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Heterogeneity of change in state affect following insulin therapy initiation in type 2 diabetic patients

Abstract: *The aim of the study was to explore heterogeneity of change in state affect following the introduction of insulin therapy in patients with type 2 diabetes. State affect was assessed twice among 305 patients: just before the introduction of insulin therapy and at 1-month follow-up. Latent class growth modeling showed that negative affect (NA) increased in 78% of the sample, whereas positive affect (PA) improved in only 17% of the participants. On the basis of cross-tabulation of these changes a 4-class model of emotional response to the new treatment was obtained. The largest subgroup of participants (57%) manifested "threat response", i.e. moderate-stable PA with increase in NA. Participants in the "challenge response" subgroup (11.8%) showed increases in both NA and PA. The third class (10.2%) characterized by "no response", had low-stable NA and moderate-stable PA. The smallest "stress response" subgroup (9.8%) showed increase in NA and high-stable PA. Gender, age and education level were significant covariates of group membership. Thus, the findings revealed heterogeneous emotional response to the new treatment, which may be of clinical relevance for improving diabetic patients' adjustment through a more individual, person-centered approach.*

Key words: *latent class growth modeling, type 2 diabetes, affect*

In the classical stress model proposed by Lazarus and Folkman (1984) emotions reflect the stressful situation and change accordingly to the appraisal of its course. Positive affect as a consequence of cognitive appraisal of difficult situations in terms of challenge or desirable outcome was included in the model (Folkman & Lazarus, 1985), but more systematic interest in positive aspects of stress experience has increased only after the seminal study of caregivers of AIDS patients (Folkman, 1997). The caregivers were found to experience both positive and negative affect under stressful conditions, which resulted in a subsequent modification of the stress model (Folkman, 2008).

As regards relationships between the two types of affect, later longitudinal studies confirm their mutual independence (Crawford & Henry, 2004) due to neurobiological underpinnings (Davidson, Ekman, Saron, Senulis, & Friesen, 1990), but modified by personal characteristics (Reich, Zautra,& Potter, 2001) or affect measure used (Egloff, 1998). Independence of emotional states with different valences extends also to the roles they play in the coping process. Negative affect not only reflects negative appraisal of the situation or of coping outcome, but may also fulfill an adaptive function and motivate the coping process (Heszen, 2013). On the other hand, positive affect enables the individual to divert attention from the stressor (Folkman & Moskowitz, 2000), support their coping efforts and restore resources (Folkman, 2008). Moreover, different but complementary adaptive functions of the two types of affect were emphasized by Fredrickson (1998) in her concurrently developed "broaden-and-build" model of positive affect. According to the author, while negative affect lead to a narrowing of the behavior repertory, positive affect broaden possibilities of behavioral or cognitive responses to the difficult situation, at the same time building up the individual's resources and effectively influencing the regulation of opposite-valence affect.

The increase of interest in positive affective states resulted also in focusing on the exploration of positive course of adaptation to stressful events. In their pivotal research on the subject Bonanno et al. (2002) showed that

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even in a group of people who experience the same event adaptation trajectories are differentiated regarding both their baseline response to the event and further course of responding. Although the cited research and its subsequent replications under various conditions (Bonanno et al., 2008) revealed that in a considerable proportion (about 35–55%) of cases despite an initial decrease in wellbeing the course of adaptation was eventually favorable, nevertheless negative aspects of functioning (such as depression or PTSD) were usually taken under consideration.

Context-related differences in the dynamics of affect due to its valence had been noted in earlier longitudinal studies (Heszen-Niejodek, Gottschalk, & Januszek, 1999) on hope and anxiety following the diagnosis of diseases that vary in controllability: hypertension, myocardial infarction (MI), and cancer. In three measurements, i.e. directly after diagnosis, at 5-week and 6-month follow-ups, the first two clinical groups presented similar intragroup dynamics of negative and positive affect. Namely, in the hypertension group a small increase was followed by stable levels of anxiety and hope, while in MI patients increase and subsequent decrease in anxiety and hope over time were noted. On the other hand, in patients diagnosed with cancer initially high anxiety levels gradually decreased with time, which was associated with a systematic rise of hope. It should be added that in all the three groups at each time point negative affect was higher than positive affect. However, these results were obtained from analyses that assumed homogeneity of change in the whole sample, so no potential interindividual differences in emotional response were accounted for.

