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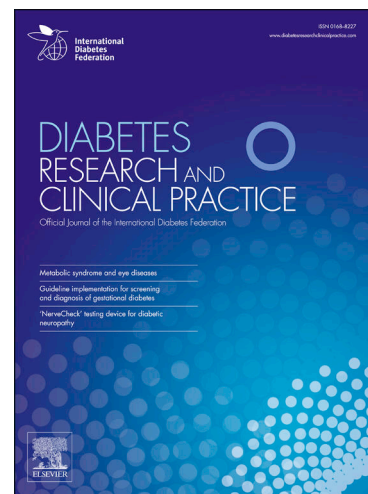
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Title:**VALIDATION OF THE POLISH VERSION OF WHO-5 AS A SCREENING INSTRUMENT FOR
DEPRESSION IN ADULTS WITH DIABETES.**

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

ABSTRACT**Aims**

The aim of this study was to validate and report the factorial analysis of the World Health Organization's 5-item Well-being Index (WHO-5) among outpatients with type 2 diabetes. We investigated the psychometric properties of the WHO-5 and its suitability for identifying potential depressive symptoms in Polish adults with diabetes.

Methods

Participants were randomly chosen among Polish diabetes outpatients and invited to participate in the cross-sectional study (N = 216). Participants completed the Polish version of the WHO-5, Problem Areas in Diabetes Scale and Patient Health Questionnaire.

Results

Factor analyses identified the one-factor structure of the Polish version of the WHO-5. The internal consistency of the Polish version of the WHO-5 is satisfying. With regard to convergent validity, there were significant negative associations between the WHO-5 and PAID, the PHQ-9, HbA1c and the amount of medical complications. The AUC indicates that the WHO-5 is an effective measure for identifying depressive symptoms. The optimal cut off values of ≤ 12 yielded the best sensitivity/specificity trade-off for identifying depression among people with diabetes.

Conclusions

The Polish version of the WHO-5 is a reliable, valid outcome measure for outpatients with type 2 diabetes and can be a useful instrument for screening for depression in people with diabetes.

KEYWORDS: Diabetes Mellitus, Type 2, Depression, World Health Organization, Quality of Life, Psychometrics, Sensitivity and Specificity

1. INTRODUCTION

In European diabetology, the objectives and methods formulated in the Declaration of St. Vincent, which was signed in 1989 under the auspices of the World Health Organisation and the International Diabetes Federation, were accepted as the basis for all activities in the care of people with diabetes [[1], [2]]. This document, including recommendations and guidelines directed at improving the health care and social conditions of people with diabetes, was also adopted by the Polish Government.

It is clear that intensive diabetes care reduces the risk of developing chronic complications of diabetes, disability and mortality [1]. The Declaration of St. Vincent included guidelines aimed at improving psychological well-being among people with diabetes which was based on the assumption that psychological well-being is associated with physical well-being, and thus may impact on diabetes [2], [3]. Indeed, empirical evidence has demonstrated that improving psychological well-being can enhance clinical outcomes including metabolic control or complications risk reduction [4][5][6], [7].

For that reason, the monitoring of well-being among people with diabetes is one of the recommended goals of diabetes management. The prevalence of depression in people with diabetes is about twice as high as the general population [8].

The severity of depressive symptoms is related to functional impairment as well as higher costs of care in people with diabetes [5], less than the optimal diabetes self-management, including lower levels of physical activity and difficulties with self-medication [9], [10], [11] and with hyperglycaemia [6]. Lower levels of physical activity and poorer control of diabetes results in greater risk of poor microvascular and macrovascular outcomes and higher mortality [12], [13].

The monitoring of psychological well-being can increase the efficacy of identifying psychological problems and facilitate the treatment of these problems resulting in improving the psychological and physical condition of people with diabetes [14]. It is critical, therefore, to routinely screen for depressive symptoms and well-being in people with diabetes using standardized measures.

