The Network of Psychological Variables in Patients With Diabetes and Their Importance for Quality of Life and Metabolic Control

MATTHIAS ROSE, MD[1]
HERBERT FLIEGE, PHD[1]
MARTIN HILDEBRANDT, MD[1]
THEA SCHIROP, MD[2]
BURGHARD F. KLAPP, MD, PHD[1]

OBJECTIVE — The primary goals in treating patients with diabetes are maintaining blood glucose levels as close to normal as possible and making a relatively normal quality of life achievable. Both of these goals are influenced by a multitude of somatic and psychological factors that should be seen as building a complex network. We examined whether a mathematical model can be construed that can depict the relative significance of each factor for achieving these treatment goals.

RESEARCH DESIGN AND METHODS — A total of 625 patients from 32 different treatment facilities were examined (224 type 1 and 401 type 2 diabetic patients) using HbA_{1c} values (high-performance liquid chromatography), number of secondary illnesses, and standardized questionnaires with respect to health-related quality of life (World Health Organization Quality of Life questionnaire), coping behavior (Freiburger Illness-Coping Strategies questionnaire), diabetes-specific knowledge (Test of Diabetes-Specific Knowledge), doctor-patient relationship (Medical Interview Satisfaction Scale), and personality characteristics (Giessen Test and Assessment of Beliefs in Self-Efficacy and Optimism). The analyses were carried out by means of a structural equation model.

RESULTS — The model proved to be valid ($\chi^2 = 88.5$, df = 76, $P = 0.16$), showing a sound fit (adjusted goodness of fit [AGFI] = 0.94). It explained 62% of the variance of the quality of life and 5% of the HbA_{1c} values. Subjects characterized by strong beliefs in their self-efficacy and an optimistic outlook on life were more likely to be satisfied with their doctor-patient relationships. They demonstrated more active coping behavior and proved to have a higher quality of life. Active coping behavior was the only psychological variable significant for the HbA_{1c} values.

CONCLUSIONS — It was possible to illustrate the various factors involved and their mutual dependency and significance for the treatment goals. Belief in self-efficacy and active coping behavior appear to have the greatest relevance for achieving the primary treatment goals.

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From the [1]Medical Clinic and Policlinic Psychosomatic Medicine and Psychotherapy, Charité Humboldt University, Berlin, Germany; and the [2]Diabetes Outpatient Clinic, Department of Intensive Care and Nephrology, Charité Humboldt University, Berlin, Germany.

Address correspondence and reprint requests to Dr. Matthias Rose, Medizinische Klinik mit Schwerpunkt Psychosomatic, Charité Campus-Virchow, Augustenburger Platz 1, 13353 Berlin, Germany. E-mail: rose@charite.de.

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Abbreviations: AGFI, adjusted goodness of fit; DWT-I-K, Test of Diabetes-Specific Knowledge; FKV-lis, Freiburger Illness-Coping Strategies questionnaire; GTS, Giessen Test; HRQL, health-related quality of life; MISS, Medical Interview Satisfaction Scale; RMSEA, root mean square error of approximation; SWOP, Assessment of Beliefs in Self-Efficacy and Optimism; WHOQOL-Bref, World Health Organization Quality of Life questionnaire.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

The goals in the treatment of patients with diabetes are to avoid secondary illnesses for as long as possible by establishing optimal blood glucose levels and to maintain the patient's quality of life for as long as possible. Both the regulation of blood glucose levels and the patient's subjective quality of life are influenced by various individual factors, some of which are clearly connected with somatic illness, but few of which are accessible to medical interventions.

Quality of life

It has repeatedly been proven that quality of life is influenced by the type and number of secondary illnesses (1–3) and the frequency of serious metabolic complications that arise (4,5). However, particular personality characteristics play a decisive, mediating role in the quality of life experienced (6–8). We find that depressed subjects generally have a poorer quality of life, independent of the physical illnesses from which they might suffer (9–12). This also applies to patients with diabetes whose personality dispositions appear to be more significant for the quality of life than, for instance, the presence of secondary illnesses (8,13,14). The patient's psychological disposition is, in turn, closely connected to cognitive and emotional aspects of his/her illness-coping strategies, which indirectly affect their health-seeking behavior (15). The patient's subjective assessment that a health-relevant behavior exists ("outcome expectancy") and the belief that he or she is able to carry out this behavior ("self-efficacy expectancy") (15) have been described as predictors for adherence to therapy (16,17) as well as for the present quality of life of patients with diabetes (18). Most studies found a positive connection between active, problem-oriented coping behavior and an improved quality of life (19–22). In the case of adolescents, however, it appears that it can be intermittently useful as well to adopt an attitude of emotion-

