

Worry and depression levels among patients with type 1 diabetes mellitus. The mediating role of illness acceptance

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ABSTRACT

Aim. The purpose of the conducted study was to explore the role of cognitive processes, such as habitual worry, with regard to depressive mood in patients with type 1 diabetes mellitus (T1DM), as well as the significance of illness acceptance in the form of personal asset and mediator in relation between worry and depression.

Material and Methods. The study involved 229 participants diagnosed with T1DM, who completed a set of self-description questionnaires. Assessment methods included The Anxious Thoughts Inventory (AnTI), The Acceptance of Illness Scale (AIS) and The Center for Epidemiologic Studies Depression Scale (CES-D).

Results. The results demonstrate that worry is positively correlated with depression. What is more, the relationship between habitual worry and depression was mediated through illness acceptance.

Conclusions. The impact of habitual worry on mental health in T1DM cannot be ignored. Moreover, the observed dependence suggests that depressive mood present in individuals with T1DM may persist, since overly worried patients do not accept their own illness. Strengthening patients' acceptance of their condition and bringing up the topic of worry in the course of diabetes education, can be a powerful tool in depression prevention. Nevertheless, further research is necessary.

Introduction

Type 1 diabetes mellitus (T1DM) is an extremely complex chronic condition, which requires patients to adjust to the specific treatment

regime and numerous restrictions. Daily tasks include proper medication intake, regular glycaemic control, a balanced diet, and physical activity performed during basic everyday activities [1]. Individual approaches to self-management can

significantly affect patients' current and future health status [2]. Poor self-care increases the risk of developing specific diabetic complications [3] and entails a higher risk of premature death [4], whereas good adherence results in a decreased risk of hospitalization [5] and in better general health outcomes [6]. Among many factors affecting the quality of diabetes treatment, a patient's decisions and motivations form solid foundations of the entire treatment process. As a result, patients not only experience constant fear for their lives, but also bear a great responsibility for each decision they make in the face of the chronic condition which may lead to overwhelming emotional distress, experienced on a daily basis [7–9].

The cross-national DAWN2 study [10], involving over 8 thousand adults diagnosed with T1DM, described diabetes as a 'significant physical and psychological burden for many individuals'. In fact, diabetes is strongly associated with comorbid psychological and psychiatric issues [9], and the data indicate that the onset of the illness increases the possibility of depressive symptoms [11,12]. Severe consequences of comorbidity of depression in T1DM have become a crucial aspect and have been the focus in numerous scientific debates, due to their impact related to the deterioration of patient self-care and diabetes management [13,14]. Hence, the American Diabetes Association recommendations [15] clearly indicate the continuous need for depression to be a valid factor, present in clinical practice, as well as in future diabetology-related research.

The mainstream theory, accounting for the mechanisms responsible for the co-occurrence of depression in the diabetes population, refers to the idea of 'chronic stress'. In fact, prolonged stress associated with the disease-related restrictions may result in an extensive activation of the hypothalamic-pituitary-adrenal axis, and hence lead to an increase in cortisol growth. This, in turn, is described as a pathway that helps to interpret the clinical relationship between T1DM and depression [16]. However, in order to better understand the impact of chronic disease on mental health, it is vital to address the following questions: why does this problem only affect some patients, and what makes the remaining group manage well with chronic stress caused by the disease?

Adaptation to a chronic disease constitutes a continuous and extremely complex process [17–19]. There are numerous theories explaining the course and components of the adaptation pathway. Nevertheless, the common denominator of these theories is the role of metacognitive processes which constitute the most crucial factors involved in the adaptation process. The most important theoretical approaches to date refer to the cognitive functions involved in adaptation to the disease as cognitive effort [20], coming to terms with the illness [21], finding benefits [22], illness perception [23] evaluation of the stress transaction [24], etc. Thus, the onset of depression can be perceived as a consequence of choosing a wrong metacognitive strategy as a form of coping with the disease-associated stress.