While stress researchers construed adaptation to stressful situations as outcome of coping (Tugade, 2011), a broader understanding of this phenomenon involves the individual's response to changing conditions (Schilling & Wahl, 2006). The predominating model of adaptation to important events, so-called "hedonic treadmill", implies a weakening of emotional response over time and in consequence returning to the emotional wellbeing that preceded the critical life event (Lyubomirsky, 2011). However, considerable individual differences should be noted as regards not only the baseline wellbeing level, but also the duration of time needed to return to that level and the degree of regaining the former wellbeing (Diener, Lucas, & Scollon, 2006). This fully corresponds to the cited earlier research by Bonnano et al. (2002, also Mancini, Bonanno, & Clark, 2011). The process goes faster in persons who experience positive events than in those experiencing negative events (Lyubomirsky, 2011), which is ascribed to properties of cognitive processes and to different functions fulfilled by the two types of affect.

Thus, some authors (Schilling & Wahl, 2006) stipulate that the dynamics of negative affect – as compared to positive affect, is characterized by lower variability, since the former is determined by personality characteristics rather than by situational factors. Evidence to the contrary comes from studies on emotion regulation in the elderly, where trajectories of both types of affect were found to depend on the context, and in the case of positive affect – additionally on the subject's physical health and personality (Aldwin, Jelong, Igarashi, & Spiro, 2014).

These research findings seem to warrant exploration of emotional response to an event that requires complex adaptational responses, i.e. to the initiation of insulin therapy in patients with type 2 diabetes. The condition is caused by an increasing pancreatic beta-cells dysfunction that eventually requires rigorous treatment involving subcutaneous injection of insulin (Niswender, 2009). This medical necessity annually affects some 5–10 % of diabetic patients (Peyrot et al., 2005). Although insulin treatment aimed at gaining the optimal blood glucose level yields good outcomes, nevertheless the initiation of this sort of treatment is delayed both by diabetic patients and by their doctors delay, which is termed "psychological insulin resistance" (Peyrot et al., 2005). Insulin therapy is regarded by the patients as the most demanding and burdensome form of diabetes treatment (Vijan, Hayward, Ronis, & Hofer, 2005). Transition to insulin suggests a failure in current management of diabetes and is a sign of progression of the disease (Peyrot, Barnett, Meneghini, & Shumm-Draeger, 2012). Moreover, the necessity of systematic insulin injections may be a source of social stigmatization (Snoek, Skovlund, & Pouwer, 2007). Thus, the situation requires long-term efforts targeted not only at effective self-monitoring of blood glucose, but also at coping with effects of the new treatment on psychosocial aspects of the patient's functioning (Bradley & Gilbride, 2008).

Results of rather few longitudinal studies that investigated psychological consequences of this treatment are not clear. Some studies reported either no change in the patients' quality of life (de Grauw, van de Lisdonk, van Gerwen, van den Hoogen, & van Weel, 2001; UKPDS 37, 1999) or negative mood changes including problems with social functioning, greater emotional fatigue and perceived burdensomeness of the treatment (Goddjin et al., 1999; Reach, Le Pautremat, & Gupta, 2013; de Sonnaville et al., 1998), as well as increased tension, but only in patients with more frequent hypoglycemic episodes (UKPDS 37, 1999). Opposite effects were also noted, i.e. improvements in mood and quality of life, but only in patients receiving less intensive insulin therapy involving fewer injections (Bradley & Gilbridge, 2008; Hajos et al., 2012; Hendra & Taylor, 2004; Hermanns, Mahr, Kulzer, Skovlund, & Haak, 2010). Such discrepancies in the research findings are explained by diversity of measurement methods used, or by side effects of the new treatment, such as e.g. increased BMI after the insulin therapy initiation (Brown et al., 2000). It is also emphasized that insulin therapy may yield only short-term improvements in psychological outcomes (Reza, Taylor, Ward, & Hendra, 2002), which might be associated with reduction of distressing bodily sensations (hyperglycemia; Davis, Clifford, & Davis, 2001). In the light of the discrepant research findings cited above, indicating patients' ambiguous evaluation of insulin therapy, it seems justified to further investigate this issue.