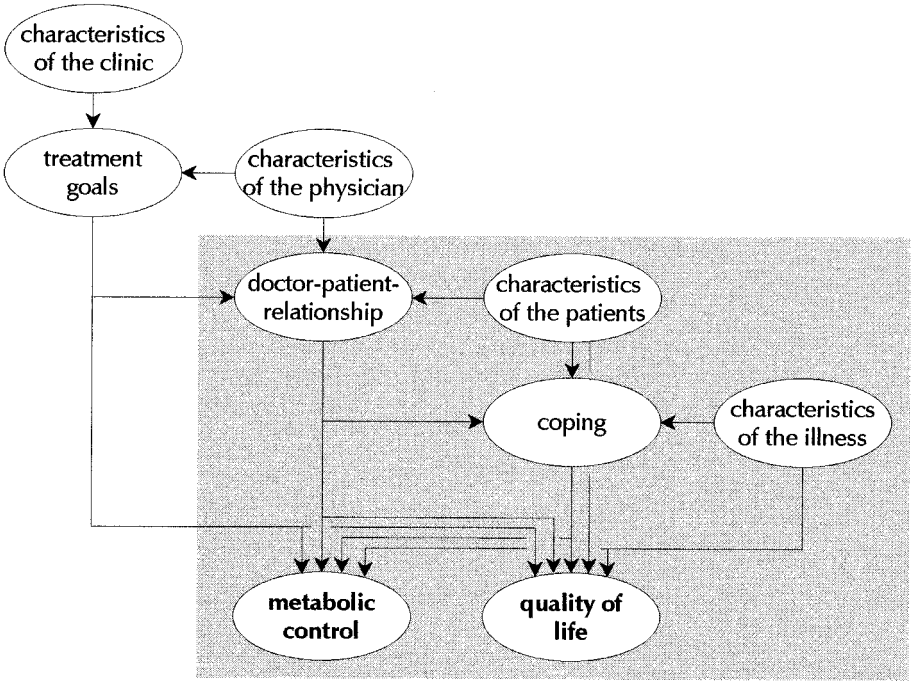

Figure 1—*Theoretical assumptions concerning a network of psychosocial determinants for two treatment goals.*

oriented coping, even denial (23). Because the treatment of patients with diabetes primarily involves instruction in self-therapy, the central belief is that the attending physician can influence the way the patients deal with their illness. Indeed, it can be shown that the effective communication of treatment-relevant information (24,25) or the effective change of emotional illness-coping strategies (20,21) can be influenced by particular educational programs, with the change in illness-coping strategies likely exerting the greater influence on relevant changes in behavior (20,21). Relatively little research has investigated the significance of the type and quality of the doctor-patient relationship, the personality of the attending physician, or the type and/or particular specialization of the clinical institution for the successful treatment of patients with diabetes. The few available studies (26–28) and the clinical experience itself suggest that these components play essential roles in achieving the previously mentioned goals of therapy.

Metabolic control

It is undisputed that the patient's motivation and willingness to take part in therapy are crucial foundations for good self-therapy and the resulting optimal blood glucose regulation (29). It has been shown that a successful communication of illness-relevant knowledge in the context of specific, educational programs has a positive effect (30). An additional (24,25) benefit seems to be achievable if the education program also focuses on the development of adequate emotional coping skills (20,21,31)

Some authors assume that the present quality of life influences metabolic regulation and vice versa (32–34). Although a positive effect has appeared to be plausible in various, detailed studies (35), there are, in our opinion, still too many contradictory results to allow us to assume that this relationship is proven at this time (36–40).

Conceptual model

The preceding overview demonstrates that many somatic, psychological, treatment-relevant factors are already known that either directly or indirectly influence the two central treatment goals, blood glucose regulation and quality of life. Glasgow (41) attempted to summarize some of these factors as "patient characteristics" and "clinic characteristics" that determine the "cycle of care" made up of "self-management behavior" and "doctor-patient relationship." We would like to make use of his model and assume that the patients with diabetes are embedded in complex network of interacting agents and forces that can be illustrated in a simplified manner, as shown in Fig. 1.

The relationships between these elements are usually examined individually. What is problematic in depicting individual factors from this conceptual network is that the relative significance of the individual factors can only be accurately represented within the context of all factors (7). Consequently, in the present study, we have attempted to simultaneously include as many of the above-mentioned factors as possible in the analysis in order to present as realistic a picture of the treatment conditions of patients with diabetes. To keep the analysis within manageable boundaries, we decided to focus solely on the patient factors and to leave out those influencing factors coming from the physician or the social background.

A structural equation model was used for the analysis of the data. Compared with a regression analysis, a structural equation model has the advantage of being able to examine the significance of psychological factors for both target criteria at the same time, as well as being able to examine the interrelationship among the observed factors, according to the previously mentioned theoretical assumptions, without having to allow for covariation among all variables.

RESEARCH DESIGN AND METHODS

— The present study examines a sample of 625 diabetic patients (224 type 1 and 401 type 2 diabetic patients). The patients come from three sources: the diabetes outpatient center of the Charité (n = 174), 3 specialist practices (n = 264), and 28 general practitioner practices (n = 187). The aim of this investigation was to acquire a relatively realistic picture of patients with diabetes who are undergoing routine treatment in various outpatient facilities.