Short, simple screening instruments are useful in quickly and systematically recognizing people experiencing significant depressive symptoms, however at present the detection of mental health problems such as depression or anxiety by physicians and nurses does not reach more than 50% [15]. Brief self-report screening instruments for depression are available such as the Beck Depression Inventory (BDI) [16], the Hamilton Rating Scale for Depression [17], and the Patient Health Questionnaire Nine (PHQ-9) [18].

Additionally, some simple tools for identifying diabetes-specific psychological problems and distress also exist, for example the Problem Areas in Diabetes Scale (PAID) [19]. All the aforementioned instruments are psychometrically reliable, short and easy to use in clinical practice for identifying depressive symptoms [20]. However, the appropriateness of using screening tools characterized by negatively phrased questions [21] especially where issues of acceptability are important (e.g. among non-psychiatric populations) has been highlighted recently [21], [22]. It has been suggested that the negative content of the questions may reduce acceptance resulting in withdrawing participation in the screening and diagnosis process [21]. In consequence the comprehensive diagnosis and accurate prediction of outcomes is often overlooked. In contrast, tools that include positive statements (e.g. asking to what extent the person has felt calm, relaxed and cheerful) are often more acceptable and can lead to a correct diagnosis of depressive symptoms as identified by the absence of positive mood [23].

The Well-being Index five item (WHO-5) [24] is one of such instruments. Results of empirical studies show that it is also useful for identifying depressive symptoms because the items included in this tool represent the lack of positive mood, interest and energy [25], [26] which correspond to some of the symptoms of depression. Evidence has demonstrated that the WHO-5 has good sensitivity and specificity regarding the prediction of major depression [27], including among people with diabetes [14], [22], [24], [28], [29].

Hence, the main aim of this study was to investigate the psychometric characteristics of the Polish version of the WHO-5 among Polish adults with diabetes. We examined the factorial structure of this tool, the internal consistency, reliability, its sensitivity and specificity for detecting depression using the standardized structured interview MINI International Neuropsychiatric Interview [30], [31] (Polish version 5.0.0).

We assumed that the Polish version (like other language versions of the WHO-5) has a single factor structure and satisfactory psychometric properties as well as a high sensitivity and specificity for diagnosing depression.

2. MATERIAL AND METHODS

The data analysed in this study is derived from the INTERPRET-DD study that was a collaborative study carried out between January 2014 and June 2015 among invited outpatient clinic attendees with Type 2 diabetes in 14 different countries [32]. The investigators were recruited from leading centres of excellence in Poland and included psychiatrists. The diabetologists in diabetes clinics invited individuals to participate in the study. Written informed consent was obtained from all participants.

2.1. Participants

The study included individuals diagnosed with type 2 diabetes at least 12 months prior to participation in their diabetes outpatient facilities. The participants were aged between 18 and 65 years [33]. Individuals with type 2 diabetes diagnosed for less than 12 months were

excluded from the study. Other exclusion criteria were: diagnosis of type 1 diabetes; uncompleted set of measures due to communication and/or cognitive difficulties; any life-threatening or severe conditions, such as cancer or stroke in the last 6 months. In order to maintain homogeneity of the group those currently admitted or planning admission for inpatient care to a hospital were excluded, because they might get a more intensive or different treatment. The additional exclusion criteria were pregnancy or childbirth in the last 6 months, clinical diagnosis of alcohol or other substance (not tobacco) dependence or a diagnosis of schizophrenia. The data delivered only from Poland was used in the analysis. At total of 216 individuals with type 2 diabetes (100 females, 116 males) took part in this study (see Table 1).

2.2. Procedure

At the first step, each eligible individual completed a survey recording age, duration of diabetes, family history of diabetes and presence/history of diabetes complications (cardiovascular disease, retinopathy, peripheral neuropathy, peripheral vascular disease, renal disease and associated disorders), the most recent blood pressure measurement, HbA1c, as well as height and weight.

Each of the participants completed the Patient Health Questionnaire (PHQ-9) [18], World Health Organization-Five Well-Being Index (WHO-5) questionnaire [34] and the Problem Areas in Diabetes (PAID) scale [19]. The translation of the WHO-5, PAID and PHQ-9 was carried out using standard forward/back-translation procedures. In addition, Polish investigators ensured that it was culturally applicable through a discussion on the contents of translated items and testing them with a range of healthcare professionals and people with type 2 diabetes, focusing on the semantic meaning of expressions and language.