Therefore, the aim of our study was to explore emotional response to the potentially stressful event of treatment modification, i.e. the transition from oral hypoglycemic medications to insulin therapy in patients with type 2 diabetes. On the grounds of the presented literature review diabetic patients can be expected to differ with regard not only to their emotional state prior to insulin therapy, but also to the extent and direction of changes in their emotional response. Moreover, both valences were assumed to be mutually independent, thus separate analyses of change were conducted for negative and positive affect and then their interrelationships were assessed. Finally, since the existing research suggests that sociodemographic variables can differentiate both the affective functioning (Gallo & Matthews, 2003), and potentially also adaptation to illness (Skinner et al., 2011), an attempt was made in our study to examine whether the membership in a specific patient subgroup, defined by trajectories of positive and negative affect changes, would be significantly related to sociodemographic characteristics. Therefore, the following research questions were posed:

1. Is our sample of type 2 diabetic patients homogeneous in terms of change in their state affect in response to the treatment modification, i.e. the introduction of insulin injections?
2. What is the relationship between trajectories of change in negative affect (NA) and positive affect (PA)?
3. Do patient subgroups distinguished on the basis of trajectories of change in PA and NA differ as regards sociodemographic characteristics?

Statistical analysis

Latent class growth modeling was used to answer the research questions concerning heterogeneity of affect changes. The method allows to identify subgroups of people within the sample, so-called classes, characterized by a high internal similarity in respect of the baseline level of a variable analyzed and the extent of change, with significant differences between the subgroups regarding these two parameters (Raudenbush, 2001). Therefore, this approach provides a useful fusion of person-centered and variable-centered analyses (Muthén & Muthén, 2000).

The first step in the analysis was to establish a model of homogeneous change for the whole sample, subsequently increasing the number of classes and comparing models obtained that way with each other. In order to identify the model with the optimal number of classes several indicators were used, in accordance with the recommendations. The Bayesian Information Criterion (BIC) is considered to be more valid there than the Akaike Information Criterion (AIC) (Nylund, Asparouhov, & Muthén, 2007). Lower values of both these indexes indicate a better model. As regards entropy, higher values indicate a more valid classification, where the value equal 1 evidences the prefect classification. On the other hand, the parametric bootstrapped likelihood ratio test (BLRT), recommended by McLachlan and Peel (2000), is a tool for direct comparisons between models, where a significant value of the difference indicates a better fit of the model with a larger number of classes (k-1 *vs* k). An important practical criterion related to replicability of the obtained classes is also their size: a small size suggests potential difficulties with identification of an analogical class in another sample.

The analyses listed above were conducted for NA and PA separately. Next, in order to compare thus obtained classes of NA and PA change, cross tabulation was used. Finally, the resulting subgroups characterized by mutually independent NA and PA changes were compared in terms of sociodemographic variables by means of multinomial logistic regression. The calculations were performed using the LatentGOLD 4.5 and IBM SPSS Statistics version 22 programs.

Method

Participants

Participants were adult patients with type 2 diabetes. Targeted selection of patients was applied, with additional inclusion criteria: under 60 years of age, no less than primary education, and no severe comorbid somatic conditions. Patient selection was based on a physician's opinion on the medical necessity of treatment modification, i.e. the introduction of insulin injections. The study sample included 305 patients (53.2% women), their mean age was 50.05 years (*SD* =9.80). As can be seen in Table 1, patients married and having children predominated in the sample. The majority had secondary education and an average financial status. About 62% of the participants were permanently employed at the time of assessment.