A total of 194 general practitioners were contacted randomly (Medical Handbook in Berlin [42]) until 30 general practitioners were recruited. Two general practitioners later refused to take part in the study. All general practitioners were expected to include eight patients consecutively within a time period of 3 months. All of them made the patients' files freely accessible, enabling us to secure data quality and control for the fulfillment of

Table 1—*Characteristics of the sample under investigation*

	Type 1 diabetic patients	Type 2 diabetic patients
n	224	401
Duration of diabetes (years)	17.8 ± 12.1	12.7 ± 9.62
BMI (kg/m^2)	24.8 ± 4.34	28.9 ± 5.85
Hypoglycemia with professional treatment/year	0.63 ± 0.99	0.28 ± 0.76
Hyperglycemia needing professional treatment/year	0.23 ± 0.71	0.20 ± 0.62
Secondary diseases (%)		
Total	0.77 ± 1.27	1.11 ± 1.37
Polyneuropathy	22.6	37.6
Retinopathy	19.9	11.0
Coronary heart disease	8.3	34.6
Nephropathy	6.8	6.7
Periphery Angiopathy	6.3	13.6
Erectile dysfunction	5.9	6.7
Diabetic foot	2.7	3.6
Amputation	1.4	0.8
Therapy (%)		
Diet	—	8.3
Tablets	—	30.3
Conventional insulin therapy	7.6	25.8
Intensified insulin therapy ("pen")	40.2	28.5
Continuous subcutaneous insulin infusion ("pump")	50.0	7.3
HbA_{1c} (%)	8.00 ± 1.45	7.73 ± 1.36
Δ HbA_{1c} (% above normal)	1.91 ± 1.45	1.55 ± 1.34
Level of education (%)		
No	3.3	7.0
Grade 10	22.7	38.2
Grade 11	27.6	21.3
Grade 12	14.9	4.8
Technical institute	13.8	15.0
University	17.7	13.7
Employment status (%)		
Unemployed	6.6	3.7
In training	8.2	7.5
Housewife/husband	48.4	16.8
Employed	11.2	0.9
Retired early	12.1	13.0
Retired due to age	13.7	58.1
Age (years)	43.8 ± 14.9	63.1 ± 9.32
Sex (F/M) (%)	53.5/46.7	52.1/47.9

Data are means ± SD unless otherwise indicated.

the recruitment conditions. All three randomly chosen specialist practices were willing to take part in the study and to include 80 of their patients. The random selection of patients was assured by the participation of one of our researchers on particular days on location, where all patients present on this day were recruited. All patients being treated at the university policlinic within a 9-month period were included in the study, resulting in a total of 174 patients. Eight patients refused to participate.

The sociodemographic characteristics and characteristics with respect to illness and therapy status are listed in Table 1.

Questionnaires

World Health Organization Quality of Life questionnaire. Health-related quality of life (HRQL) was measured using the multidimensional World Health Organization Quality of Life questionnaire (WHOQOL-Bref) (43) in its short version (26 items). It was developed in 17 countries on >17,000 patients worldwide. The German representative sample consisted of 2,055 subjects. The scales showed a good internal consistency for the sample under investigation (Table 2).

Freiburger Illness-Coping Strategies questionnaire. The Freiburger Illness-Coping Strategies questionnaire (FKV-lis) (44) covers a broad spectrum of illness-coping strategies on cognitive, emotional, and behavioral levels. The FKV-lis is made up of 35 items and five scales. The validation process was carried out on random samples of various acute and chronically ill patients ($n = 350$). In this study, we used the scale "active problem-oriented coping strategy" (with items such as "I am actively seeking information about the illness and its treatment"). It showed a good internal consistency for the sample under investigation (Table 2).

Medical Interview Satisfaction Scale. The Medical Interview Satisfaction Scale (MISS) (45) examines the patients' assessment of their relationship with their physician, taking into account the level of trust in the relationship, the assessment of the physician's reliability, and the time that the physician takes for the patient. Therefore, the questionnaire examines the patients' subjective assessment of the quality of the treatment situation. The German version is made up of 16 items (46). The scales "empathy," "competence," and "information" were used. The scales showed a good internal consistency for the sample under investigation (Table 2).

Giessen Test. The Giessen Test (GTS) (47) is a self-assessment test, based on theoretical assumptions from depth psychology, that offers subjects the opportunity to assess themselves according to their self-image. The test consists of 40 bipolar questions (e.g., "I blame myself very seldom. . . very often"). A representative German sample ($n = 1,575$) as well as various clinical samples served as a validation of the test. The test has been used and cited in >2,000 German studies. In this study, we used one scale that consisted of six items asking for different trait markers of depression ("depressive disposition"). It showed a sufficient internal consistency for the sample under investigation (Table 2).

Assessment of Beliefs in Self-Efficacy and Optimism. The Assessment of Beliefs in Self-Efficacy and Optimism (SWOP) questionnaire (48) was created by restructuring two older questionnaires (49,50). The SWOP consists of a scale as-

Table 2—*Reliability of the scales and their factor loadings on the latent traits*

Psychometric questionnaires and scales	Item no.	Cronbach α	Communality	Factor loading
MISS				
empathy	5	0.831	0.866	0.930
information	4	0.754	0.823	0.907
competence	4	0.768	0.870	0.932
GTS				
depressive disposition	6	0.584	0.544	−0.737
SWOP				
self efficacy	5	0.758	0.651	0.807
optimism	4	0.708	0.649	0.806
WHOQOL-Bref				
physical	7	0.844	0.687	0.829
psychological	6	0.795	0.812	0.901
social	3	0.698	0.533	0.730
FKV-lis				
active coping	5	0.734	—	—

Latent variables: MISS, doctor-patient relationship; GTS and SWOP, characteristics of the patient; WHOQOL-Bref, quality of life.

sessing self-efficacy (five items; for instance: "I face difficulties with relative ease because I can count on my abilities") and four items assessing optimism/pessimism (for instance: "Things never go the way I want"). The validation of this instrument was carried out on five clinical samples with a total of 726 patients. The scales showed a good internal consistency for the sample under investigation (Table 2).