In order to identify the occurrence of a current major depressive disorder (MDD) a MINI International Neuropsychiatric Interview [30] was subsequently conducted. Any

medications for mental health problems or documented diagnosis or treatment of any psychiatric condition were recorded. Participants were also asked about the location of their accommodation (rural or urban area), level of education (no formal, some/completed primary, some/completed secondary school, or higher education), marital status (married/cohabiting vs being single/widowed/divorced) and financial status.

2.3. Measures

To validate the Polish version of WHO-5, the relevant data were extracted from the International Prevalence and Treatment of Diabetes and Depression (INTERPRET-DD) study dataset [33]. We took into consideration the patient's results in the PHQ-9 and the PAID scales which were used as external scales to verify convergent validity of the Polish version of WHO-5.

The WHO-5 is a unidimensional, five-item tool used to measure general emotional well-being in the past two weeks [28]. Participants are asked to rate how often they have felt on a 6-point Likert Scale ranging from 0 (not at all) to 5 (all of the time). The scores are summed with higher scores indicating better emotional well-being. All of the items are positively worded statements (e.g. "I have felt cheerful and in good spirits). Thus, the raw score ranges from 0 (absence of well-being) to 25 (maximal well-being). A raw score below 13 (≤ 12) indicates poor well-being. Raw scores may also be transformed to a percentage value from 0 to 100 by multiplying the raw score by 4 [27]. The English version of the WHO-5, and its many translations, including Polish version, are available at <https://www.psykiatri-regionh.dk/who-5/who-5-questionnaires/Pages/default.aspx>. It is recommended to administer the Major Depression (ICD-10) Inventory if the raw score is below 13 or if the patient has answered 0 to 1 to any of the five items [34]. With regard to populations with diabetes, the majority of studies have employed self-report tools such as the PHQ-9 or the Centre for Epidemiological Studies Depression Scale (CES-D). The cut-off scores on both these

instruments that indicate likely depression have been shown to correspond with WHO-5 results [27], [28], [35], [36]. It is noteworthy, that other studies have identified other cut-offs for likely depression [27]. For example, in a study carried out by Hajos et al. [36] when a PHQ-9 score of ≥ 10 or ≥ 12 are the criterion for depression, a WHO-5 score of 48 (≤ 12 raw scores) and 46 (< 12 raw scores) yield the optimal trade-offs between sensitivity and specificity respectively. To our knowledge only the one study has used DSM-IV depression criteria as assessed by a structured interview as the gold standard reference among participants with diabetes [29]. However, in this study sensitivity/specificity trade-off was presented only for the conventional WHO-5 cut-off point of < 13 (indicating poor well-being) and we do not know the sensitivity and specificity for alternative cut-offs. This is important because the sensitivity and specificity values vary for a cut-off of < 13 (< 50) across the studies. The sensitivity ranges from 0.57 to 1 and specificity from 0.78 to 0.88 [27]. For example, the study carried out among people with diabetes in Japan showed that the WHO-5 had a sensitivity of 0.57 and specificity of 0.83 for the conventional cut-off point (≤ 13 points) [35]. On the other hand, using the same cut off point among paediatric outpatients in the Netherlands resulted in a sensitivity of 0.89 and specificity of 0.86 [28]. These discrepancies indicate the necessity of evaluating the cut-offs for individual countries and populations; the usefulness of unified cut-offs irrespective of the specificity of the population seem to be limited.

We used the PHQ-9 [18] to assess the severity of depressive symptoms. The participants rate the frequency of the presence of depressive symptoms from 0 (not at all) to 3 (nearly every day). The value of the Cronbach's α in this sample yielded 0.86.

