THE ROLE OF COPING WITH DISEASE IN ADHERENCE TO TREATMENT REGIMEN AND DISEASE CONTROL IN TYPE 1 AND INSULIN TREATED TYPE 2 DIABETES MELLITUS

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SUMMARY - Background: Coping is defined as the behavioral and cognitive efforts used in an attempt to deal with stressful events. The objective of this study was to explore the relationship between coping with diabetes and the following outcome variables in type 1 and insulin treated type 2 diabetes mellitus: glycemic control, microangiopathic complications, adherence to self monitoring of blood glucose, adherence to insulin injections, and adherence to diet.

Methods: Subjects were 196 insulin treated adult diabetes patients visiting an outpatient clinic at a government university hospital in Istanbul, Turkey. Coping with disease was measured with the Turkish version of the Diabetes Coping Measure and adherence to treatment regimen was measured with a questionnaire adapted from the subscales of the Summary of Diabetes Self-Care Activities Questionnaire. Data on patients' HbA1c levels and severity of microangiopathic complications were obtained from their medical records.

Results: Partial correlations controlling for background variables suggested that coping was a good predictor of outcome for both type 1 and insulin treated type 2 diabetes mellitus. These associations were more pronounced for type 1 patients when compared to type 2 patients. Regressing the outcome variables on the two second-order coping factors (obtained by a factor analysis) also supported the hypothesis that coping is an important construct in explaining the outcome variables. Finally, the effect of coping on HbA1c was only partially mediated by adherence.

Conclusion: Coping with diabetes-related issues is an important factor in both types of diabetes, with type 1 patients showing slightly stronger associations. Therefore, training and education programs for diabetic adults might benefit from including a component that is aimed at improving coping with issues specific to diabetes.

Key-words: coping, diabetes mellitus, self-care, microangiopathic complications, glycemic control.

RÉSUMÉ - Rôle du coping du diabète sur le contrôle glycémique, les complications et l’autoprise en charge chez des diabétiques de type 1 et de type 2.

Contexte : Le « coping » se définit comme l’ensemble des efforts comportementaux et cognitifs mis en œuvre pour faire face aux événements porteurs de stress. Les objectifs de cette étude étaient d’explorer les relations entre le coping du diabète et les variables suivantes au cours du diabète de type 1 et de type 2 : contrôle glycémique, complications microangiopathiques, adhésion à l’autosurveillance glycémique, adhésion aux injections d’insuline et au régime.

Méthodes : L’étude a porté sur 196 diabétiques adultes traités par insuline suivis en consultation externe dans un hôpital universitaire gouvernemental à Istanbul.

Résultats : On observe des différences statistiquement significatives dans le coping entre les diabétiques de type 1 et ceux de type 2. Cependant, ces différences ne sont plus significatives lorsqu’on ajuste pour l’âge, le délai depuis le diagnostic, le statut marital et le sexe. Des corrélations partielles ajustées sur ces variables suggèrent que le coping est un meilleur prédicteur du devenir chez le diabétique de type 1 que chez le patient de type 2. L’analyse de régression des variables de devenir sur les deux facteurs de coping de second ordre (obtenus par analyse factorielle) est également en faveur de l’hypothèse selon laquelle le coping est un élément important pour expliquer les variables de devenir. Enfin l’effet du coping sur l’HbA1c n’est que partiellement médial par l’adhésion.

Conclusion : Le coping des problèmes liés au diabète est un facteur important dans les deux types de diabète, le diabète de type 1 montrant des associations légèrement plus fortes. Ainsi, les programmes d’entraînement et d’éducation pour les adultes diabétiques pourraient bénéficier de composants visant à améliorer le coping du diabète.

Mots-clés : coping, diabète, auto-prise en charge, complications, contrôle glycémique.
**INTRODUCTION**

Diabetes mellitus is a major health problem with increasing prevalence in many countries. Intensive treatment is an important factor for achieving good glycemic control in order to prevent diabetic macro- and microangiopathic complications in type 1 [1] as well as type 2 diabetes mellitus [2]. Patient adherence to self-monitoring of blood glucose (SMBG), insulin injections, and diet plays a central role in intensive diabetes treatment.