In the present paper, habitual worry is interpreted as a metacognitive mechanism activated due to the stress associated with everyday challenges in T1DM. Moreover, in its pathological form, it is related to the perseverative negative thinking loop, which constitutes an inadequate coping strategy leading to an impaired emotional self-regulation [25]. The adaptation of the metacognitive model of pathological worry to account for the severity of depression in T1DM patients seems theoretically promising for two reasons. Firstly, similar research models obtained statistically significant results [26–28], and secondly, chronic disease, such as diabetes, is extremely dynamic in its course and affects many levels of patients' daily life functioning. Nevertheless, successful treatment is 95% dependent on patients' self-care behaviours [29]. Therefore, it appears that worry could be an integral part of chronic illness treatment in the form of cognitive strategy, which helps dealing with uncertainty, volatility and unpredictability, as well as with planning and self-care in diabetes treatment.

The metacognitive model differentiates two kinds of worry: (1) the first type involves coping with daily life challenges, whereas (2) the second one, also referred to as 'meta-worry', includes negative evaluation of worry [30]. Although positive observations regarding worry are considered a common and a non-pathological strategy of dealing with problems, e.g. 'If I worry about my blood glucose level, I will always be adequately prepared', negative ones seem to increase the

sensitivity to threatening stimuli, thus, hindering individual adaptive coping strategies due to deep, looped, and pathological worry, e.g., 'My worry is uncontrollable, I am going to lose my mind' [31].

According to the literature, in contrast to the phenomenon of worry, acceptance is often referred to as a special agreement between patient and the disease [32], a change of orientation towards positive aspects of everyday life [33], and a positive self-perception [34]. By definition, illness acceptance is a personal resource reflecting the attitude of full understanding and a sense of self-worth, despite the current state of health, disability or dependence [35]. As a personal resource, acceptance constitutes a stable feature, a kind of prism that can set the course for dealing with the chronic disease-specific stress transactions [36], for instance, as an examination and correction of the inner coping mechanisms and behaviour patterns [37]. Research concerning the issues of health psychology has indicated that acceptance of illness promotes better adaptation to the disease [35], affects patients' dispositional optimism [38] and quality of life assessment [39,40]. Similar observations were made in the studies involving groups of patients with type 1 or type 2 diabetes mellitus (T2DM) [41–43].

Aim

The first objective of this study was to test the hypothesis of the relationship between habitual worry and the level of depression among patients with T1DM. The second aim was to investigate the hypothesis regarding the mediating role of illness acceptance in view of habitual worry and the depressive mood in T1DM patients.

In this particular study, the following two hypotheses were formulated: (1) T1DM patients present a higher level of habitual worry and of depressive mood, (2) acceptance of illness, as a personal resource, mediates the relationship between worry and depressive mood.

Material and methods

The study was conducted in 2018 and 2019, in the pre-COVID-19-pandemic period, at the Department of Internal Medicine and Diabetology,

Poznan University of Medical Sciences (PUMS), among in-patients suffering from T1DM. The study was questionnaire-based (see description below). Patients who agreed to participate in the study received a set of 3 questionnaires as well as a demographic survey collecting data, such as: gender, disease duration, marital status, education, residence and employment, all in an envelope. Completed questionnaires were collected in a secure box at the PUMS Department of Diabetology, which ensured complete anonymity of the participants. The project was approved in November 2018 by the PUMS Bioethics Committee (Resolution number 1123/18).

The inclusion criteria for the study were as follows: age over 18, disease duration over 3 months, ongoing insulin therapy and a written informed consent to participate in the study. The criteria for exclusion from the study were: previous acute infections, surgery or other severe complications within the last 3 months, pregnancy, coexisting diseases, such as heart, lung, kidney or liver failure, cancer, confirmed mental illness or mental disorders preventing the completion of the questionnaire.

Assessment methods included The Anxious Thoughts Inventory (AnTI), The Acceptance of Illness Scale (AIS), as well as The Center for Epidemiologic Studies Depression Scale (CES-D).

The Anxious Thoughts Inventory (AnTI) developed by Wells [44], was used to assess generalized worry. AnTI is a 22-item self-report scale, assessing three dimensions of worry: social worry, health worry, and meta-worry. The scale was created to emphasize the differences between worry (concerns about daily life) and metacognitions about worry (concerns about worry and cognitive functioning) [31]. Participants are asked to use a four-point Likert scale to respond to the test items. The total score represents the sum of all the provided responses [44]. Psychometric properties of AnTI were reported to be satisfying, both in the general population, as well as in clinical trials. The reliability of AnTI was sufficient for the purpose of the study - *alfa* Cronbach's=0.96 (see Table 3).