The PAID scale [19] consists of 20 statements regarding the existence of negative states commonly experienced by people with diabetes (e.g. "worrying about the future and the possibility of serious complications"). Participants report the extent to which each issue is

currently a problem for them on a 4-point Likert scale (from 0 – not a problem to 3 – a serious problem) According to the Polish version of the PAID we included single factorial structure of this tool in the analysis. The Cronbach's alpha obtained was $\alpha = 0.95$.

The diagnostic status of all the participants at the time of the WHO-5 assessment was determined by the MINI International Neuropsychiatric Interview (Version 5.0.0) [30], [31] which has been widely used among different populations, including those with serious illnesses. It is a reliable diagnostic instrument according to Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-5) criteria [30]. The interview was conducted by a trained Psychiatrist. The classification of depressed or non-depressed was based on DSM-IV criteria for current Major Depressive Disorder (MDD).

2.4. Statistical analyses

2.4.1. Factorial structure, internal consistency reliability and convergent validity of the Polish version of the WHO-5.

The statistical analyses were carried out using SPSS version 25 for Windows. In order to determine the factorial structure of the Polish version of the WHO-5, an Exploratory Factor Analysis with Oblimin rotation was conducted. Principal axis factoring (PAF) method was applied because of the result of Kolmogorov-Smirnov test indicating non-normal distribution of the data. The recommended value of factorial loadings of every item is above 0.3 [37].

The internal consistency reliability of the WHO-5 was assessed using Cronbach's alpha with α values between 0.80 and 0.90 usually indicating good internal consistency [38]. To measure convergent validity, Pearson product moment correlations were applied. We assumed that WHO-5 scores would be negatively associated with PHQ-9 results and negatively related to PAID scores. A strong or moderate strength of the relationship (r value from $|0.50|$ to $|0.80|$) between WHO-5 scores and these two measures indicates satisfactory convergent validity [39].

2.4.2. Screening accuracy for likely depression.

In order to assess the discriminatory validity of the Polish version of the WHO-5 as a screening tool for current depressive episodes, the positive predictive value (PPV) and negative predictive value (NPV) were calculated using logistic regression. The PPV is the probability of disease for positive test results while the NPV means the probability of being healthy when test results are negative [40]. Then, we employed a Wald statistic estimated for the depression indicator variables from a logistic regression model to test whether the variation in the prevalence rate of persistent depression across the level of well-being is different than expected by chance. Odds ratios (ORs) and their confidence intervals (CI) were estimated.

In this study the results of the WHO-5 are reported on a continuous scale, therefore the sensitivity and specificity can be computed across all the possible threshold values. The sensitivity and specificity depend on the value of the threshold and the sensitivity is inversely related with specificity [40], [41]. To determine sensitivity and specificity of the WHO-5, Receiver Operating Characteristic (ROC) curve was mapped and the area under the curve (AUC), as an effective measure of accuracy of the WHO-5 for identifying depression has been calculated. In previous studies researchers have not reported the applied criteria for the choice of optimal cut-off [28], [29], [35], [36]. We identified the optimal cut off values using Youden's index which ranges between 0 to 1, with higher values indicating greater diagnostic performance [42]. Statistical significance for all of the conducted analysis was established at $p < 0.05$.

3. RESULTS

3.1. Demographic, clinical and psychological sample characteristics

The demographic, clinical, and psychological characteristics of the participants are presented in Table 1.

The mean age of participants was 57.43 ($SD = 7.30$) ranged between 18 and 65 years with a mean duration of diabetes of 9.47 ($SD = 7.10$) years. The mean WHO-5 scores for total sample was 15.97 ($SD = 6.48$; range 0 – 25). WHO-5 scores were not significantly associated with age ($r = 0.11$, $p = 0.11$). There was also no difference according to either gender ($t(214) = 1.29$, $p = 0.20$), education level ($H(2) = 1.669$, $p = 0.44$) or location of residence ($U = 1559.50$, $p = 0.13$). WHO-5 scores were not significantly associated with diabetes duration ($r = -0.11$, $p = 0.11$).

Table 1 around here

3.2. Reliability and validity

The analysis indicated one factor of the Polish version of the WHO-5 with eigenvalues > 1.0 (3.36; second highest value is .58). The inspection of the scree plot also suggested a one-factor structure (see Figure 1).