Being a diabetic patient is stressful. The patients are aware of the risks of many serious long-term complications. In addition, they face problems of hypoglycemia and hyperglycemia on a daily basis. The daily demands of self-care activities are also quite stressful. Finally, the psychosocial aspects of diabetes also create a source of stress for many patients. According to the theory of stress and coping developed by Lazarus and Folkman [3] how one copes with a stressful life event is an important factor in determining the outcome of the event. In this theory, coping is defined as the behavioral and cognitive efforts used in an attempt to deal with stressful events.

Research on the effects of coping on health outcomes with diabetic patients has yielded contradictory results [4-6]. Most of these studies measured how patients cope with stressors in general. Some researchers have posed the question of whether research should focus on coping with diabetes-related issues or with general stressors [5]. Previous research supported the notion that severe chronic illnesses evoke different coping strategies than everyday hassles [7, 8]. This led to the development of coping measures specific to illness [7].

Therefore, it seems important to explore the effects of coping specifically with diabetes-related issues (using a coping scale, which was specifically designed to measure how patients cope with diabetes) and to compare the effect of coping for type 1 and insulin treated type 2 adult patients. This is what the current study aimed to accomplish. Another aim of the study was to examine the mechanism through which coping exerts its effect on glycemic control. Two alternative pathways for this effect may be possible. Coping may affect adherence to treatment regimen, which in turn may affect glycemic control. In other words, coping may exert its effect on glycemic control indirectly through adherence. In such a case, one can conclude that the effect of coping on glycemic control is mediated by adherence. Alternatively, coping may affect glycemic control directly, or through mechanisms other than adherence. Stress has been suggested as one such mechanism [9]. We hypothesized that the effect of coping on glycemic control is only partially mediated by adherence. This is because many studies exploring the association between adherence and glycemic control have either failed to find statistically significant results or could find relatively small associations [10, 11].

**RESEARCH DESIGN AND METHODS**

Subjects were 196 insulin treated diabetic adults visiting a diabetes outpatient clinic. The site was a large government university hospital in Istanbul, Turkey. Most patients utilizing health services in this hospital are of low or middle socioeconomic status. Whenever possible, we included all eligible patients visiting the clinic during the four-month study period. All of these patients were diagnosed according to the WHO diagnostic criteria for diabetes [12]. Patients having severe comorbidity (e.g. acute coronary syndrome, a recent operation, hepatic failure, and malignancy) were excluded.

The sample consisted of 107 insulin treated type 2 and 89 type 1 patients. There were slightly more women than men (58% vs. 42%). Thirty-three percent of type 1 patients and 75% of insulin treated type 2 patients were married. Type 1 patients were between 16 and 66 years of age (29.0 ± 11.0) with a duration of diabetes between one year and 34 years (11.1 ± 7.8). Type 2 patients were between 31 and 82 years of age (59.3 ± 11.1) with a duration of diabetes between one year and 40 years (13.5 ± 7.9). All of the subjects had previously received training on insulin injection method, HMBG, hypoglycemia, ketoacidosis, diet, and related insulin dose adjustments. Type 1 patients recruited for the study use multiple insulin injections. Type 2 patients participating in the study are on conventional insulin therapy with two daily injections of mixed insulin or multiple injection therapy. The treatment goal for all patients attending the clinic is an HbA1c level of less than 7%.