Test of Diabetes-Specific Knowledge. The German Test of Diabetes-Specific Knowledge (DWT-I-K) (51) is based on comparable Anglo-American questionnaires (52,53) and covers knowledge in the following areas: causes/pathophysiology, insulin/effects of insulin, insulin injection/storage, nutrition and physical activity, personal control over metabolic functions, hyperglycemia, hypoglycemia, illnesses, insulin adaptation, and consequential damages. The DWT-I-K consists of 30 questions with three possible dichotomized answers (yes/no), resulting in a total of 90 items. A question is considered to be answered correctly when all three possible answers have been answered correctly. The questionnaire has been validated on 912 persons in specialized treatment facilities and is widely used in the German-speaking world. It was given to all patients undergoing insulin therapy. Because there was no corresponding validated instrument in German for patients with type 2 diabetes who are not undergoing insulin treatment, these patients were only asked those DWT-I-K questions that did not concern insulin. Four ad hoc questions concerning diet were added. Therefore, this instrument consisted of 15 questions with the same multiple-answer options that were previously mentioned. The assessment of the results was carried out solely by means of sum scores (in percent) with respect to the maximum number of correct answers possible (54).

Ad hoc questionnaire: physician. The attending physician was asked to fill out an ad hoc questionnaire (13 items), which yielded information concerning the patient's present secondary illnesses.

Ad hoc questionnaire: patient. The patients were asked to fill out an ad hoc questionnaire (30 items), which yielded information concerning their social status, present therapy, and the frequency of hypo- and hyperglycemic episodes that required professional treatment (metabolic complications).

HbA_{1c}

The HbA_{1c} values were determined at the laboratories of the respective treatment facilities, all of which used the high-performance liquid chromatography method. Due to the slightly differing normal ranges, the HbA_{1c} values are presented as absolute deviations from the upper normal cutoff of the respective laboratory.

Statistical procedures

Based on the assumptions outlined in the introduction, a structural equations model was created to assess the factors as follows:

1) The construct "doctor-patient relationship" was understood as a subjective assessment of the doctor-patient relationship and was measured by means of the MISS. The scales measuring "empathy," "information," and subjectively experienced level of medical "competency" showed very high loadings (>0.90) on the one proposed factor, making it possible to operationalize this construct as a latent variable (Table 2).

2) "Patient characteristics" were assessed using the GTS and the SWOP. The scale "depressive disposition" showed a comparably low factor loading (−0.73) and communality (0.54), indicating that this factor is less homogeneous than the first one. Nevertheless, it seems to be justified to include this theoretically important construct in the latent variable, made up of the three scales "depressive disposition," "self-efficacy," and "optimism" (Table 2).

3) The construct "coping" was covered by two approaches: by a self-assessment asking the patients whether they use a problem-oriented active-coping behavior and by testing the present treatment-specific knowledge as an indicator for effective information-seeking behavior.

4) The number of secondary illnesses and the frequency of hypo- or hyperglycemias needing professional treatment were used to assess the "characteristics of the illness." The type of secondary illness did not play a role in the statistical calculations.

5) The HbA_{1c} values were used to measure the targeted variable "metabolic control."

6) Quality of life was measured using the WHOQOL-Bref. In accordance with the generally accepted understanding of HRQL as a multidimensional construct mirroring biopsychosocial aspects of illness, the three scales "physical domain,"

