Stone MA, Peters JL, Davies MJ, Khunti K. The prevalence of comorbid depression in adults with type 2 diabetes: a systematic review and meta-analysis. *Diabet Med* 2006;23:1165-73.
- [6] Barnard KD, Skinner TC, Peveler R. The prevalence of co-morbid depression in adults with type 1 diabetes: systematic literature review. *Diabet Med* 2006;23:445-8.
- [7] Poongothai S, Pradeepa R, Ganesan A, Mohan V. Prevalence of Depression in a Large Urban South Indian Population — The Chennai Urban Rural Epidemiology Study (Cures – 70). *PLoS One* 2009;4:e7185.
- [8] Fisher L, Skaff MM, Mullan JT, Arean P, Mohr D, Masharani U, et al. Clinical depression versus distress among patients with type 2 diabetes: not just a question of semantics. *Diabetes Care* 2007;30:542-8
- [9] Spitzer RL, Williams JB, Gibbon M, First MB. The Structured Clinical Interview for DSM-III-R (SCID). I. History, rationale, and description. *Arch Gen Psychiatry* 1992;49:624–9.
- [10] Wittchen HU. Reliability and validity studies of the WHO–Composite International Diagnostic Interview (CIDI): a critical review. *J Psychiatr Res* 1994;28:57-84.
- [11] American Psychiatric Association. Diagnostic and statistical manual of mental disorders: DSM-IV [Internet]. 4th ed. Washington (DC): American Psychiatric Association; 1994 [cited 2010 Mar 8]. 866 p. Available from: <http://www.psychiatryonline.com/DSMPDF/dsm-iv.pdf>
- [12] Kroenke K, Spitzer RL. The PHQ-9: a new depression diagnostic and severity measure. *Psychiatric Annals* 2002;32:509–21.

- [13] Joseph N, Unnikrishnan B, RaghavendraBabu YP, Kotian MS, Nelliyanil M. Proportion of depression and its determinants among type 2 diabetes mellitus patients in various tertiary care hospitals in Mangalore city of South India. *Indian Journal of Endocrinology and Metabolism* 2013;17:681–88.
- [14] Roy T, Lloyd CE. Epidemiology of depression and diabetes: a systematic review. *J Affect Disord* 2012;142 Suppl:S8-21
- [15] Arroll B, Goodyear-Smith F, Crengle S, Gunn J, Kerse N, Fishman T, et al. Validation of PHQ-2 and PHQ-9 to Screen for Major Depression in the Primary Care Population. *Ann Fam Med* 2010;8:348–53.
- [16] Sawaya H, Atoui M, Hamadeh A, Zeinoun P, Nahas Z. Adaptation and initial validation of the Patient Health Questionnaire - 9 (PHQ-9) and the Generalized Anxiety Disorder - 7 Questionnaire (GAD-7) in an Arabic speaking Lebanese psychiatric outpatient sample. *Psychiatry Res* 2016;239:245-52.
- [17] The fifth report of the Joint National Committee on the Detection, Evaluation, and Treatment of High Blood Pressure. *Arch Intern Med* 1993;153:154-83.
- [18] Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, et al. Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; National Heart, Lung, and Blood Institute; National High Blood Pressure Education Program Coordinating Committee: Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension* 2003;42:1206-52.
- [19] Egede LE, Zheng D, Simpson K. Comorbid depression is associated with increased health care use and expenditures in individuals with diabetes. *Diabetes Care* 2002;25:464–70.
- [20] Talbot F, Nouwen A, Gingras J, Bélanger A, Audet J. Relations of diabetes intrusiveness and personal control to symptoms of depression among adults with diabetes. *Health Psychol* 1999;18:537-42.
- [21] Wang S, Sun Z, Guo Y, Yuan Y, Yang B. Diabetes impairs hippocampal function via advanced glycation end product mediated new neuron generation in animals with diabetes-related depression. *ToxicolSci* 2009;111:72-9.
- [22] Krabbe, K.S., Nielsen, A.R., Krogh-Madsen, R., Plomgard, P., et al., Brain-derived neurotrophic factor (BDNF) and type 2 diabetes. *Diabetologia* 2007;50:431-8.
- [23] Saeed AK, Al-Dabbagh TQ. Type 2 diabetes and its association with hypertension and depression in an Iraqi population. *Ann Saudi Med* 2003;23:254-9.
- [24] Rubio-Guerra AF, Rodriguez-Lopez L, Vargas-Ayala G, Huerta-Ramirez S, Serna DC, Lozano-Nuevo JJ. Depression increases the risk for uncontrolled hypertension. *Experimental and Clinical Cardiology* 2013;18:10-2.
- [25] Nabi H, Chastang JF, Lefèvre T, Dugravot A, Melchior M, Marmot MG, et al. Trajectories of depressive episodes and hypertension over 24 years: The Whitehall II prospective cohort study. *Hypertension* 2011;57:710–6.
- [26] Goldstein D, Lake C. Plasma norepinephrine and epinephrine levels in essential hypertension. *Federation Proceedings* 1984;43:57-61.
- [27] Lake CR, Pickar D, Zeigler MG, Lipper S, Slater S, Murphy DL. High plasma norepinephrine levels in patients with major affective disorder. *Am J Psychiatry*. 1982;139:1315-8.
- [28] Roy A, Pickar D, Linnoila M, Potter WZ. Plasma norepinephrine levels in affective disorders. Relationship to melancholia. *Arch Gen Psychiatry* 1985;42:1181-5.
- [29] Robert Friis , G. Nanjundappa. Diabetes, depression and employment status. *SocSci Med* 1986;23:471-75.
- [30] Strandh M, Hammarström A, Nilsson K, Nordenmark M, Russel H. Unemployment, gender and mental health: the role of the gender regime. *Sociol Health Illn.* 2013;35:649-65.
- [31] Kroenke K, Spitzer RL, Williams JBW. The PHQ-Validity of a Brief Depression Severity Measure. *J Gen Intern Med* 2001;16:606–13.
- [32] Burdovic Andreas J, Brunborg GS. Depressive Symptomatology among Norwegian Adolescent Boys and Girls: The Patient Health Questionnaire-9 (PHQ-9) Psychometric Properties and Correlates. *Front Psychol*. 2017;8: 887.
- [33] Titov N, Dear BF, McMillan D, Anderson T, Zou J, Sunderland M. Psychometric comparison of the PHQ-9 and BDI-II for measuring response during treatment of depression. *Cogn Behav Ther.* 2011;40:126-36

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