Interns at the clinic administered the questionnaires by reading out loud the items and recording the verbal responses. Coping with diabetes-related issues was measured by the Diabetes Coping Measure [13, 14]. This measure has four subscales: avoidance, passive resignation, tackling spirit, and lack of integration. The selection and design of the first three of these subscales was based on the Medical Coping Modes Questionnaire, which includes avoidance, passive resignation, and tackling spirit as the most important coping strategies used by medical patients in general [7, 15]. The fourth subscale, lack of integration, is a shorter form of the Diabetes Integration Scale (also known as AIT 19), which measures adjustment to diabetes [13, 14, 16]. The Diabetes Coping Measure was translated into Turkish by our team using the back translation method. First, the items were translated into Turkish. Subsequently, this translation was translated back to English by a different translator. Finally, the original English version and the back translation were compared for differences in meaning in order to finalize the Turkish version. We pre-tested all ques-
We conducted reliability analyses to ensure that the Turkish version of the Diabetes Coping Measure had adequate internal consistency. The passive resignation, lack of integration, and avoidance scales had satisfactory reliability ($\alpha = 0.75$, $\alpha = 0.79$, and $\alpha = 0.56$, respectively) especially when one considers that coping scales in general are expected to have low internal consistency [20, 21]. The tackling spirit subscale, on the other hand, had a low internal consistency ($\alpha = 0.37$), which may be partially explained by the fact that this subscale consists of only three items. Further reliability analyses revealed that this subscale has especially low reliability ($\alpha = 0.25$) for insulin treated type 2 patients.

As health outcome measures we chose adherence to treatment regimen, glycemic control, and microangiopathic complications. Glycemic control was assessed by HbA$_{1c}$, measured by high pressure liquid chromatography (HPLC, Hitachi brand) method. The three most recent HbA$_{1c}$ values were extracted from the patients’ medical records. We took the mean of these three tests to arrive at the HbA$_{1c}$ value to be used in analyses. The correlations of these three measures with each other were between 0.66 and 0.73. The mean HbA$_{1c}$ was 8.22 ± 1.81 for type 1 patients and 7.95 ± 1.39 for insulin treated type 2 patients.

Microangiopathic complications were assessed using both self-report and objective methods. Patients were asked to rate the severity of relevant complications. These included retinal hemorrhages, laser photocoagulation, vitrectomy and loss of vision to assess the severity of diabetic retinopathy. Questions about albuminuria, edema, hypertension, and hemodialysis were also included. Symptoms of peripheral neuropathy like burning, numbness, pain and loss of sensation in the feet, deformities and history of foot ulcers were asked to define the presence of diabetic peripheral neuropathy.

In order to obtain objective data on the severity of retinopathy and nephropathy we consulted patients’ medical records when available. Patients undergo periodic dilated eye fundus examination by an ophthalmologist. Fundus fluorescein angiography is performed if indicated. Diabetic retinopathy (DR) is classified by the ophthalmologist into four categories according to the following criteria [17]: 1: No retinopathy, 2: Mild non-proliferative DR; microaneurisms with or without retinal edema, 3: Moderate and severe non-proliferative DR; intraretinal microvascular abnormalities, intraretinal hemorrhages, venous beading, or macular edema, 4: Proliferative DR; presence of new vessels, 5: Vision loss.

Kidney function is assessed by annual measurements of serum creatinine and proteinuria in a 24-hour urine sample. Technicon 2000 SE is used for serum creatinine. In cases of positive Albustix, the Esbach method is used to assess quantitative albumin excretion rate. Otherwise, microalbuminuria is measured by using the RIA method.

Serum creatinine and albumin excretion rate were highly correlated ($r = 0.58$, $p < 0.001$). We combined these two kidney function measures into one variable called nephropathy. We did this by converting the raw scores for both measures into standardized scores with a mean of 0 and standard deviation of 1 (z-scores) and taking the mean of these two standardized scores. The standardized scores allow one to combine different measures with different means and standard deviations.

Adherence to treatment regimen was measured in terms of SMBG, diet, and insulin injections. For this purpose, we used a questionnaire adapted from the subscales of the Summary of Diabetes Self-Care Activities Questionnaire [11]. This system measures adherence to regimen as the percentage of the total number of required behaviors (blood tests or insulin injections) within the last seven days. Instead of asking the patients directly about the percentage of the prescribed behaviors they performed, we asked them about the absolute number of behaviors performed as well as the number prescribed by the medical staff. We then calculated the percentages ourselves. This strategy was chosen because the low educational level of our sample could have reduced the reliability of the percentages obtained obtained directly from patients. In the case of insulin injections, we consulted the patients’ files to obtain information about the number of insulin injections per day prescribed by the medical staff. We then used this information to calculate the percentage value.

