

Determinants of the Quality of Life of Patients With Diabetes Under Intensified Insulin Therapy

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OBJECTIVE — The concept of quality of life (QOL) is understood as a multidimensional construct made up of physiological, psychological, and social aspects, but their particular weightings for the global QOL are rarely investigated. We examined 1) the general QOL of patients with diabetes, 2) the significance of the individual QOL aspects for the overall assessment of QOL, and 3) the modulating function of coping mechanism and particular personality traits.

RESEARCH DESIGN AND METHODS — A total of 116 diabetes patients under intensified insulin therapy were studied, as were 107 patients with inflammatory bowel disease, 66 patients with chronic hepatitis C, and 229 students who served as control subjects. The examination was based on eight standardized QOL and personality questionnaires (354 items) and assessed by means of linear structural regression models (AMOS 3.6).

RESULTS — The QOL of diabetes patients appears to be higher than the QOL of other chronically ill patients. Social, psychological, and physical aspects contribute to the overall QOL, although physical complaints receive a comparatively low weighting. Coping behavior and particular personality traits covary with all QOL aspects, giving these variables greater significance for the QOL than the existence of secondary illnesses.

CONCLUSIONS — The hypothesis that the various factors involved in the multidimensional construct QOL receive different weightings was confirmed, making a simple summary score for the general QOL appear unjustifiable. In addition, all aspects that are commonly understood as parameters of QOL are influenced by external factors, such as coping behavior, based on individual personality characteristics.

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Prolonging life or improving particular bodily functions have been the traditional goals of medical treatment, yet in spite of the enormous progress being made, these goals are increasingly seen as reductionistic by society as well as the medical community, particularly in the case of

chronic illnesses such as diabetes. Even the area of research is being confronted with demands to relate somatic improvements to the more general “quality of life” of patients (1). The difficulty herein arises out of the need to satisfactorily operationalize the concept of quality of life (QOL). There

is, on the one hand, general agreement that physical and psychological well-being, level of independence, and social integration contribute in an essential way to the QOL of the individual (2), thereby making multidimensional measurements of QOL necessary (3,4). However, the weighting of individual aspects in particular cases or in specific illness situations is largely unclear. For pragmatic reasons, simple summary scores are often made, but from a methodological perspective, only knowledge of the weighting of the individual aspects allows for a meaningful aggregation of data in the form of an overall index. This, then, is a prerequisite for research that investigates, for example, whether one treatment is superior to another in terms of QOL or so-called “quality-adjusted life years” (5,6).

In the case of diabetes, it is well known that most of the aforementioned individual aspects of QOL are in some way impaired as a result of the chronic illness, whereby much significance is attributed to the existence of secondary illnesses as they affect areas relevant to QOL. In particular, retinopathy and nephropathy, in addition to physical complaints, are most often associated with serious states of depressive anxiety (7–10), although these states can be mitigated to a large extent through positive social integration (9). Furthermore, frequent metabolic disorders diminish the QOL in physical as well as social aspects (8), whereas, analogously, good blood glucose control is connected with less anxiety and depression and greater self-confidence (11–14). The ideographic results of the Diabetes Control and Complications Trial can be interpreted as also demonstrating that a patient's sense of well-being resulting from an increased sense of self-determinacy or self-control in intensified conventional insulin therapy (ICT) groups can compensate for the burden of frequent blood glucose testing (15,16). However, even in this research and in other large studies (17), the concept of QOL has been understood only descriptively. Therefore, the published results offer a good overview of the restrictions in individual aspects of experience of diabetic patients, but they do not offer infor-

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Abbreviations: ACSA, Anamnestic Comparative Self Assessment; AGFI, adjusted goodness of fit index; BMQ, Berlin Mood Questionnaire; DLF, Daily Living Functioning; FCQ, Freiburg Coping Questionnaire; GCQ, Giessen Complaint Questionnaire; GT, Giessen Test; ICT, intensified conventional insulin therapy; LSI, Life Satisfaction Inventory; QOL, quality of life; SOSU, Questionnaire Social Support.