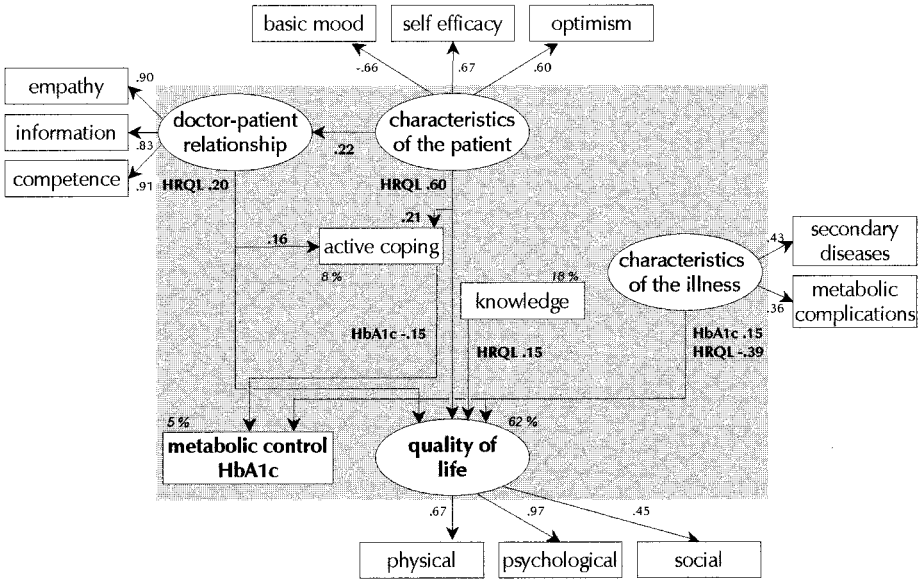

Figure 2—*Empirical data regarding a network of psychosocial determinants for two treatment goals. Structural equation model: rectangles indicate observed indicator variables. The highest-positioned rectangle received a fixed regression weight of 1. Ovals indicate unobserved latent variables. Numbers at single-headed arrows indicate standardized regression weights (bold indicates β-values with* $P < 0.05$*). Numbers at variables indicate squared multiple correlation coefficients. There were no indefinite matrixes and no constrained parameters. The SEM of standardized regression weights was <0.149 (*$\chi^2 = 88.5$*, df = 76,* $P = 0.16$*). Fit indexes:* $C_{min}/df = 1.16$*, AGFI = 0.94, goodness of fit index = 0.96, RMSEA = 0.02, Tucker-Lewis index (Bentler and Bonnett non-formed fit index) = 0.99. The standardized regression weights between age and the observed variables were as follows: coping, knowledge −0.42 (*$P = 0.004$*); active behavior 0.06 (*$P = 0.117$*). Quality of life; physical −0.20 (*$P = 0.004$*), psychological 0.07 (*$P = 0.020$*). Patient, self-efficacy 0.08 (*$P = 0.034$*), optimism 0.07 (*$P = 0.045$*). Doctor-patient relationship: competence 0.06 (*$P = 0.032$*), empathy 0.15 (*$P = 0.004$*). Illness: secondary illnesses 0.30 (*$P = 0.004$*).*

"psychological domain," and "social domain" were measured. All three scales showed loadings >0.70 in a one-factor solution, indicating that there is a fair amount of shared variance between them. We focused on this shared variance, which allowed us to form the latent variable, quality of life.

All observed variables were controlled for the age of the patient (Fig. 2). The statistical calculations were carried out with the AMOS 4.0 program (available online from http://www.smallwaters.com). The adequacy of fit of the model can be assumed if a P value >0.10 is reached. The standard error and the significance of the β-coefficients were calculated using a bootstrap procedure (maximum likelihood method, 95% CIs, 500 bootstrap samples).

RESULTS — If we construct the structural equation model as illustrated in Fig. 1, we come up with a valid model ($\chi^2 = 74.3$, $P = 0.16$) and a good index of fit (adjusted goodness of fit [AGFI] = 0.94, root mean square error of approximation [RMSEA] = 0.03, $C_{min}/df = 1.18$). If we further restrict the model by using only the significant β-weights ($P < 0.05$) for recalculation, the new constructed model is also valid ($\chi^2 = 88.5$, $P = 0.16$) (Fig. 2), showing very similar interrelationships and fit indexes (AGFI = 0.94, RMSEA = 0.02, $C_{min}/df = 1.16$). As there is a common interpretation of both models, the reported data in the following paragraphs will refer to the second model, which is more restricted.

In a multigroup approach, we checked whether significant differences occur between the regression patterns of type 1 and type 2 diabetic patients. If we force all regression coefficients of type 1 and type 2 diabetic patients to be the same and compare this model with one in which the regression coefficients are allowed to differ, the model with the forced restrictions is favored (df = 38, $C_{min} = 37.62$, $P = 0.487$). We can conclude that there are no significant differences between the types with regard to the models of the adult type 1 and type 2 diabetic patients.

Metabolic control

In Fig. 2, we can see that 5% of the variance in the observed HbA_{1c} values can be explained by the factors included. Patients suffering from a severe somatic illness condition who report acute metabolic complications needing professional treatment more often had the poorest HbA_{1c} values ($\beta = 0.15$). In contrast, patients who reported an active coping style were found to have better HbA_{1c} values ($\beta = 0.19$). The diabetes-specific knowledge and the patient's subjective assessment of the doctor-patient relationship played a subordinate role in connection with the HbA_{1c} values ($P > 0.05$).

HRQL

Sixty-two percent of the variance of the HRQL can be explained by the model. The most significant determinants for the HRQL were the "patient characteristics" ($\beta = 0.60$). Patients with a more optimistic attitude, showing stronger beliefs in self-efficacy and a generally more positive disposition, had the higher HRQL values.

Patients with a more severe somatic condition had, as expected, the lower HRQL values ($\beta = -0.39$). Independent of this, with a standardized regression value of $\beta = 0.20$, the subjectively expe-

rienced doctor-patient relationship also played an important role for the HRQL values. Patients who were found to be better informed ("knowledge") (Fig. 2) also reported a higher quality of life (β = 0.15).

Coping

The more optimistic patients, those with stronger beliefs in self-efficacy, and patients with better doctor-patient relationships reported a more active coping style (β = 0.21/0.15). The relevance of these values for the treatment-specific knowledge is minimal. Only the age of the patient played a particularly important role for this variable (β = −0.42). The younger patients were, on average, better informed than the older ones.

CONCLUSIONS — The goals in treating patients with diabetes are, most importantly, a sufficient blood glucose regulation and a quality of life with as few restrictions as possible. There are innumerable studies that can identify various factors related to these two treatment goals (1). In the daily treatment context of patients, however, these individual factors are part of a complex network of interacting forces. For these reasons, we wanted to construct and assess a model that can present the various individual factors simultaneously, making it possible to examine the relative significance of the single factors for realizing the treatment goals. It was indeed possible to develop a statistically valid structural equation model with a sound goodness of fit, allowing us to assume that most of the conceptual assumptions regarding the interactive character of the various influencing factors are in fact correct.