The Acceptance of Illness Scale (AIS), developed by Felton, Raveson, and Hinrichsen [35], was used to evaluate the acceptance of illness. The scale is presented according to the Polish adaptation by Juczyński [45], and measures the inten-

sity of successful disease acceptance, despite its association with disability, dependency or sense of worthlessness. Originally, AIS was applied by the authors as part of psychological interviews assessing the degree of psychological adjustment in adult patients with chronic conditions. The scale consists of 8 statements, describing the consequences and limitations resulting from a disease. The participants use a five-point scale to respond to the test items: starting from 1 – I strongly agree, to 5 – I strongly disagree. The total score represents the sum of all the provided responses. A high score indicates acceptance of one's own medical condition, whereas a low score reflects a lack of acceptance and adaptation to the disease [35]. The reliability of AIS was sufficient for the purpose of the study - *alfa* Cronbach's=0.85 (see Table 3).

The Center for Epidemiologic Studies Depression Scale (CES-D) developed by Locke and Putnam [46], was used to determine depression levels. The Scale was provided according to the Polish adaptation created by Ziarko, Kaczmarek and Haładziński [47]. It is a brief self-report tool, designed to assess "the current level of depressive symptomatology, with emphasis on the affective component, depressed mood" in the general population (p.385) [46]. It consists of 20 statements, describing the frequency of affective, cognitive or somatic depression signs, experienced during the last week. Participants use a four-point scale to respond to the tool items: where 1 means "Rarely or not at all", and 4 - "Mostly or all the time". A high score reflects a greater frequency of depression symptoms occurrence. The reliability of CES-D was sufficient for the purpose of the study - *alfa* Cronbach's=0.88 (see Table 3).

The collected questionnaires and surveys were verified for completeness and subsequently entered into the statistical package IBM® SPSS® (version: 25.0 license 5725-A54) in order to extract statistical information. The collected data were analysed in three steps. Firstly, simple

Pearson's *r* correlation coefficients were calculated to assess the relationship between generalized worry, acceptance of illness and depression. Secondly, simple Pearson's *r* correlations coefficients were calculated to evaluate whether the age of patients affected the obtained results. Thirdly, a mediation analysis was performed according to the method suggested by Preacher and Hayes [48], i.e. to test the hypothesis regarding the mediating role of acceptance in the relationship between worry and the level of depression. In the analysis of mediation, a resampling procedure was conducted, with five thousand repetitions.

Results

The final study sample involved 229 volunteers diagnosed with T1DM. All respondents agreed to participate in the study and completed a set of self-description questionnaires. Women and men who participated in the study were of similar age and had been suffering from diabetes for a similar period of time (see Table 1).

Other demographic data have been presented in Table 2. The studied population was dominated by patients who were married 97 (42.4%), with tertiary education 62 (27.1%), who live in the countryside 69 (30.1%) and who were professionally active 133 (58.0%).

In the course of the analysis of the relationship between worry and depression, it was found that the level of generalized worry correlated positively with the level of depression. The obtained correlation coefficients ranged from $r=-0.16^{**}$ in terms of the relationship between worry and a sense of well-being, and up to $r=0.73^{**}$ regarding the relationship between worry and depressive mood. Generalized worry correlated negatively with illness acceptance (see Table 3).

It was also assessed whether the age and the duration of the disease were related to the vari-

Table 1. Characteristics of the study group

Variable	Participants (n=229)				Test t		
	Men (n=88)		Women (n=141)		t	df	p
	Mean	±SD	Mean	±SD			
Age	39.36	10.33	30.18	10.36	-0.127	185.213	0.889
Disease duration	10.42	7.75	11.57	7.61	1.089	183.030	0.274

Source: in house materials.