Table 1. Sociodemographic characteristics of participants (N = 305)

Variable	N (%)
Age in years (M ± SD)	50.05 ± 9.80
Gender (women)	162 (53.1%)
Marital status	
Married/Cohabitating	219 (71.8%)
Single	85 (27.9%)
Missing data	1 (0.3%)
Children (yes)	238 (78.0%)
Education	
Primary	41 (13.4%)
Basic vocational	66 (21.6%)
Secondary	111 (36.4%)
College/University	86 (28.2%)
Missing data	1 (0.3%)
Material status[a] (M ± SD)	1.99 ± 0.57
Employment (yes)	188 (61.6%)

Note. M = mean, SD = standard deviation.
[a] Material status was self-rated on a three-point scale (1 – *below average*, 2 – *average*, 3 – *above average*).

Table 2. Descriptive statistics and Pearson's correlations between negative and positive affect

Variable	Mean	*SD*	Skewness	Kurtosis	NA_1	PA_1	NA_2
NA_1	2.33	0.85	0.15	-0.87			
PA_1	2.25	0.70	0.00	-0.28	.08		
NA_2	2.54	0.85	-0.27	-0.83	.47*	.06	
PA_2	2.35	0.63	0.22	0.07	.07	.60*	-.02

Note. NA – negative affect, PA – positive affect.
Indexes 1 and 2 denote the baseline (before the introduction of insulin therapy) and follow-up (after the introduction of insulin injections) measurements, respectively.
* $p<.001$.

Instruments

Affect was assessed using the Positive and Negative Affect Schedule (PANAS) by Watson, Clark and Tellegen (1988; the Polish adaptation by Brzozowski, 2010). The respondents were asked to rate on a 5-point Likert scale their current feelings concerning their disease. Mean PA and NA scores were calculated, where score 1 denoted the emotion experienced very slightly or not at all, and score 5 – extremely. Cronbach's alpha coefficients for successive measurements were, respectively: for NA – .95 and .96, while for PA – .91 and .90.

Procedure

The presented study was a part of the research project No. MEiN 1 H01F 019 30. Outpatients of diabetes clinics were contacted on the grounds of their physicians' opinion recommending that due to medical necessity their treatment plan should be modified in the nearest future, i.e. subcutaneous insulin injections should be introduced. On obtaining the patient's informed consent the baseline measurement of their affective state was conducted together with an assessment of sociodemographic variables. The follow-up evaluation was performed about a month (on average, 35 days) after the introduction of insulin therapy.

Results

Missing data analysis and descriptive statistics

At the follow-up 278 patients were assessed, which corresponds to about 9% attrition rate. Moreover, individual missing-data items were noted both in affective states and sociodemographic variables measurement – they all accounted for fewer than 1% responses. The MCAR test results indicate their random character ($\chi^2=1.189$, $df=4$, $p=.88$). In accordance with the current recommendations (Graham, 2009), the missing data were substituted using the EM algorithm. Further analyses were conducted therefore for the sample size $N=305$.

Table 2 presents descriptive statistics for NA and PA, as well as their correlations on both measurements. As can be seen, the two variables remain independent in the sample under study – thus, their changes over time were analyzed separately. Besides, correlations of the same variables over time (i.e., autoregression), even if significant, turned out to be moderate, which suggests potential differentiation of change in the sample.

Heterogeneity of change – identification of classes

Classes of NA change

For the whole sample, i.e. 1-class solution, the baseline NA level is 2.33 ($z=47.97$, $p<.001$), with a significant increase ($B=0.30$, $z=4.34$, $p<.001$) at the follow-up. Table 3. shows goodness-of-fit indicators that allow to decide on the optimal number of classes. Beginning from the 1-class model, a systematic decrease in BIC and AIC values along with increasing number of classes can be seen up to the 3-class solution, then these values begin to rise. Also the BLRT indicates a poorer fit of the 4-class model as compared to the 3-class model. Likewise, entropy is definitely the highest for the 3-class model. Besides, in the latter solution the smallest class still has an acceptable size, similar to that in the 4-class model. Therefore, all the parameters point to the 3-class solution, plotted in Figure 1 (the left panel).