We added two more items to the single item for adherence to insulin injection, which asked how many of the recommended injections they took in the last seven days. Toobert and Glasgow reported that in their studies this item had a very high mean as well as a very low variance, making it difficult to find significant associations with other variables [11]. The preliminary analyses that we conducted showed this to be the case in our study, as well. As Glasgow et al. point out, “... while most patients may take their medication, they are far less adherent with timing or adjusting medication administration” [18]. Therefore, we added two more items asking about the timing and determination of the amount of insulin injections. We conducted reliability analyses for this scale for adherence to insulin injections. The item about the percentage of injections taken reduced the reliability as well as the
We conducted exploratory t-tests and ANCOVA analyses in order to see whether type 1 and insulin treated type 2 patients differ in terms of coping. In the latter analyses age, years since diagnosis, marital status, and gender were statistically controlled. As mentioned above, the outcome measures selected for this study were adherence to treatment regimen (adherence to insulin injections, diet, and SMBG), glycemic control, and microangiopathic complications. Two different sets of analyses were used in order to test for the effect of coping on outcome and to test for differences between the two types of diabetes in this respect.

First, partial correlation coefficients (again controlling for the above mentioned background variables) between each coping style and outcome measure were obtained for type 1 and insulin treated type 2 patients separately. Because retinopathy is not a continuous measure, we used Spearman rank correlation analyses to study the relationship between retinopathy and the four coping styles. Theory and previous research on chronic illness led us to hypothesise that the coping strategies avoidance, passive resignation, and lack of integration are negatively related to favorable outcome [7, 13-15]. Tackling spirit, on the other hand, was hypothesised to be positively associated with favorable outcome.

Second, we conducted a second-order factor analysis (principal component analysis with varimax factor rotation, [19]) on the four coping subscales (avoidance, tackling spirit, lack of integration, and passive resignation) in an attempt to obtain a smaller number of coping dimensions that are less highly correlated with each other. This resulted in two orthogonal (independent) coping factors that explained 77% of the total variance. The three negative coping strategies avoidance, passive resignation, and lack of integration had very high loadings on factor 1 (all loadings higher than 0.77). The positive coping strategy tackling spirit had a very small loading on this factor (0.01). On the other hand, tackling spirit loaded very strongly on factor 2 (0.98). The other three subscales had relatively low loadings on this factor (all loadings smaller than 0.26). Therefore, we labeled factor 1 and factor 2 negative coping and positive coping, respectively. These two factors were used as predictors in multiple regression analyses. In these analyses the outcome variables successively served as the dependent variable. A similar analysis for retinopathy serving as the dependent variable could not be performed, again due to noncontinuous nature of this scale. We therefore conducted Spearman rank correlation analyses to investigate the association between retinopathy and the two coping factors.

Finally, we conducted mediation analyses (a series of multiple regression analyses as recommended by Baron and Kenny) [20, 21] to test for the mediating effect of adherence in the relationship between coping and glycemic control. These analyses were done for the coping variables that were found to be related to glycemic control.

### RESULTS

T-tests revealed that type 2 patients were higher on passive resignation (2.45 ± 1.77) and tackling spirit (4.47 ± 1.26) but significantly lower on avoidance (1.36 ± 1.34) than type 1 patients (1.75 ± 1.20, 3.90 ± 1.42, 1.74 ± 1.22, respectively for passive resignation, tackling spirit, and avoidance, all p’s ≤ 0.05). However, these significant differences disappeared when age, years since diagnosis, gender, and marital status were controlled in ANCOVA analyses.

Correlations between the four coping subscales and the outcome variables (except for retinopathy) are presented in Table I. Because the above-mentioned background variables seem to have an effect on results, they were statistically controlled in these analyses. An inspection of Table I reveals that all outcome variables are significantly related to at least one coping strategy for both types of diabetes in expected directions. However, coping seems to be a better predictor of outcome for type 1 patients. More associations are significant for this type of diabetes mellitus and the significant correlation coefficients are generally larger than the ones for insulin treated type 2 patients. Note that the only significant correlation in the unexpected direction is between tackling spirit and nephropathy for type 2, which is probably due to low reliability of the tackling spirit subscale for insulin treated type 2 patients. In addition, Spearman rank correlation coefficients between retinopathy and the four coping scales were computed. Table II presents the results of these analyses and reveals that passive resignation is significantly related to the degree of retinopathy for both type 1 and insulin treated type 2 patients.