Figure 1 around here

Figure 1. Scree plot of the Polish version of the WHO-5.

The one-factor solution indicated that factorial loading of each of the five items is above the recommended minimal value of 0.3 [37] and all factor loadings are 0.76 or higher. The total variance of the one-factor solution was 67.28% (see Table 2).

Table 2 around here

In the next step, we assessed the reliability of the WHO-5 scale by calculating the Cronbach's alpha reliability coefficients. Cronbach's alpha for the Polish version of this tool yielded 0.87. Thus, the internal consistency reliability of the WHO-5 is satisfactory, indicating the homogeneous structure of the measure.

In terms of convergent validity WHO-5 scores indicated a strong significant inverse correlation with the PHQ-9 (whole group: $r = -0.75, p < 0.001$) and a strong negative correlation with PAID scores ($r = -0.52, p < 0.001$). Additionally, there was a significant negative correlation between WHO-5 scores and HbA1c ($r = -0.18, p < 0.05$). The relationship between WHO-5 and the amount of medical complications was also significant ($r = -.184, p < 0.05$). The medical complications including: stroke or cerebrovascular incident, heart attack or myocardial infarction, any other heart trouble (e.g. angina etc), retinopathy, macular oedema, neuropathy, nephropathy, peripheral vascular disease, heart disease/ heart problems, kidney problems, problems with legs / feet, high blood pressure, high cholesterol. These results demonstrate a good convergent validity of the Polish version of the WHO-5.

3.3. Screening accuracy for depression

The logistic regression analysis indicated that the model containing the WHO-5 as a predictive factor for a major depressive episode was statistically significant, $\chi^2(1) = 111.32; p < 0.001$. The Hosmer–Lemeshow test indicated goodness of fit of the prediction model, H-L $\chi^2(7) = 0.89; p = 0.996$. The coefficient of determination Nagelkerke's *R squared*, $R^2 = 0.71$ indicated that approximately 71% of the variability in the MDD is explained by the WHO-5 scores. The Wald test showed that the variation in the prevalence of major depressive disorder across the level of well-being is more varied than expected by chance, $W(1)=35,23; p < 0,001$ (OR = 0.617; 95%CI: 0.526 – 0.724).

The ROC curve was mapped to determine the sensitivity and specificity of the WHO-5 for the detection of a current major or minor depressive episode according to the Polish version of the WHO-5 total score (see Figure 2).

Figure 2 around here

Figure 2. ROC curve of the WHO-5 for detecting likely depression in adults with type 2 diabetes (N = 216).

The AUC was 0.965; $p < 0.001$ (95% CI 0.940–0.989). The Youden's index (0.802) indicated that a cut-off of ≤ 12 yielded the best sensitivity/specificity trade-off: sensitivity 93.8%; specificity 86.5%; PPV 54.5%; and NPV 98.8% (see Table 3).

Table 3 around here

4. DISCUSSION

This is the first study to identify the psychometric properties of the Polish version of the WHO-5 and its utility as a suitable screening tool for depression among Polish adults with type 2 diabetes. The results of our analysis provide empirical evidence for the internal consistency, reliability and convergent validity of the Polish version of the WHO-5, with a high Cronbach's alpha and expected strong negative associations with the PAID and PHQ-9. We observed a weak negative relationship between WHO-5 scores and HbA1c as well as between WHO-5 scores and the amount of medical complications. Additionally, the results of Principal Axis Factoring (PAF) support a one-factorial structure of the WHO-5, which confirms the findings of other research in people with diabetes [22], [28], [36], as well as the Danish general population [24].

The ROC analysis supports the use of the WHO-5 as a screening tool for verifying likely depression in people with type 2 diabetes. The AUC was very close to 1, suggesting a

good accuracy of the WHO-5 for screening for depression. It also had high sensitivity and specificity for the optimal (≤ 12) cut-off value. According to our knowledge, this is the first study applying Youden's index to find the optimal cut-off values among people with diabetes, making an important contribution to existing work where discrepancies in the sensitivity and specificity for the conventional cut-off of < 12 have been found up to now [27]. Furthermore, unlike our research, the majority of previous studies did not compare the WHO-5 with a structured diagnostic interview and so should be interpreted with caution. For this reason, we diagnosed depression using DSM-IV criteria assessed by a structured interview (the M.I.N.I) as the gold standard reference.