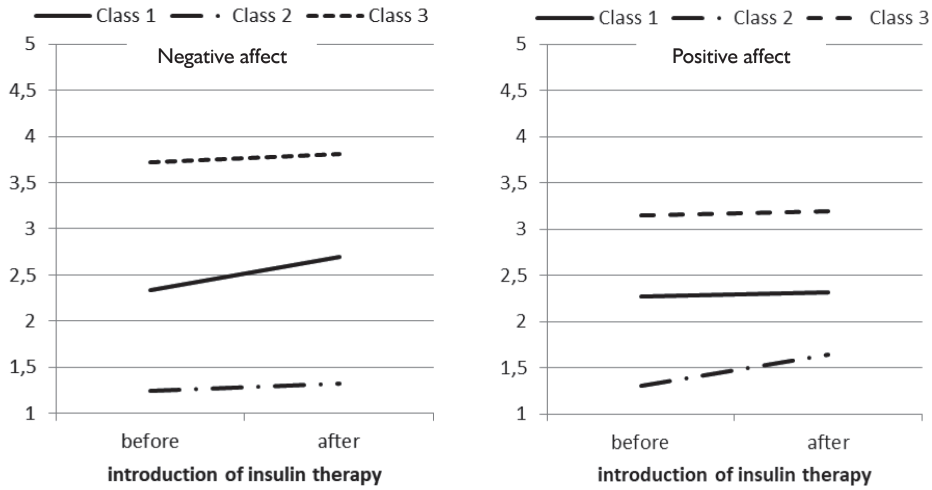
The classes identified that way significantly differ in their baseline affect levels ($Wald=827.17$, $p<.001$) and the extent of change ($Wald=10.43$, $p=.01$). The first class, definitely the most numerous ($n=240$, 78% of the sample), encompasses patients with an average NA level at the baseline and a significant increase at the follow-up ($B=0.36$, $z=5.60$, $p<.001$). The remaining two classes differ only in their starting points, since in both cases NA remain stable. Class 2 ($n=38$; 12% of the sample) consists of patients with a stable low NA, while class 3 ($n=27$, 9% of the sample) those with a stable high NA.

Classes of PA change

Analogical analyses for PA indicators also suggest a 3-class solution, since it is for this model that BIC attains the lowest value, subsequently rising. The 3-class and 4-class models do not differ in terms of entropy. BLRT systematically indicates superiority of models with a larger number of classes, however, in the 4-class model the smallest class covers only 3% of the sample. Thus, the 3-class solution was chosen - it is plotted in Fig. 1 (the right panel).

Similarly as for NA, the identified PA classes differ in respect of the baseline affect levels ($Wald=218.48$,

Figure 1. Trajectories of emotional response to the introduction of insulin therapy in distinct subgroups of type 2 diabetic patients identified through latent class growth modeling: negative (left panel) and positive affect (right panel), separately



$p < .001$) and the presence of change (Wald = 9.73, $p = .01$). Again, class 1 was the most numerous ($n = 204$, 67% of the sample), but this time no significant change in affect intensity over time was found – thus, this group of patients is characterized by a moderate and stable PA. A significant increase in PA (B = 0.35, z = 4.10, $p < .001$) can be seen in class 2 ($n = 51$, 17% of the sample), which had the lowest baseline PA. Finally, class 3 ($n = 50$, 16% of the sample) encompassed patients with the highest and stable PA. By comparison, in the 1-class solution the baseline PA was average (B = 2.25, z = 59.63, $p < .001$), and showed no significant change over time (B = 0.10, z = 1.81, $p > .05$).