Next, we entered the two second-order coping factors negative coping and positive coping together with the background variables into regression equations to predict the outcome variables. The results of these analyses are presented in Table III and Table IV. Type of diabetes and the interaction between type of diabetes and the two coping factors were also entered into these equations so that we could test the differential effectiveness of coping for the two types. However, these interactions were not significant for any of the outcome variables except for injection adherence. Therefore, only the equation for injection adherence includes these interactions in the final models presented in Table III and Table IV. As can be seen in these tables, negative coping is significantly related to all of the outcome variables in expected directions. On the other hand, positive coping is associated with only
adherence to diet and adherence to injections, again in the expected directions.

However, the fact that the interaction terms (type x negative coping and type x positive coping) are significant for injection adherence means that the relationship between coping and injection adherence is different for type 1 and insulin treated type 2 patients. In order to interpret these interactions, we repeated regression analyses for the two types separately (Table V).

Table V reveals that even though negative coping was related to poor injection adherence in both types of diabetes, this relationship was stronger in type 1 (\(\beta = -0.35\)) when compared to type 2 (\(\beta = -0.25\)). On the other hand, positive coping led to better injection adherence only in type 1 patients (\(\beta = 0.28\)).

Spearman rank correlation analyses revealed that retinopathy is significantly related to negative coping (Spearman \(r = 0.19, p \leq 0.05\)) and to positive coping (Spearman \(r = 0.18, p \leq 0.05\)).

### Table I. Partial Correlations Between Coping Subscales and the Outcome Variables for Type 1 (\(n = 89\)) and Insulin Treated Type 2 (\(n = 107\)).

<table>
<thead>
<tr>
<th>Coping subscale</th>
<th>Injection Adherence</th>
<th>SMBG Adherence</th>
<th>Diet Adherence</th>
<th>Mean HbA1c</th>
<th>Self-report Complications</th>
<th>Nephropathy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type 1</td>
<td>Type 2</td>
<td>Type 1</td>
<td>Type 2</td>
<td>Type 1</td>
<td>Type 2</td>
</tr>
<tr>
<td>Avoidance</td>
<td>-0.37**</td>
<td>-0.27**</td>
<td>-0.31**</td>
<td>-0.05</td>
<td>-0.23*</td>
<td>-0.15</td>
</tr>
<tr>
<td>Passive Resignation</td>
<td>-0.37**</td>
<td>-0.20*</td>
<td>-0.22*</td>
<td>-0.26*</td>
<td>-0.26*</td>
<td>-0.16</td>
</tr>
<tr>
<td>Lack of Integration</td>
<td>-0.34**</td>
<td>-0.24*</td>
<td>-0.11</td>
<td>-0.17</td>
<td>-0.15</td>
<td>-0.19**</td>
</tr>
<tr>
<td>Tackling Spirit</td>
<td>0.34**</td>
<td>-0.09</td>
<td>0.15</td>
<td>0.13</td>
<td>0.24*</td>
<td>0.09</td>
</tr>
</tbody>
</table>

*p \leq .05. **p \leq .01.

### Table II. Spearman Rank Correlations Between Coping Subscales and Retinopathy for Type 1 (\(n = 50\)) and Insulin Treated Type 2 (\(n = 80\)) Diabetes Mellitus.

<table>
<thead>
<tr>
<th>Coping subscale</th>
<th>Retinopathy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type 1</td>
</tr>
<tr>
<td>Avoidance</td>
<td>0.03</td>
</tr>
<tr>
<td>Passive Resignation</td>
<td>0.35**</td>
</tr>
<tr>
<td>Lack of Integration</td>
<td>0.24</td>
</tr>
<tr>
<td>Tackling Spirit</td>
<td>0.06</td>
</tr>
</tbody>
</table>

*p \leq 0.05. **p \leq 0.01.

### Table III. Regression of the Outcome Variables (Except for Adherence to Insulin Injections and Retinopathy) on Two Second Order Coping Factors, Type of Diabetes, and the Background Variables (\(N = 196\)).