International guidelines recommend routine screening for depression in people with diabetes [43], [44]. However, although there is strong evidence that up to 10-20% of people with type 2 diabetes may have depression, this often goes unrecognized [15]. This may be partly explained by healthcare professionals often reporting being insufficiently equipped to provide diabetes self-management education, including emotional and psychological aspects of diabetes [45]. The absence of psychological services is considered as the most significant barrier in recognizing mental problems and providing people with adequate treatments [46]. However, it is unlikely that both expanding the diabetes team with specialist psychological expertise and providing mental health professional, as an integral part of the team will be resolved in the short term [47]. Thus, providing a screening tool for depression which healthcare professionals will find easy to use may improve recognition of depression among patients with diabetes [45]. This may contribute to providing more complex, appropriate treatment or support leading to health enhancing or quality of life improvements, reducing the adverse impact of depressive symptoms on diabetes management, glycaemic control and other health outcomes [48]. The WHO-5 has been useful as an outcome measure among various clinical groups [27]. For example, Wade et al. [49] applied the WHO-5 to measure the

efficacy of a prolonged release melatonin formulation among people with insomnia. Among people with breast cancer the WHO-5 was used to test the effect of mindfulness-based therapy [50]. In turn, Robinson et al. [51] examined the effect of paroxetine among individuals with tinnitus using the WHO-5 as one of the outcome measures. The extensively applicability of the WHO-5 as a valid screening tool for depression in geriatrics [52], neurology [53] and endocrinology [29], [35], [36] has also been observed.

This research provides support for the Polish version of the WHO-5 that may be useful for both clinical practice and empirical research in people with diabetes, because of both satisfactory psychometric properties and brief, positively worded content. Undoubtedly, free accessibility online of all existing language versions of the WHO-5 is a valuable asset which should contribute to the enhanced recognition of depression in people with diabetes.

However, the validation of each version and determine optimal cut-off point are necessary for clinical practice, because health professionals have to be sure that any employed screening instrument is adapted to the patient's culture, language, and literacy abilities [23]. The main aim of this study is consistent with the general objective of INTERPRET-DD project, namely, to assess the specificity and sensitivity of depression screening instruments when used in people with Type 2 diabetes [33]. Additionally, changes in wellbeing can be monitored when evaluating ongoing treatment, with a difference of 10% indicating a significant change [54].

Thus, the effectiveness of the WHO-5 as a screening tool for depression is not only derived from its psychometric properties. The results of this study allow us to recommend the WHO-5 as a suitable first-step screening instrument for likely depression. Obviously, the WHO-5 cannot be used as the only and sufficient tool for the diagnosis of depression. Professionals should keep in mind that screening instruments only enhance recognition and do not replace a full clinical test. The presence of clinically significant depressive symptoms has

to be verified by full clinical diagnostic process including structured psychiatric diagnostic interview [20].

The strength of this study is the comparison of the WHO-5 scores with a clinical diagnostic interview for depression (MINI). Secondly, the PHQ-9 was used in this study as it is based on the DSM-IV diagnostic criteria for depression, and simultaneously it is recommended and commonly used for depression screening in people with diabetes [23]. Additionally, our exploratory ROC analyses comparing the WHO-5 with the diagnosis for major depressive syndrome by MINI are consistent with previous research indicating that WHO-5 is a reliable and valid self-assessment screening tool for major depression in people with diabetes at a cut-off point of ≤ 12 [55].