Metabolic control

With a variance explanation of only 5%, all included factors have little explanatory value for the observed HbA_{1c} variance, and it is obvious that other factors that were not studied are more significant. Contrary to our assumptions but similar to results reported by Roth et al. (51), we did not find a connection between actual treatment-specific knowledge and HbA_{1c} values, at least when measured under routine treatment conditions. Obviously, good glycemic control can be achieved by means of routine or intuition, without having detailed knowledge about the disease, just as having such knowledge does not necessarily mean being able to implement it. The only significant psychological factor for the metabolic control was how active the patients describe their coping behavior. In accordance with other studies (22), we found that, in adults, a more active coping style covaries with better blood glucose regulation.

HRQL

A large number of methodologically sophisticated studies have focused on the identification of individual factors that influence the self-reported quality of life of patients. Rubin and Peyrot (1) have recently summarized these studies very clearly.

When including these known factors in one structural equation model, a total of 62% of the variance in the reported quality of life could be correctly predicted. This is much more than the variance that could be explained for the HbA_{1c} values. When interpreting these results, however, we must take into account that predictors in the model include patient self-assessments. Because the present quality of life measure is also a self-assessment, the methodological overlap with this criterion is larger than with the chemical lab results of HbA_{1c} values.

Nevertheless, the relatively high β-weights for those variables that are not self-assessments confirm that we already know a great deal about the determinants of quality of life: solid diabetes-specific knowledge was found to be associated with a higher HRQL (β = 0.15), and of course, the well-being of the patients is determined to a large extent by the presence and number of secondary illnesses and acute metabolic complications (β = −0.39).

Much more significant, however, is the personal attitude of the patient (β = 0.60). As we have similarly reported earlier (14), we were now able to confirm that if a patient reports a good, optimistic outlook on life and strong beliefs in self-efficacy, he/she is more likely to report a higher quality of life, even in the presence of secondary illnesses.

Therefore, the personality characteristics "self-efficacy," "optimism," and "depressive disposition" may appear to be related to the quality of life construct, particularly in terms of its psychological dimensions, so that a high covariation could appear tautological. To address this potential problem, we made sure that the personality characteristics assessed and the questionnaires used measured stable, illness-independent traits of the individual, whereas the quality of life measurements only assessed the patient's present situation. In fact, there are no overlapping questions in the questionnaires used. Of course, even when it is possible to establish a sufficient conceptual and methodological separation of the two, based on present research standards, the principally close relationship between these constructs naturally remains. These data thereby illustrate the peculiar situation to be found in the present understanding of the concept of HRQL. If we want to include and influence psychological dimensions of health or illness, we must admit that in many situations, a large proportion of HRQL is more fundamentally determined by factors that are to be found in the personality development of the patients than in the illness or its treatment.

Coping

The key variable among the characteristics of the illness, the patient, and the physician often appears to be the coping behavior of the patient. Here, we might be able to name a construct that is crucially significant for the self-treatment of chronic illnesses and one that also lies within the physician's realm of influence. In fact, on one hand, the coping behavior covaried with the metabolic control and, on the other hand, with a positively attributed doctor-patient relationship and a personal attitude of self-efficacy. The cognitive "knowledge" was exclusively related to the age of the patient (54).

The key psychological variable for both therapy goals—namely, blood glucose regulation and HRQL—proved to be the patient's belief in his/her self-efficacy and an optimistic outlook on life. These variables were directly connected with a more positively experienced doctor-patient relationship, more active coping behavior, and better HRQL. If the patient is able to maintain this attitude for as long as possible despite his/her somatic condition, then the context appears to be favorable for the realization of both therapeutic goals. It is therefore worthwhile to consider whether the patient training programs, for instance, should routinely include the goal of enhancing beliefs in self-efficacy in their interventions, particularly in light of the fact that positive experiences in this area have already been

reported (21) and the fact that pure, cognitive knowledge of treatment appears to have limited significance under routine conditions.