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

mation regarding the interplay of the various facets of QOL. In general, there is little research that takes into account the interactive relationship between individual aspects of QOL or that explicitly examines the particular parameters decisive for a patient's general QOL (18).

Also seldom taken into account, in our observations, is the well-known importance of personality characteristics for coming to terms with, or "coping," with an illness (19), which is of great relevance for compliance and likely an essential confounder in measurements of QOL (20).

For this reason, we felt the following should be studied in diabetic patients with intensified insulin therapy: 1) the QOL in comparison to other chronically ill patients; 2) the kind of interaction that exists between the known QOL subdimensions in diabetic patients—in other words, the weighting of individual components in the overall assessment of the QOL; and 3) the physical, psychological, and social influences that determine the QOL for these patients.

RESEARCH DESIGN AND METHODS

Sample

The present study concerns a consecutive sampling of 116 patients (70 men and 46 women) suffering from diabetes (86 with type 1 and 30 with type 2) and pursuing intensified insulin regimes (80 continuous subcutaneous insulin infusion, 36 ICT). They represent nearly all patients treated during the 1-year sampling period in the diabetes outpatient center of the Charité Campus-Virchow (five patients refused to take part in the study). The gathering of data and/or questionnaires took place in the context of the patient's regular visits at the diabetes outpatient center and was carried out by employees of the psychosomatic and psychotherapy division of the clinic. The employees had no knowledge of the somatic status of the patient.

The patients were, on average, 44.7 ± 12.2 years old (range 19–70 years), with 53.1% employed, 9.3% in training, 11.1% unemployed, and 20.8% retired. Of the total, 17.2% had graduated from high school, and 84.1% lived with a partner. Patients with type 2 diabetes were, on average, somewhat older and had more adiposity than the group of patients with type 1 diabetes. The groups could not be further differentiated from one another with respect to other biological or

psychological characteristics. The length of illness was between <1 year and 41 years, with an average of 14.8 years. Intensified insulin therapy had been taking place for a few months or up to 12 years, with an average length of treatment of 5 years.

For purposes of comparison, two other groups of chronically ill patients were examined, all of whom were being treated in the outpatient clinic of the Charité and who demonstrated similar socioeconomic characteristics: 1) 66 hepatitis C patients without medication (34 men, 32 women, 46.7 ± 10.5 years old, 68.8% employed, 7.0% in training, 12.1% unemployed, 12.1% retired, 19.0% with high school graduation, 82.5% living with a partner); and 2) 107 patients with inflammatory bowel disease (46 men, 61 women, 54.5% employed, 14.9% in training, 12.9% unemployed, 15.9% retired, 76.7% living with a partner), who were, however, ~ 5 years younger (38.7 ± 13.1 years old) with a higher level of education (35.3% with high school graduation) than the diabetic patients. At the time of the study, 32 patients exhibited an increased intestinal inflammatory activity (Crohn's Disease Activity Index >150 or Rachmillewitz Score >3). Serving as the healthy control group were 229 medical students (112 men, 117 women, 24.3 ± 4.6 years old), who were examined by us, and 350 students whose data were documented by the test authors of the Daily Living Functioning questionnaire (21). A representative sample of German inhabitants was gathered by the test authors for the complaints questionnaire (716 men, 841 women, 39 years old on average [22]) and for the social support questionnaire (933 men, 1,246 women, 44.4 ± 16.8 years old, 50.5% employed, 8.0% in training, 10.1% unemployed, 22.9% retired, and 17.9% with high school graduation [T. Fydrich, M. Geyer, A. Hessel, G. Sommer, E. Brähler, unpublished observations]).