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>(\beta)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome variable: Adherence to diet</td>
<td>Negative coping</td>
<td>-0.30</td>
<td>0.10</td>
</tr>
<tr>
<td>Positive coping</td>
<td>0.22</td>
<td>0.11</td>
<td>0.15*</td>
</tr>
<tr>
<td>Outcome variable: Adherence to SMBG ((n = 148))</td>
<td>Negative coping</td>
<td>-0.08</td>
<td>0.03</td>
</tr>
<tr>
<td>Positive coping</td>
<td>0.05</td>
<td>0.03</td>
<td>0.13</td>
</tr>
<tr>
<td>Outcome variable: Self-report Complications</td>
<td>Negative coping</td>
<td>0.11</td>
<td>0.04</td>
</tr>
<tr>
<td>Positive coping</td>
<td>-0.03</td>
<td>0.04</td>
<td>-0.05</td>
</tr>
<tr>
<td>Outcome variable: Mean HbA1c</td>
<td>Negative coping</td>
<td>0.34</td>
<td>0.11</td>
</tr>
<tr>
<td>Positive coping</td>
<td>-0.08</td>
<td>0.12</td>
<td>-0.05</td>
</tr>
<tr>
<td>Outcome variable: Nephropathy ((n = 132))</td>
<td>Negative coping</td>
<td>0.19</td>
<td>0.10</td>
</tr>
<tr>
<td>Positive coping</td>
<td>0.18</td>
<td>0.11</td>
<td>0.15</td>
</tr>
</tbody>
</table>

The background variables gender, age, duration of diabetes, and marital status as well as type of diabetes are also entered into all of these regression analyses. However, the regression coefficients for those variables are not reported in the table in order to save space. *p \leq 0.05. **p \leq 0.01. B is the unstandardized regression coefficient, SE B is the standard error, and \(\beta\) is the standardized regression coefficient (usually between -1 and + 1).
these relationships. In other words, avoidance and adherence only partially mediates conduct mediation analyses [20, 21]. These analyses revealed that adherence only partially mediates these relationships. In other words, avoidance and negative coping had considerable effect on glycemic control that was not through adherence.

### CONCLUSIONS

The present study examines the effects of coping specifically with diabetes-related issues. Results support the hypothesis that how a diabetic patient treated with insulin copes with diabetes plays an important role in determining adherence to treatment regimen, glycemic control, and microangiopathic complications. Further, this relationship seems to be stronger for type 1 patients when compared with type 2 patients. This finding is consistent with previous research. Many more studies report significant associations between health outcomes and psychosocial variables (such as stress, personality characteristics, and adherence to treatment regimen) for type 1 patients. The hypothesis that these factors are more important in type 1 diabetes was also supported by the results of one study specifically testing this hypothesis [9]. The authors of that study suggest that this is because of the residual capacity for insulin production in type 2 diabetes. This residual capacity, which type 1 patients lack, partially protects type 2 patients from the negative effects of psychosocial factors.

The differential effect of coping in two types of diabetes is apparent in the partial correlation coefficients. More correlations are statistically significant for type 1 patients and the significant coefficients are larger for this type of patients. In regression analyses we used the whole sample and included type of diabetes as well as the interaction between type and coping. A significant interaction means that the relationship between coping and outcome is different for the two types. The interaction term was significant only when injection adherence was the dependent variable. However, one has to remember that significant interaction terms are statistically difficult to obtain [21].

The findings of this study underscore one important issue. Researchers need to be very careful when comparing the amount of coping efforts used by type 1 and type 2 patients. For example, insulin treated type 2 patients appear to use passive resignation more than type 1 patients. Such apparent differences between the two types of patients in terms of how much they use a coping strategy may be due to differences in terms of age, duration of diabetes, and marital status. When we statistically controlled for these background variables and gender, these differences between the two patient groups were no longer statistically significant. Note that this is different than our assertion made above that coping is a better predictor of outcome in type 1 than type 2 diabetes. In that case, we were referring to the strength of the relationship between coping and outcome.