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References

1. Rubin RR, Peyrot M: Quality of life and diabetes. *Diabetes Metab Res Rev* 15:205–218, 1999
2. Trief PM, Grant W, Elbert K, Weinstock RS: Family environment, glycemic control, and the psychosocial adaptation of adults with diabetes. *Diabetes Care* 21: 241–245, 1998
3. Wu SY, Sainfort F, Tomar RH, Tollios JL, Fryback DG, Klein R, Klein BE: Development and application of a model to estimate the impact of type 1 diabetes on health-related quality of life. *Diabetes Care* 21:725–731, 1998
4. Richmond J: Effects of hypoglycaemia: patients' perceptions and experiences. *Br J Nurs* 5:1054–1059, 1996
5. Weinger K, Jacobson AM: Psychosocial and quality of life correlates of glycemic control during intensive treatment of type 1 diabetes. *Patient Educ Couns* 42:123–131, 2001
6. Testa MA, Simonson DC: Assesment of quality-of-life outcomes. *N Engl J Med* 334:835–840, 1996
7. Wilson IB, Cleary PD: Linking clinical variables with health-related quality of life: a conceptual model of patient outcomes. *JAMA* 273:59–65, 1995
8. Grey M, Boland EA, Yu C, Sullivan-Bolyai S, Tamborlane WV: Personal and family factors associated with quality of life in adolescents with diabetes. *Diabetes Care* 21:909–914, 1998
9. Barge-Schaapveld DQ, Nicolson NA, Berkhof J, deVries MW: Quality of life in depression: daily life determinants and variability. *Psychiatry Res* 88:173–189, 1999
10. Evans DL, Staab JP, Petitto JM, Morrison MF, Szuba MP, Ward HE, Wingate B, Luber MP, O'Reardon JP: Depression in the medical setting: biopsychological interactions and treatment considerations. *J Clin Psychiatry* 60 (Suppl. 4):40–55, 1999
11. Rose M, Fliege H, Danzer G, Klapp BF: "Gesundheitsbezogene Lebensqualität" ein Teil "allgemeiner Lebensqualität." In *Jahrbuch der Medizinischen Psychologie*. Bullinger M, Ravens-Sieberer U, Eds. Göttingen, Germany, Hogrefe, 2000, p. 206–222.
12. Wittchen HU, Lieb R, Wunderlich U, Schuster P: Comorbidity in primary care: presentation and consequences. *J Clin Psychiatry* 60 (Suppl. 7):29–36, 1999
13. Hanninen JA, Takala JK, Keinanen-Kiukaanniemi SM: Depression in subjects with type 2 diabetes: predictive factors and relation to quality of life. *Diabetes Care* 22:997–998, 1999
14. Rose M, Burkert U, Scholler G, Schirop T, Danzer G, Klapp BF: Determinants of the quality of life of patients with diabetes under intensified insulin therapy. *Diabetes Care* 21:1876–1885, 1998
15. Bandura A: *Self-Efficacy: The Exercise of Control*. New York, Freeman, 1995
16. Kavanagh DJ, Gooley S, Wilson PH: Prediction of adherence and control in diabetes. *J Behav Med* 16:509–522, 1993
17. Ott J, Greening L, Parardy N, Holderby A, DeBell W-K: Self-efficacy as a mediator variable for adolescents' adherence to treatment for insulin-dependent diabetes mellitus. *Children's Health Care* 29:47–63, 2000
18. Aalto AM, Uutela A, Aro AR: Health related quality of life among insulin-dependent diabetics: disease-related and psychosocial correlates. *Patient Educ Couns* 30:215–225, 1997
19. Gilden JL, Casia C, Hendryx M, Singh SP: Effects of self-monitoring of blood glucose on quality of life in elderly diabetic patients. *J Am Geriatr Soc* 38:511–515, 1990
20. Grey M, Boland EA, Davidson M, Yu C, Sullivan-Bolyai S, Tamborlane WV: Short-term effects of coping skills training as adjunct to intensive therapy in adolescents. *Diabetes Care* 21:902–908, 1998
21. Grey M, Boland EA, Davidson M, Li J, Tamborlane WV: Coping skills training for youth with diabetes mellitus has long-lasting effects on metabolic control and quality of life. *J Pediatr* 137:107–113, 2000
22. Watkins KW, Connell CM, Fitzgerald JT, Klem L, Hickey T, Ingersoll-Dayton B: Effect of adults' self-regulation of diabetes on quality-of-life outcomes. *Diabetes Care* 23:1511–1515, 2000
23. Marrero DG, Golden MP, Kershnar A, Myers GL: Problem-focused versus emotion-focused coping styles in adolescent diabetics. *Pediat adolesc Endocr* 10:141–146, 1982
24. Clark CM Jr: Reducing the burden of diabetes: the National Diabetes Education Program. *Diabetes Care* 21 (Suppl 3): C30–C31, 1998
25. Muller UA, Femerling M, Reinauer KM, Risse A, Voss M, Jorgens V, Berger M, Muhlhauser I, for the ASD (the Working Group on Structured Diabetes Therapy of the German Diabetes Association): Intensified treatment and education of type 1 diabetes as clinical routine: a nationwide quality-circle experience in Germany. *Diabetes Care* 22 (Suppl. 2):B29–B34, 1999
26. Drass J, Kell S, Osborn M, Bausell B, Corcoran J, Moskowitz A, Fleming B: Diabetes care for Medicare beneficiaries: attitudes and behaviors of primary care physicians. *Diabetes Care* 21:1282–1287, 1998
27. Pringle M, Stewart EC, Coupland C, Williams I, Allison S, Sterland J: Influences on control in diabetes mellitus: patient, doctor, practice, or delivery of care? *BMJ* 306: 630–634, 1993
28. Siebert C, Lipsett LF, Greenblatt J, Silverman RE: Survey of physician practice behaviors related to diabetes mellitus in the U.S. I. Design and methods. *Diabetes Care* 16:759–764, 1993
29. Peyrot M, McMurry JF, Jr., Kruger DF: A biopsychosocial model of glycemic control in diabetes: stress, coping and regimen adherence. *J Health Soc Behav* 40: 141–158, 1999
30. Langewitz W, Wossmer B, Iseli J, Berger W: Psychological and metabolic improvement after an outpatient teaching program for functional intensified insulin therapy (FIT). *Diabetes Res Clin Pract* 37: 157–164, 1997
31. Peyrot M: Behavior change in diabetes education. *Diabetes Educ* 25:62–73, 1999
32. van der Does FE, de Neeling JN, Snoek FJ, Kostense PJ, Grootenhuis PA, Bouter LM, Heine RJ: Symptoms and well-being in relation to glycemic control in type II diabetes. *Diabetes Care* 19:204–210, 1996
33. van der Does FE, de Neeling JN, Snoek FJ, Grootenhuis PA, Kostense PJ, Bouter LM, Heine RJ: Randomized study of two different target levels of glycemic control within the acceptable range in type 2 diabetes: effects on well-being at 1 year. *Diabetes Care* 21:2085–2093, 1998