Physical condition

The information regarding existing secondary illnesses was gathered by the treating physician, who did not have knowledge of any psychological data: 24 patients had diabetic retinopathy in different stages, none of whom were blind; 6 had nephropathy, none of whom were on dialysis; 12 had peripheral angiopathy; 17 had coronary heart disease; and 36 had a documented polyneuropathy. (For 25 patients, one second illness was documented; for 18 patients, two illnesses; for 7 patients, three illnesses; for 2 patients, four illnesses; and for 1 patient, five ill-

nesses). For the purpose of further analysis, we divided the patients into one group with no second disease ($n = 63$) and one group with at least one ($n = 53$). Information regarding the previous need for treatment of hypo- or hyperglycemia, length of illness, and treatment was gathered directly from the patients themselves. The average HbA_{1c} was $7.2 \pm 1.8\%$ (normal range at Charité laboratory <6.1%). Although HbA_{1c} is one of our targeted somatic outcome parameters, this article focuses on interactions of psychological interest; therefore, HbA_{1c} is not further analyzed.

Psychological condition

In addition to questions concerning anamnesis and treatment (66 items), the following standardized and well-established German questionnaires were used to cover the following previously mentioned subdimensions of QOL: physical health—Giessen Complaint Questionnaire (GCQ), 57 items (22); psychological state—Berlin Mood Questionnaire (BMQ), 30 items (24); social support—Questionnaire Social Support (SOSU), 22 items (25); and level of independence—an adapted version of the Daily Living Functioning (DLF) questionnaire, 28 items (21). In addition, two instruments with a more global assessment of QOL—Anamnestic Comparative Self Assessment [ACSA], 1 item (26), and Life Satisfaction Inventory (LSI), 15 items (27) (to measure life satisfaction)—were used. The QOL-related instruments of measurement were expanded to include possible determinants relevant to the patient's general coping strategies in dealing with the illness, as measured by the Freiburg Coping Questionnaire (FCQ) (35 items [28]), and the assessment of specific personality characteristics, measured by the psychoanalytically based Giessen Test (GT) (40 items [29]). The total number of items was 354. The patients filled out the first group of questionnaires (BMQ, patient ad hoc, GCQ, LSI, ACSA, and FCQ; 203 items total; average time to complete: 1 h) during their regular consultation with the physician. The second group of questionnaires was sent later, by mail (151 items; average completion time: 45 min; 80% return quotient). In addition, the treating physician gave an assessment of the patient's compliance and prognosis through a further ad hoc questionnaire (30 items).

Statistical analysis

The comparison of means was carried out with variance analysis (Table 1). All factor-

Table 1—Measurements of QOL and personality characteristics compared in various group samples