. Although the total sample of this project is large, this report is based on data collected only in Poland (N = 216). Nevertheless it is larger than the majority of previous similar studies [28],[29], [35], [56] and makes a significant contribution to the field. The other caveat is that the large majority of the participants was living in an urban rather than rural location. It may be important point with respect to the difference in accessibility methods of non-pharmacological treatment. However, the INTERPRET-DD study did not record any non-pharmacological treatments at baseline. Moreover, the study was undertaken in specialist clinics where the sample of patients may be varied from the wider diabetes population. For example, there may be an overestimate or underestimate of the severity of depressive symptoms. The other limitations of INTERPRET-DD study with respect to the possibility of comparing results with other countries are reported elsewhere [33].

5. CONCLUSIONS

This study has demonstrated that the psychometric properties and suitability of the WHO-5 as a screening instrument for likely depression in Polish adults with type 2 diabetes

are very good. Additionally, this study provides further support for the recommended cut-off value of ≤ 12 . We have provided empirical support for the utility of the WHO-5 which can be a useful tool for both clinical practice and future studies carried out among Polish people with diabetes.

CONTRIBUTION STATEMENT

All authors made substantial contributions to the concept and design of the study. TG and AKo acquired data. EC analysed the data. EC, AKi, AKo, BR, CL and NS interpretation of data. EC prepared the draft of the article. All authors revised it critically for important intellectual content, edited and approved the final version of the manuscript.

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Table 1

Associations between participants' demographic and clinical characteristics with WHO-5 scores (N=216)

	WHO-5 scores M (SD)	<i>statistic</i>	<i>p value</i>
Gender			
Male (n = 100)	16.50 (6.36)	t(214) = 1.29	= 0.20
Female (n = 116)	15.36 (6.61)		
Total sample (N = 216)	15.97 (6.48)		
Education level			
No formal (n = 0)	-	H(2) = 1.66 ^a	= 0.44
Some/completed primary school (n = 19)	16.56 (6.35)		
Some/completed secondary school (n = 141)	15.48 (6.73)		
Higher education (college, post-grad/professional) (n = 57)	17.00 (6.48)		
Residence			
Rural/village (n = 20)	14.20 (6.30)	U = 1559.50 ^b	= 0.13
Urban (n = 196)	16.15 (6.49)		
Age	57.42 (7.32)	r = 0.110	= 0.109
Diabetes duration	9.47 (7.10)	r = - 0.108	= 0.114

Note:

^{a)} Based on nonparametric The Kruskal-Wallis H Test because of unequal group sizes

^{b)} Based on nonparametric the Mann–Whitney U test because of unequal group sizes

Table 2

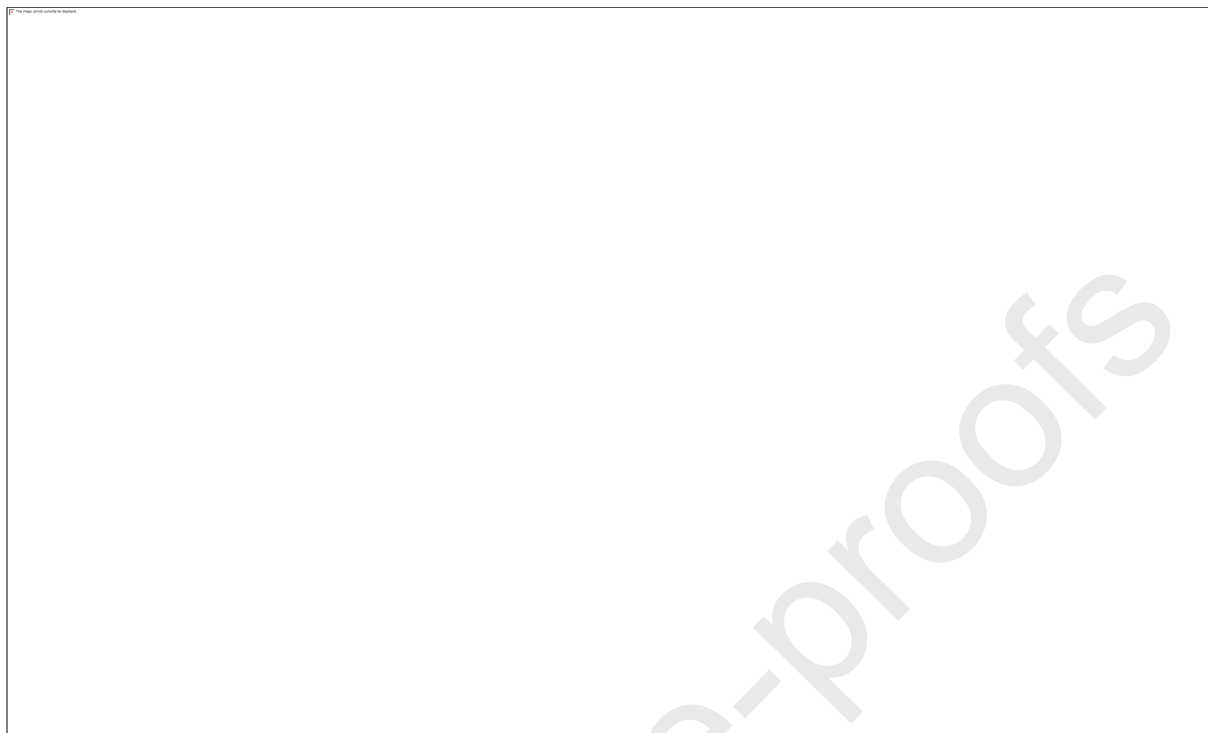
The results of Principal Axis Factoring and factor loadings of the 5 WHO-5 items (N = 216) for one factor solution