Table 2. Demographic characteristics of the study group

	Variables	n	%
Marital status	Married	97	42.4%
	Engaged	25	10.9%
	Cohabitation	12	5.2%
	Relationship	24	10.5%
	Single	57	24.9%
	Other	14	6.1%
Education level	Primary	14	6.1%
	Basic vocational	30	13.1%
	Secondary vocational	45	19.7%
	Secondary	31	13.5%
	Post-secondary	23	10.0%
	University student	24	10.5%
	University Graduate	62	27.1%
Residence	Rural	69	30.1%
	Urban	157	68.6%
Occupation	Working	133	58.0%
	Not working	71	31.1%
	Retired	24	10.5%

Source: in house materials.

ables included in the study (see Table 4). There was a weak correlation between age and depression $r = 0.15^*$ and one of its components - somatic symptoms $r = 0.14^*$.

Figure 1 shows the graphic presentation of a simple mediation model investigated in this study. The presented material reveals how habitual worry and its components affects depressive mood through illness acceptance. Path *a* (left arrow) represents the effect of habitual worry on illness acceptance, whereas path *b* (right arrow) is the effect of illness acceptance on depression neglecting the effect of worry. Path *c* (above mid-

Table 4. Pearson's correlation coefficient between age, disease duration and the analysed variables

	Age	Diseaseduration
Habitual worry	0.04	-0.03
Social worry	-0.07	-0.06
Health worry	0.12	-0.02
Meta-worry	0.07	0.01
Depression	0.15*	0.07
Depressive mood	0.13	0.09
Well-being	0.03	0.03
Somatic symptoms	0.14*	0.01
Attitude towards people	0.10	0.07
Illness acceptance	-0.03	-0.08

* $p < 0.05$. ** $p < 0.01$

Table 3. Descriptive Statistics, Cronbach's Reliability Coefficients, and Correlations Between Variables

	Range	Mean	±SD	z	1	1a	1b	1c	2	2a	2b	2c	2d
Habitual worry	22.00-76.00	40.63	11.88	0.96	0.09**								
Social worry	9.00-35.00	16.87	5.21	0.88	0.09**	0.91**							
Health worry	6.00-22.00	10.94	3.69	0.84	0.13**	0.79**	0.55**						
Meta-worry	7.00-26.00	12.82	4.38	0.86	0.11**	0.95**	0.80**	0.67**					
Depression	0.00-49.00	17.48	10.42	0.88	0.14**	0.64**	0.55**	0.63**	0.63**				
Depressive mood	0.00-21.00	5.31	5.14	0.90	0.16**	0.73**	0.58**	0.72**	0.89**				
Well-being	0.00-10.00	6.01	2.13	0.74	0.14**	-0.16*	-0.09	-0.16*	0.18**	-0.11			
Somatic symptoms	0.00-20.00	5.21	4.77	0.85	0.14**	0.59**	0.53**	0.58**	0.90**	0.79**	-0.04		
Attitude towards people	0.00-6.00	0.94	1.39	0.77	0.37**	0.45**	0.30**	0.41**	0.66**	0.58**	0.10	0.53**	
Illness acceptance	8.00-40.00	26.67	7.35	0.85	0.08**	-0.36**	-0.30**	-0.34**	-0.42**	-0.48**	0.05	-0.39**	-0.27**