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**TABLE IV. Regression of Adherence to Insulin Injections on Two Second Order Coping Factors, Type of Diabetes, and the Background Variables (N = 196).**

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome variable: Adherence to insulin injections for Type 1</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.13</td>
</tr>
<tr>
<td>Type of diabetes</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.33**</td>
</tr>
<tr>
<td>Negative coping</td>
<td>0.02</td>
<td>0.01</td>
<td>0.17*</td>
</tr>
<tr>
<td>Positive coping</td>
<td>0.02</td>
<td>0.01</td>
<td>0.20**</td>
</tr>
<tr>
<td>Type x negative coping</td>
<td>-0.02</td>
<td>0.01</td>
<td>-0.19**</td>
</tr>
</tbody>
</table>

The background variables gender, age, duration of diabetes, and marital status are also entered into all of these regression analyses. However, the regression coefficients are not reported in the table in order to save space. *p ≤ 0.05. **p ≤ 0.01.

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**TABLE V. Regression of Adherence to Insulin Injections on Two Second Order Coping Factors and the Background Variables Separately for Type 1 (n = 89) and Insulin Treated Type 2 (n = 107).**

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome variable: Adherence to insulin injections for Type 1</td>
<td>-0.05</td>
<td>0.01</td>
<td>-0.35**</td>
</tr>
<tr>
<td>Negative coping</td>
<td>0.03</td>
<td>0.01</td>
<td>0.28**</td>
</tr>
<tr>
<td>Positive coping</td>
<td>-0.01</td>
<td>0.00</td>
<td>-0.25**</td>
</tr>
<tr>
<td>Outcome variable: Adherence to insulin injections for insulin treated type 2</td>
<td>-0.02</td>
<td>0.01</td>
<td>-0.04</td>
</tr>
</tbody>
</table>

The background variables gender, age, duration of diabetes, and marital status are also entered into all of these regression analyses. However, the regression coefficients are not reported in the table in order to save space. *p ≤ 0.05. **p ≤ 0.01.
As predicted, adherence to treatment regimen only partially mediated the effect of coping on glycemic control. This means that there are additional pathways through which coping exerts its effect on glycemic control. Further research is needed to explore what those additional pathways are. As mentioned earlier, stress is one likely candidate for this [9]. Activity level and mood might be other factors through which coping exerts its effect on glycemic control [28].

It should be added that many factors besides coping and adherence may affect glycemic control. These include age, degree of nephropathy, comorbid conditions, depression, and life stressors. In this study we controlled statistically for age and excluded those patients with comorbidity. In a heterogeneous sample such as ours the issue of determining what constitutes good glycemic control for an individual patient with his or her unique characteristics is very complex.

Our results support the hypothesis that coping is associated with selected outcome measures in predicted ways. However, the cross-sectional and correlational nature of our study prevents us from drawing conclusions about causality. On the other hand, our results are congruent with the findings of previous studies using longitudinal designs. Research on adjustment to other medical conditions found evidence for the hypothesis that coping predicts later adjustment [24-26].

This study was conducted with patients of low or middle socioeconomic status. We do not know whether or not our results can be generalized to other populations. In addition, only patients visiting the clinic were included in the study. These patients may be more adherent to treatment regimen than the general population of diabetes patients. Future studies could test the generalizability of these findings to the general diabetes patient population. Such studies can also expand on the results of this study by including macroangiopathic complications. This is especially relevant to type 2 diabetes, where macroangiopathic complications constitute the main outcome of the disease.

The results of this study might have implications for training programs for diabetes patients. Intervention programs could incorporate a module on coping specifically with diabetes-related stressors. According to our findings, the patients may benefit from reducing the use of avoidance, lack of integration, and passive resignation. They may also benefit from developing a tackling spirit attitude. However, one caveat of applying these findings in training programs need to be mentioned. We found that different levels of coping that occur naturally have effects on outcome. This does not mean that interventions aimed at modifying these coping responses will necessarily result in better outcomes, at least not for everyone [27]. What is needed is a longitudinal intervention study examining the effects of a coping training program based on the conceptualization and findings of this study.

REFERENCES