	Diabetic patients with second illnesses	Healthy control subjects	t value	Diabetic patients without second illnesses	Chronic disease control subjects		F value
					Chronic hepatitis C	Inflammatory bowel disease	
Complaints—GCQ							
Exhaustion	5.05 ± 4.43	4.6 ± 4.4	—	6.87 ± 5.07	7.57 ± 6.09	7.75 ± 5.17	—
Joint pains	4.76 ± 4.23	5.4 ± 4.8	—	7.28 ± 4.97	6.23 ± 5.05	6.18 ± 5.50	—
Heart ailments	1.95 ± 2.71	3.0 ± 3.6	2.28*	3.57 ± 4.60	2.50 ± 2.98	2.44 ± 2.68	—
Stomach ailments	1.71 ± 2.20	2.7 ± 3.3	2.34†	2.90 ± 3.56	3.21 ± 3.52	4.19 ± 5.33	—
Total score	13.45 ± 11.03	15.7 ± 13.3	—	20.57 ± 14.74	19.51 ± 15.15	20.22 ± 14.43	—
Mood—BMQ							
Tiredness	0.78 ± 0.76	1.78 ± 0.95	7.60†	0.66 ± 0.63	1.11 ± 1.03	1.17 ± 0.85	4.65†
Depressive anxiety	0.34 ± 0.42	0.82 ± 0.71	5.05†	0.63 ± 0.68	0.89 ± 0.85	0.60 ± 0.62	—
Anger	0.32 ± 0.39	1.13 ± 0.89	6.93†	0.37 ± 0.47	0.51 ± 0.59	0.52 ± 0.73	—
Elevated mood	2.20 ± 0.92	1.69 ± 0.89	−3.95†	2.05 ± 1.01	1.50 ± 0.93	1.64 ± 1.08	4.54†
Social support—SOSU							
Total score	4.38 ± 0.56	4.00 ± 0.66	−4.15†	4.19 ± 0.82	4.37 ± 0.59	4.41 ± 0.86	—
Daily function—DLF							
Everyday life	4.24 ± 0.57	4.27 ± 0.50	—	4.02 ± 0.82	—	3.87 ± 0.98	—
Psyche	4.06 ± 0.62	4.09 ± 0.62	—	3.91 ± 0.79	—	3.73 ± 0.94	—
Body	4.19 ± 0.55	4.19 ± 0.57	—	3.85 ± 0.83	—	3.48 ± 0.76	1.99*
Total score	4.14 ± 0.54	4.11 ± 0.63	—	3.87 ± 0.72	—	3.77 ± 0.74	—
Life satisfaction—LSI							
General	2.87 ± 0.56	2.46 ± 0.57	−2.17†	2.93 ± 0.63	2.75 ± 0.63	2.73 ± 0.66	—
Health	3.06 ± 0.59	3.03 ± 0.74	—	2.87 ± 0.77	1.99 ± 0.83	2.03 ± 0.84	19.5‡
Familial	3.08 ± 0.84	2.58 ± 0.94	−3.00†	2.89 ± 1.02	2.89 ± 0.86	2.88 ± 0.93	—
Total score	2.96 ± 0.52	2.69 ± 0.53	−2.74†	2.91 ± 0.66	2.62 ± 0.59	2.60 ± 0.60	3.93*
QOL—ACSA							
Single item	6.65 ± 1.99	5.82 ± 2.58	−1.85*	6.31 ± 2.32	5.80 ± 2.17	5.24 ± 2.69	—

Data are means ± SD. Item ranges: GCQ/BMQ, 0–4; DLF/SOSU/LSI, 1–5; ACSA, 0–10. For healthy control subjects, GCQ, German representative sample (n = 1,557) (22); BMQ students (n = 229) own data (24); DLF students (n = 350) (21); SOSU German representative sample (n = 2,179) (23); LSI students (n = 52) own data; ACSA students (n = 43) own data. *P < 0.05, †P < 0.01, ‡P < 0.001.

ial analyses were carried out as major component analyses with orthogonal rotation (Table 2). The choice of factors was made according to the Scree Test (30). Multiple regression analysis was used for the simultaneous inclusion of predictors, and Pearson's correlation coefficient was used for the description of interscale correlations (Table 3). Calculations for the linear structural regression models (Figs. 1–3) were carried out in the maximum likelihood method by means of the program AMOS 3.6 (J.L. Arbuckle, distributed by SPSS-Munich, Munich).

RESULTS

Comparison of QOL between groups

Standard instruments. If one considers the results of the various measurements (Table 1), it is striking to note that diabetic patients without secondary illnesses report, in almost all subdimensions, as well as in the individual scales, the “best” values for QOL compared with all other groups sam-

pled. Not even their health-related life satisfaction is lower than that reported by healthy students, whereas their global life satisfaction (or rather, QOL) compared with the best and/or worst times in their lives (ACSA) is significantly higher when compared with the students. It is possible that these findings reflect a selection effect through the chosen sampling of students, but comparing the diabetic patients with a representative sampling in Germany also supports the tendency of diabetic patients having “better” QOL values than “healthy” persons—here in terms of physical condition and social support—with no significant differences in individual socioeconomic characteristics (Table 1).

Diabetic patients with secondary illnesses exhibit a noticeably higher score in the area of physical ailments, to an extent comparable with other chronically ill individuals in outpatient care, like those with inflammatory bowel disease or hepatitis C, who show the typical raised values with respect to exhaustion and abdominal com-

plaints. Nevertheless, even diabetic patients with secondary illnesses report only slight restrictions in their level of independence, despite their high level of physical ailments, so that they exhibit “better” values for their bodily functioning than, for example, patients with active inflammatory bowel disease. According to these scores, diabetic patients see themselves as being in a better mood and were markedly more satisfied with their health condition than were the control groups.