* $p < 0.05$. ** $p < 0.01$

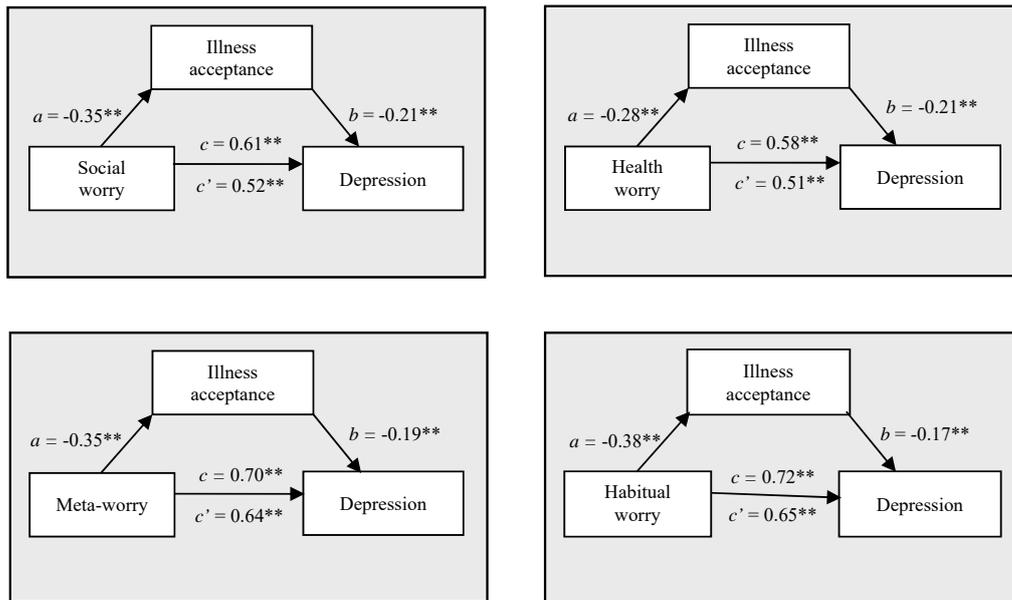


Figure 1. Mediating role of illness acceptance (M) to habitual worry (X) and depression (Y). * $p < 0.01$, ** $p < 0.05$

dle arrow) shows the indirect effect on depression through illness acceptance, whereas path c' (below middle arrow) demonstrates the direct effect on dependent variables. Paths a , b , c and c' present regression coefficients.

The relationship between the independent variable of habitual worry and the dependent variable of depression was mediated through the mediator, i.e. the acceptance of illness. Acceptance demonstrated to be a mediator for both the general level of worry and its single components (social worry, health worry, and meta-worry), as well as for the severity of depression. The observed dependence suggests that depressive mood in people with type I diabetes may persist, since excessively worried patients do not accept their own illness. The observed mediations are partial, which means that other factors also mediate the investigated relationship (see Table 5).

Discussion

The results obtained in the current study confirmed the hypothesis regarding the correlation between worry (and its individual components: social worry, health worry, meta-worry) and depression among patients with T1DM. First of all, this supports the data found in literature that worrying is a phenomenon commonly present not only in anxiety disorders, but also in depression [25]. Furthermore, the study found that the nature of worry seems to reflect rumination thinking style in severe depression in patients suffering from diabetes. In particular, following the metacognitive model of emotional disorders as a response to negative circumstances, the selected coping strategy can be negatively evaluated on the metacognitive level [31]. Despite the fact that the scientific data [27] suggest that

Table 5. Mediating role of illness acceptance (M) with regard to habitual worry (X) and the level of depression (Y)

	Paths				Model summary			Sobel test		95% CI	
	a	b	c	c'	R ²	F	p	z	p	Lower	Upper
Habitual worry	-0.38**	-0.17**	0.72**	0.65**	0.53	129.12	<0.001	3.14	0.017	0.02	0.13
Social worry	-0.35**	-0.21**	0.61**	0.52**	0.41	81.90	<0.001	3.36	<0.001	0.02	0.14
Health worry	-0.28**	-0.26**	0.58**	0.51**	0.41	79.97	<0.001	3.24	0.001	0.03	0.14
Meta-worry	-0.35**	-0.19**	0.70**	0.64**	0.53	129.54	<0.001	3.25	0.001	0.02	0.13

* $p < 0.05$. ** $p < 0.01$

a depressive thinking style is rather associated with ruminations (orientation to the past personal loss, accidents, failures, etc.) than with worry (future-problem orientation, in example: "What if...?"), the meaning of worry and its components in terms of chronic disease cannot be neglected. Particularly, since diabetes management is primarily based on planning and anticipating current issues and future challenges. In this sense, worry constructs a desirable, significant form of adaptive cognitive mechanism preparing the individual for possible danger, as well as takes part in the decision making process [49]. Unfortunately, constant, uncontrollable, or too frequent preparatory system activation is considered maladaptive due to the emotional and information - processing disruption, resulting in individual high emotional costs [50], and may reflect symptoms of mood disorders. According to Matthews and Funke [51], 'worry relates to general tendency towards various forms of negative self-referent thinking' (p.64), e.g. in the sense of self-incompetence, catastrophic thinking loop, and/or avoidance coping strategies of choice. In daily management of diabetes, maladaptive worry may explain withdrawal from active treatment and patients' non-adherence. Recent studies also emphasized the role of metacognitive processes, such as worry, which are involved in the onset of a patient's depression. Moreover, Ziarko, Jasielska, and Mielcarek [28] studied the group of 210 hospitalized patients with rheumatoid arthritis, and found that depressive mood was associated with the habitual meta-worry and worry.