34. Guttmann-Bauman I, Flaherty BP, Strugger M, McEvoy RC: Metabolic control and quality-of-life self-assessment in adolescents with IDDM. *Diabetes Care* 21:915–918, 1998
35. Testa MA, Simonson DC, Turner RR: Valuing quality of life and improvements in glycemic control in people with type 2 diabetes. *Diabetes Care* 21 (Suppl. 3): C44–C52, 1998
36. U.K. Prospective Diabetes Study Group: Quality of life in type 2 diabetic patients is affected by complications but not by intensive policies to improve blood glucose or blood pressure control (UKPDS 37). *Diabetes Care* 22:1125–1136, 1999
37. Weinberger M, Kirkman MS, Samsa GP, Cowper PA, Shortliffe EA, Simel DL, Feussner JR: The relationship between glycemic control and health-related quality of life in patients with non-insulin-dependent diabetes mellitus. *Med Care* 32: 1173–1181, 1994
38. Wikblad K, Leksell J, Wibell L: Health-related quality of life in relation to metabolic control and late complications in patients with insulin dependent diabetes mellitus. *Qual Life Res* 5:123–130, 1996
39. Larsson D, Lager I, Nilsson PM: Socioeconomic characteristics and quality of life in diabetes mellitus: relation to metabolic control. *Scand J Public Health* 27:101–105, 1999
40. Ahroni JH, Boyko EJ, Davignon DR, Pecoraro RE: The health and functional status of veterans with diabetes. *Diabetes Care* 17:318–321, 1994
41. Glasgow RE: A practical model of diabetes management and education. *Diabetes Care* 18:117–126, 1995
42. Kugler, J: *Die Medizin in Berlin*. Berlin, Verlag, 1997
43. Angermeyer MC, Kilian R, Meils H: *WHOQOL 100*: *Handbuch für die Deutschsprachige Version des WHO Instruments zur Erfassung von Lebenqualität*. Göttingen, Germany, Hogrefe, 1999
44. Muthny FA: *Freiburger Fragebogen zur Krankheitsverarbeitung*. Weinheim, Germany, Beltz, 1989
45. Wolf MH, Putnam SM, James SA, Stiles WB: The Medical Interview Satisfaction Scale: development of a scale to measure patient perceptions of physician behavior. *J Behav Med* 1:391–401, 1978
46. Zuzok S: *Validierung der Deutschsprachigen Fassung der Medical Interview Satisfaction Scale*. Dissertation Fachbereich Humanmedizin, Düsseldorf, Germany, Heinrich-Heine Universität, 2000
47. Beckmann D, Braehler E, Richter HE: *Der Giessen-Test (GT): Ein Test fuer Individual- und Gruppendiagnostik*. Bern, Huber, 1991
48. Scholler G, Fliege H, Klapp BF: Fragebogen zu selbstwirksamkeit, optimismus und pessimismus: restrukturierung, itemselektion und validierung eines instrumentes an untersuchungen klinischer stichproben. *Psychother Psychosom Med Psychol (PPmP)* 49:275–283, 1999
49. Jerusalem M, Schwarzer R: Fragebogen zur Erfassung von "Selbstwirksamkeit." In *Skalen zur Befindlichkeit und Persoenlichkeit (Forschungsbericht 5)*. Schwarzer R, Ed. Berlin, Freie Universitaet, Institut fuer Psychologie, 1986, p. 18
50. Scheier MF, Carver CS: Optimism, coping, and health: assessment and implications of generalized outcome expectancies. *Health Psychol* 4:219–247, 1985
51. Roth R, Kulzer B, Teupe B, Borkenstein M: *Diabetes-Wissens-Test: TYP-I*. Goettingen, Germany, Hogrefe, 1996
52. Dunn SM, Bryson JM, Hoskins PL, Alford JB, Handelsman DJ, Turtle JR: Development of the diabetes knowledge (DKN) scales: forms DKNA, DKNB, and DKNC. *Diabetes Care* 7:36–41, 1984
53. Hess GE, Davis WK: The validation of a diabetes patient knowledge test. *Diabetes Care* 6:591–596, 1983
54. Rose M, Hildebrandt M, Fliege H, Seidlitz B, Cotta L, Schirop T, Klapp BF: Relevance of the treatment facility for disease-related knowledge of diabetes patients. *Diabetes Care* 23:1708–1709, 2000
55. Golden MP: Incorporation of quality-of-life considerations into intensive diabetes management protocols in adolescents. *Diabetes Care* 21:885–886, 1998