Item	FACTOR 1 WHO-5
1. I have felt cheerful and in good spirits	.834
3. I have felt active and vigorous	.819
2. I have felt calm and relaxed	.801
5. My daily life has been filled with things that interest me	.797
4. I woke up feeling fresh and rested	.765

Table 3

Accuracy of the WHO-5 cut-off values for detecting major depression (diagnosed with the MINI) in adults with type 2 diabetes for the Polish sample (N = 216)

WHO-5 raw score cut-off	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	Positive likelihood ratio	Negative likelihood ratio	Youden's index
0,000	0,094	1,000	1,000	0,864	0,000	0,906	0,094
≤1	0,188	1,000	1,000	0,877	0,000	0,813	0,188
≤2	0,313	0,995	0,909	0,893	57,813	0,691	0,307
≤3	0,406	0,995	0,929	0,906	75,156	0,597	0,401
≤4	0,531	0,995	0,944	0,925	98,281	0,471	0,526
≤5	0,594	0,995	0,950	0,934	109,844	0,408	0,588
≤6	0,625	0,995	0,952	0,939	115,625	0,377	0,620
≤7	0,719	0,978	0,852	0,953	33,242	0,287	0,697
≤8	0,719	0,951	0,719	0,951	14,774	0,296	0,670
≤9	0,781	0,930	0,658	0,961	11,118	0,235	0,711
≤10	0,875	0,903	0,609	0,977	8,993	0,138	0,778
≤11	0,906	0,892	0,592	0,982	8,383	0,105	0,798
≤12	0,938	0,865	0,545	0,988	6,938	0,072	0,802
≤13	0,969	0,822	0,484	0,993	5,431	0,038	0,790
≤14	0,969	0,778	0,431	0,993	4,371	0,040	0,747
≤15	1,000	0,697	0,364	1,000	3,304	0,000	0,697
≤16	1,000	0,632	0,320	1,000	2,721	0,000	0,632
≤17	1,000	0,551	0,278	1,000	2,229	0,000	0,551
≤18	1,000	0,481	0,250	1,000	1,927	0,000	0,481
≤19	1,000	0,405	0,225	1,000	1,682	0,000	0,405
≤20	1,000	0,330	0,205	1,000	1,492	0,000	0,330
≤21	1,000	0,232	0,184	1,000	1,303	0,000	0,232
≤22	1,000	0,184	0,175	1,000	1,225	0,000	0,184
≤23	1,000	0,141	0,168	1,000	1,164	0,000	0,141
≤24	1,000	0,108	0,162	1,000	1,121	0,000	0,108
≤25	1,000	0,000	0,147	1,000	1,000	0,000	0,000



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