Item selection. In addition to the presentation of the standard scales used for comparison with other groups, factorial analyses of all QOL questionnaires were carried out (Table 2) to sort out those areas relevant for the diabetes sample for the further calculations.

For the mood questionnaire (BMQ), all original scales were confirmed. For the SOSU, factor analysis showed a theoretically assumable differentiation in “emotional” and “practical” social support (25). However, for the complaint instrument (GCQ),

some items for the investigated sample had to be re-scaled. Of the original 57 items, we extracted two areas with more or less typical complaint complexes for diabetes. They can be understood as being ailments connected with the experience of metabolic dysregulations and polyneuropathy. For the daily functioning questionnaire (DLF), factor analysis suggested an extraction of those items that 1) ascertain the level of bodily functioning and 2) deal with the potential for "active living" (Table 2). All chosen scales were restricted to the five highest-loading items and showed a good internal consistency, with Cronbach α values of ~ 0.80 .

Interactions between QOL dimensions

The correlation and regression analyses show (Table 3) that all QOL subdimensions contribute to the experienced "life satisfaction" (LSI), whereas in this sample, "elevated mood" (BMQ), "active living" (DLF), and "practical social support" (SOSU) seem to be of special importance. All of the latter variables showed a β -weight of > 0.20 . The expressed ailments were surprisingly unimportant. Only the "tiredness" scale (BMQ) was able to explain a substantial part of the observed variance, with a β -weight of 0.17.

By using an analogous scale (ACSA), the QOL was measured in comparison with the best and worst times in life and highly correlated with the experienced daily life functioning, although it showed no relation to the presently measured ailments.

Overall, it can be concluded that all scales of the instruments used depict some part of the life satisfaction and, with some restrictions, also of the comparative QOL (ACSA). As a result, it was examined further 1) whether the theoretically based model of psychological interactions is a sufficient explanatory model as a whole and 2) which relationships could be uncovered in a linear structural regression model. Hence, a model guided by the World Health Organization hypothesis was constructed (Fig. 1). Because of the relatively small sample size, the described scales had to be combined into sum scales according to their QOL dimensions ("complaints," "daily life functioning," and "social support"). Because a summing up for mood scales is not possible due to their multidimensionality (31), the "depressive anxiety" and "elevated mood" scales were still considered separately.

As was to be expected from the correlation matrix, the constructs physiological health, psychological state, daily life functioning, and social support explained a