Relationship between classes of NA change and classes of PA change

Since classes of NA and PA change were analyzed independently of each other, a question arises to what extent the membership in a particular NA class is related to the membership in a particular PA class. This problem is illustrated in Table 4. As shown, the most numerous subgroup ($n = 174$, 57% of the sample) consisted of patients with a moderate stable PA and increase in NA. This subgroup can be described as including patients who negatively reacted to their treatment modification (i.e. manifested threat response). Other subgroups were definitely less numerous. Namely, the subgroup of patients whose scores evidenced increases in both NA and PA included 36 participants (11.8% of the sample). This subgroup can be said to react ambivalently to the change in treatment (i.e. challenge response). The next subgroup encompasses patients with moderate stable PA and low stable NA ($n = 31$, 10.2% of the sample), i.e. those who reported no change in their affective state (no response). Finally, 30 patients (9.8%) were found to have high stable

Table 3. Fit indices for latent class growth models with different numbers of classes

Model	BIC	AIC	Number of parameters	Entropy	BLRT		Smallest class	
					value	*p*	proportion of N	frequency
Negative Affect								
1-Class	1549.75	1538.59	3					
2-Class	1478.64	1452.60	7	.79	93.99	<.001	.15	45
3-Class	1437.57	1396.64	11	.84	63.95	<.001	.09	27
4-Class	1452.49	1396.68	15	.67	7.96	.204	.09	27
Positive Affect								
1-Class	1241.66	1230.50	3					
2-Class	1177.32	1151.27	7	.59	87.23	<.001	.31	90
3-Class	1144.03	1103.11	11	.70	56.17	<.001	.17	50
4-Class	1148.61	1092.81	15	.70	18.29	.008	.03	10

Table 4. Cross-tabulation of 3 classes of negative affect change x 3 classes of positive affect change

Classes of change				
	NA			
PA	Class 1 (moderate increasing)	Class 2 (low stable)	Class 3 (high stable)	Total
Class 1 (moderate stable)	174 *threat response*	31 *no response*	9	204
Class 2 (low increasing)	36 *challenge response*	7	8	51
Class 3 (high stable)	30 *stress response*	10	10	50
Total	240	38	27	305

Note. NA – negative affect, PA – positive affect.
Names of groups derived from NA x PA cross-tabulation are provided in italics.

PA and increasing NA (corresponding to stress response). Since each of the remaining subgroups covered less than 5% of the sample, they were excluded from further analyses.

Sociodemographic differences

Eventually subgroups characterized by different NA x PA configurations were obtained: in three subgroups a significant change in affectivity in response to the treatment modification occurred, while in one subgroup the patients' affective status turned out to be stable despite the new treatment initiation. Multinomial logistic regression was used to check whether the four subgroups differed in terms of sociodemographic variables, with the "no response" subgroup chosen as the reference group. The data shown in Table 5 indicate that the subgroups with affect change of either valence generally consist of younger patients. Moreover, the "challenge response" subgroup (responding with increase in both PA and NA) encompassed patients characterized by lower self-rated financial status and more frequently by vocational education. Finally, as compared to the reference group, the "stress response" subgroup had a higher proportion of female patients.

Table 5. Results of multinomial logistic regression for four groups of negative and positive affect change

Variables	Threat response OR (95% CI)	Challenge response OR (95% CI)	Stress response OR (95% CI)
Age	0.87 (0.79-0.97)*	0.83 (0.74-0.93)**	0.86 (0.76-0.96)*
Gender			
Women	2.42 (0.88-6.64)	2.24 (0.67-7.50)	5.06 (1.43-17.91)*
Men	1	1	1
Marital status			
Single	0.77 (0.29-2.31)	0.34 (0.08-1.41)	0.69 (0.17-2.83)
Married/Cohabitating	1	1	1
Children			
No	0.78 (0.18-3.43)	0.65 (0.11-3.85)	0.57 (0.09-3.54)
Yes	1	1	1
Education			
Primary	1.29 (0.21-7.98)	6.79 (0.75-61.35)	3.02 (0.37-24.59)
Basic vocational	2.60 (0.42-16.06)	15.07 (1.76-129.36)*	6.29 (0.79-50.10)
Secondary	0.59 (0.18-1.97)	1.96 (0.39-9.89)	0.29 (0.06-1.51)
College/University	1	1	1
Material status	0.54 (0.19-1.53)	0.23 (0.07-0.83)*	0.43 (0.12-1.53)
Employment			
No	2.71 (0.84-8.72)	3.34 (0.80-13.35)	3.93 (0.90-17.13)
Yes	1	1	1

Note. The group without change in emotional state ("no response") is the reference group.
Likelihood ratio test for the model: $\chi^2(27) = 51.82$, $p = .003$.
The categories of variables with OR =1 are reference categories.
$*p < .05$; $** \, p \leq .001$.