The current study demonstrated that the age of T1DM patients affects depressive mood and somatic symptoms in a limited although statistically significant way. This result is similar to the previous data obtained in large-scale studies [10].

The obtained data confirmed the hypothesis with regard to the mediating role of acceptance of illness between worry and depressive mood, which is consistent with the literature review [25, 41-43]. The test results indicate that the lack of acceptance may constitute a kind of vulnerability, exacerbating the depression. Conversely, high acceptance can help patients adapt well to the challenges of diabetes and provide a protective barrier against the development of mood disorders.

The current recommendations of the American Diabetes Association [15] promote the involvement of people qualified to provide psychological assistance in the course of diabetes management. The results obtained in the present paper indicate that these recommendations are accurate and allow mental health professionals to precisely diagnose patients who do not accept illness, who are sensitive to worry and who are prone to affective disorders. Moreover, these specialists could supplement patient education programmes with psychotherapeutic content and interventions, designed according to the needs of specific patients. Unfortunately, despite the fact that the recommendations of the Polish Diabetes Association [52] also emphasize the significance of psychological interventions based on team care (including a psychologist), the presence of qualified health psychologists in Polish diabetes clinics is inadequate [53]. We believe that this is an area full of potential for development, and the current study can help by reintroducing the discussion concerning the situation of Polish diabetic patients in terms of clinical care.

The study includes several practical implications for specialists focusing on diabetes, but also in the area of research regarding the role of cognitive functions in adaptation to chronic diseases in general. Worry is a fairly common phenomenon in numerous chronic diseases. This fact was demonstrated in the meta-analysis conducted by Lebel, Mutsaers, Tomei et al. [54]. According to the authors, worry can occur in any chronic disease, although it affects various issues related to the course and characteristics of the condition, e.g. fear of recurrence (cancer), worrying about hypoglycaemia (diabetes), fear of pain (cardiac disease), etc. The above mentioned conclusions stem from the fact that so far, most studies on the phenomenon of worry in chronic diseases have been based on specific questionnaires, adapted to a specific problem and disease. Therefore, it is impossible to start a statistical discussion regarding the intensity and connotation of generalized worry in chronic diseases. The use of evaluation methods investigating the severity of generalized worry may contribute to the collection of data that in the future may support a cross-diagnostic analysis of the described problem. Our study shows the idea of using a metacognitive tool to collect data on gen-

eralized worry among people with diabetes. Furthermore, it may be interesting to compare the results concerning the phenomenon of worry and its relation to acceptance and depression in various chronic diseases.

The study has certain limitations, with the sample bias representing a major one, which should be addressed in the future. Patients involved in the study do not constitute a representative research group. Unfortunately, the research began in the pre-pandemic period, and the COVID-19 pandemic prevented the extension of the subject group in the same situational context. Moreover, the study did not include patients from the outpatient diabetes care or individuals who are not currently receiving clinical treatment. Future research involving a more diverse group of adults with T1DM may provide more data in this area. Thus, ongoing behavioural studies are necessary.

Conclusions

This study demonstrated that metacognitive processes, such as worry, contribute to depression among T1DM patients. In addition, the obtained data indicate that the age of patients may influence the general depressive mood, as well as the experienced somatic symptoms. Furthermore, a depressive mood occurring among patients with T1DM may persist due to the fact that the overly worried patients do not accept their own illness. One of the advantages of the present study was the use of research tools measuring the generalized worry, as well as the impact on the psychopathological components. The paper also emphasizes the importance of the presence of psychology specialists in T1DM patient's healthcare. Although the presented research has several limitations which need to be addressed in the future, we believe that it will contribute to the discussion regarding how metacognitive processes, such as worry, affect coping with a chronic disease.

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Conflict of interest statement

The authors declare no conflict of interest.

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