Table 2—Factor analysis and re-scaling of QOL instruments

Items	Factor solution		Scaling	
	a_1	h_2	Mean \pm SD	$r_{i(t-i)}$
Complaints (GCQ)	Factor 2: variance cl. 6.3%		Metabolic complaints α : 0.79	
Nausea	0.75	0.70	0.23 \pm 0.56	0.50
Dazed	0.64	0.51	0.36 \pm 0.74	0.73
Shaky	0.63	0.50	0.36 \pm 0.73	0.75
Heat waves	0.57	0.45	0.61 \pm 1.03	0.79
Dizziness	0.57	0.52	0.53 \pm 0.83	0.72
Complaints (GCQ)	Factor 3: variance cl. 5.4%		Neurological complaints α : 0.84	
Heaviness in the legs	0.70	0.57	0.84 \pm 1.03	0.70
Walking difficulties	0.62	0.40	0.43 \pm 0.90	0.62
Numbness	0.61	0.57	0.81 \pm 1.14	0.69
Pain in joints or limbs	0.54	0.59	1.05 \pm 1.18	0.67
Sleeping disorders	0.52	0.59	0.68 \pm 1.04	0.51
Mood (BMQ)	Factor 1: variance cl. 29.3%		Tiredness α : 0.89	
Weary	0.88	0.81	0.84 \pm 0.86	0.79
Exhausted	0.81	0.80	0.73 \pm 0.90	0.80
Weak	0.78	0.70	0.61 \pm 0.74	0.63
Tired	0.77	0.74	0.87 \pm 0.91	0.73
Lethargic	0.76	0.65	0.61 \pm 0.79	0.69
Mood (BMQ)	Factor 2: variance cl. 10.3%		Elevated mood α : 0.88	
Content	0.85	0.81	2.00 \pm 1.24	0.83
Happy	0.82	0.78	2.09 \pm 1.14	0.77
Cheerful	0.80	0.74	1.88 \pm 1.21	0.75
Harmonious	0.58	0.56	2.35 \pm 1.12	0.53
Relaxed	0.57	0.61	2.46 \pm 1.18	0.65
Mood (BMQ)	Factor 3: variance cl. 8.6%		Depressive anxiety α : 0.80	
Concerned	0.77	0.69	0.53 \pm 0.80	0.68
Worried	0.72	0.59	0.71 \pm 0.96	0.56
Insecure	0.72	0.62	0.41 \pm 0.63	0.53
Depressed	0.53	0.67	0.31 \pm 0.67	0.55
Sad	0.46	0.67	0.39 \pm 0.74	0.62
Daily life functioning (DLF)	Factor 2: variance cl. 8.2%		Bodily functions α : 0.86	
Exert oneself physically	0.85	0.78	4.11 \pm 1.15	0.75
Physical exercise	0.73	0.65	3.85 \pm 1.01	0.68
Fulfill tasks at home or at work	0.72	0.84	4.25 \pm 1.00	0.75
Use your body unimpeded	0.66	0.69	4.07 \pm 1.03	0.59
Can concentrate	0.54	0.64	4.08 \pm 0.96	0.60
Daily life functioning (DLF)	Factor 3: variance cl. 5.9%		Active living α : 0.84	
Pursue hobbies	0.84	0.82	3.79 \pm 1.08	0.77
Leisure time activities	0.69	0.64	3.55 \pm 1.23	0.66
Relax	0.64	0.69	4.18 \pm 1.03	0.63
Do something nice	0.56	0.75	3.92 \pm 1.19	0.63
Shopping	0.45	0.42	4.31 \pm 0.98	0.56
Social support (SOSU)	Factor 1: variance cl. 46%		Practical support α : 0.81	
Others take care of me	0.77	0.65	4.59 \pm 0.83	0.53
Help in hopeless situations	0.74	0.72	4.25 \pm 1.09	0.69
Support in case of illness	0.73	0.67	4.64 \pm 0.83	0.66
Help from a close friend	0.72	0.67	4.69 \pm 0.70	0.73
Possibility to loan tools/food	0.59	0.35	4.59 \pm 0.86	0.43
Social support (SOSU)	Factor 2: variance cl. 8.2%		Emotional support α : 0.82	
Wish for more security and warmth	-0.74	0.55	2.40 \pm 1.60	0.61
Having someone to show my feelings	0.69	0.64	4.03 \pm 1.26	0.60
Having someone to share joy and sorrow	0.67	0.61	4.46 \pm 0.89	0.67
Having someone to embrace me	0.65	0.64	4.39 \pm 1.13	0.59
Wish for more affection	-0.63	0.42	2.56 \pm 1.41	0.65

For clarity, only the items of the factor solution are listed here that were finally used to create the scales. Marker items according to Sommer and Fydrich (25): $a_1 \geq 0.45$ $a_2^2/h^2 > 0.50$; a_1 , factor loading after Varimax rotation; h_2 , communality; $r_{i(t-i)}$, part-corrected, whole-corrected item scale correlation.