Discussion

The aims of the study were, firstly, to investigate heterogeneity of emotional response - separately positive and negative, in patients with type 2 diabetes in whom the transition from oral hypoglycemic medication to insulin injections was necessary, and secondly, to find out whether the identified classes of patients with different patterns of affect change in response to this situation would differ in their sociodemographic characteristics.

The sample under study was found to be nonhomogeneous as regards the dynamics of affective response to diabetic treatment modification. Heterogeneous classes of patients were identified differing in the level and direction of change in both NA and PA. In regard to NA, three classes were identified: moderate-increasing (78% of the whole sample), low-stable (12%) and high-stable (9%). Thus, the majority of the sample were patients with moderate baseline NA levels, significantly rising after the introduction of insulin therapy. However, there were also patients who scored either higher or lower on both measurements of NA. It seems noteworthy though that in the analysis of NA change in the whole sample (1-class solution) a significant increase was noted at follow-up. Therefore, this type of analysis based on average scores does not reflect the genuine dynamics of NA following insulin therapy initiation. The results of latent class growth modeling indicate that the increase in NA occurred "only" in 78% of the sample, while in the remaining 22% of patients NA was stable over the 1-month follow-up period after the antidiabetic treatment modification. Moreover, the direction of NA change was dependent on the baseline NA level.

Three classes of patients were also identified based on PA levels and direction of change: moderate-stable (67%), low-increasing (17%) and high-stable (16%). Interestingly, on both measurements the subjects turned out to experience either at least moderate PA, or increased PA after the introduction of insulin therapy (the low-increasing PA subgroup). While no significant change in PA was noted over time in the whole sample, in 17% of patients PA did increase after insulin therapy initiation, and namely, in the subgroup characterized by a low NA at the baseline. The findings corroborate then that both PA and NA can be experienced in a difficult situation (Folkman, 2008), and that the course of emotional response may vary in a group of patients. At the same time, the direction of affect change suggests stressfulness of the situation, since the vast majority (78%) of patients reported increased NA, while only 17% – increase in PA.

Similarly as in other studies (Crawford & Henry, 2004), PA and NA in our sample turned out to be mutually independent. This justified testing cross-tabulated relationships between the identified separately PA and NA classes. Due to insufficient class frequencies, only the most numerous four classes were analyzed. In the whole sample predominated patients with a configuration of moderate-increasing NA and moderate-stable PA (the "threat response" subgroup), i.e. those negatively responding to the diabetes treatment change (57%). The next most numerous subgroup (11.8%) included patients responding ambivalently to the situation, i.e. with increased both NA and PA (challenge response). The third subgroup (10.2%), characterized by a lack of emotional change following insulin therapy initiation, encompassed patients with low stable NA and moderate stable PA (no response). Finally, the fourth subgroup (9.8%) consisted of patients in whom high stable PA was nevertheless associated with a significant increase in NA at follow-up (stress response). It should be noted that in three out of the four subgroups the baseline NA turned out to be significantly higher at the 1-month follow-up, irrespective of PA baseline levels and the course of PA change. The finding seems to confirm research reports about negative consequences of insulin therapy for diabetic patients' wellbeing (de Sonnaville et al., 1998; Goddjin et al., 1999), suggesting that they perceive the situation as difficult. On the other hand, it should not be overlooked that these negative changes were accompanied if not by at least moderate PA, then by its levels increasing over time. This might fulfill a buffering function in the process, and as proposed by Fredrickson (1998), might influence the regulation of NA. Interestingly, only about 10% of patients followed the so-called resilient trajectory (Bonanno et al., 2002), i.e. experienced low NA with simultaneously moderate PA (the "no response" subgroup). However, the short follow-up period (a month since the introduction of insulin therapy) does not allow to reliably predict either further changes in the patients' affect trajectories, as well as proportions of patients constituting various affect-based classes after insulin therapy initiation. As the previously cited studies suggest, positive psychological effects of insulin therapy may be short-lived (Reza et al., 2002), therefore further research covering longer time periods needs to be undertaken.

When the above-described four subgroups were compared in terms of sociodemographic variables, only modest intergroup differences were found. Namely, patients from the subgroups characterized by increased NA were significantly younger than those from the "no response" subgroup. Their younger age may be related to the generally shorter duration of their disease, but also with a more severe course of the condition. In developed countries the peak incidence for type 2 diabetes is noted in adults aged about 65 years (Wild, Roglic, Green, Sicree, & King, 2004). Thus, patients significantly younger may perceive the disease as more burdensome and stigmatizing (Skinner et al., 2011), and insulin therapy as interfering with their occupational career (Reach et al., 2013) or social life, which would contribute to increasing NA. As compared to the "no response" subgroup, patients from the ambivalent subgroup representing "challenge response" rated their material status lower and more often had vocational education. Thus, it can be speculated that ambivalent emotions related to insulin therapy (as evidenced by increases in both NA and PA) were experienced more often by persons with lower levels of resources (Hobfoll, 1989). It should be also noted that these patients had the lowest baseline PA. Thus, despite the adaptation costs, the treatment regimen modification nevertheless might have brought about a noticeable improvement in this subgroup. However, it is difficult to determine the mechanism underlying the phenomenon. In the "stress response" subgroup as compared to that of "no response" female patients predominated. A number of gender differences concerning emotional response in type 2 diabetes were described in the literature: as compared to men, women were found to be more resistant to initiation of insulin therapy (Brod, Kongsø, Lessard, & Christensen, 2009), had more depressive symptoms (Chiu & Wray, 2011; de Cock, Emons, Nefs, Pop, & Pouwer, 2011), and lower health-related quality of life (Jelsness–Jorgensen, Ribu, Bernkley, & Moum, 2011). Our results do not fully corroborate the cited findings, but suggest that increased NA in women was more often accompanied by relatively high stable PA. It should be noted however, that these considerations concerning sociodemographic differences between subgroups of patients varying in positive and negative affect change are speculative and may be due to the specificity of the sample studied. Nevertheless, no clear-cut tendency was found indicating that sociodemographic resources are favorable for the enhancement of PA or NA reduction. This suggests that other variables may explain diabetic patients' emotional response to insulin therapy initiation, probably directly related to their subjective representation of this treatment regimen. It is worth noting that for a vast majority of patients this treatment modification is accompanied by increased NA, which points to a crucial role of situational rather than personal factors in the follow-up period.

The presented study is not without limitations. As mentioned previously, the research design covered a relatively short period: from the baseline immediately preceding the introduction of new treatment to the 1-month follow-up (after insulin therapy initiation). It is difficult then to compare the obtained results with findings of other studies on trajectories of adaptation to stressful situations, including health-related events. As mentioned earlier, on the basis of our results it is also difficult to make inferences about long-term adaptation to the new treatment regimen. Relevant clinical data such as e.g. the form of insulin regimen (number of injections) or glycated hemoglobin (HbA1c) level, both significantly related to quality of life in this patient group (Hajos et al., 2012), were not controlled in our study, which may also considerably affect validity of the research conclusions. Nevertheless, the obtained data describe in a novel way diabetic patients' short-term adaptation to a very important life event, i.e. the introduction of regular insulin injections due to medical necessity. Firstly, the analyses were focused not only on negative, but also positive changes in affect. Secondly, the course of adaptation was found to be heterogeneous, i.e. varying across patient subgroups as regards both positive and negative valence of emotional response. Thirdly, sociodemographic characteristics were taken under consideration as potential correlates of the patients' differentiated emotional response to the introduction of insulin therapy. Consequently, it seems that this clinically important situation should be explored in future research in a longer time perspective, and that other predictors of heterogeneous emotional response to insulin therapy (e.g. those related to coping) should be taken into account.

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