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Table 3—Scale intercorrelations and regressions to the life satisfaction scale

	Complaints			Moods		Daily life functioning			Social support			QOL global		Regression to LSI	
	Neurological	Tired	Total	Elevated	Depressive anxiety	Body	Active living	Total	Practical	Emotional	Total	ACSA	LSI	β	t
Metabolic	0.43†	0.07	0.66†	-0.20*	0.36†	-0.34†	-0.20	-0.30†	-0.04	-0.29†	-0.21*	-0.16	-0.23*	0.08	0.90
Neurological	1.00	0.27†	0.85†	-0.25†	0.32†	-0.54†	-0.30†	-0.47†	-0.16	-0.16	-0.18	-0.09	-0.33†	0.00	0.05
Tiredness	—	1.00	0.62†	-0.40†	-0.22*	-0.32†	-0.43†	-0.43†	0.01	-0.17	-0.11	-0.09	-0.40†	-0.17	-1.88*
Complaints total	—	—	1.00	-0.40†	0.42†	-0.56†	-0.43†	-0.56†	-0.26*	-0.09	-0.22*	-0.14	-0.45†	—	—
Elevated mood	—	—	—	1.00	-0.32†	0.52†	0.50†	0.58†	0.21*	0.21*	0.24*	0.38†	0.59†	0.28	2.88†
Depressive anxiety	—	—	—	—	1.00	-0.39†	-0.36†	-0.43†	-0.18	-0.32†	-0.30†	-0.16	-0.38†	0.04	0.41
Bodily functioning	—	—	—	—	—	1.00	0.56†	0.88†	0.12	0.18	0.18	0.34†	0.49†	-0.05	-0.53
Active living	—	—	—	—	—	—	1.00	0.89†	0.08	0.16	0.14	0.37†	0.57†	0.24	2.47*
Daily life functioning total	—	—	—	—	—	—	—	1.00	0.20	0.11	0.18	0.40†	0.60†	—	—
Practical support	—	—	—	—	—	—	—	—	1.00	0.55†	0.93†	0.20	0.39†	0.24	2.62†
Emotional support	—	—	—	—	—	—	—	—	—	1.00	0.83†	0.22*	0.39†	0.10	1.02
Social support total	—	—	—	—	—	—	—	—	—	—	1.00	0.24*	0.44†	—	—
Life satisfaction total	—	—	—	—	—	—	—	—	—	—	—	1.00	0.49†	—	—

To prepare analysis shown in Fig. 1, the total sum scores of each QOL subdimension are also shown here. Regression for the dependent variable “life satisfaction” is shown (LSI sum: $R^2 = 0.58$, $R^2 = 0.53$, $R = 0.76$, $F = 12.03$; $P < 0.001$). Correlation coefficient: * $P < 0.05$; † $P < 0.01$. Regression analysis to ACSA ($R^2 = 0.14$, $R^2 = 0.23$, $F = 2.61$; $P < 0.01$) only shows β -weights of $P < 0.1$.

major part (66%) of the construct QOL, which was operationalized here as a latent variable (32) out of the scales from LSI and ACSA (Fig. 1). In this model, daily life functioning, social support, and elevated mood played the most important role in explaining the variance. With a $\chi^2 = 22.8$ and 17 degrees of freedom (df), the test statistics (with $P = 0.16$) allowed for the acceptance of the basic model with a satisfying goodness of fit ($C_{min}/df = 1.34$). At this point, therefore, we can conclude that the model based on the World Health Organization hypothesis has been confirmed by the empirical data to be an accurate operationalization of the QOL construct and can consequently be used for further analysis.

Determinants of the QOL

Biological variables. As could be expected, the existence of diabetic secondary illnesses influences reports of QOL with respect to bodily complaints and functions (“neurological complaints”: without second illness 0.52 ± 0.71 , with second illnesses 1.19 ± 0.93 , $t = -4.36$, $P < 0.001$; “bodily functioning”: without second illness 4.28 ± 0.62 , with second illnesses 3.73 ± 0.96 , $t = 3.32$, $P < 0.001$). But the differences in these dimensions find no expression in more general QOL questions, so that in this case, no major differences could be observed between patients with and without secondary diabetic illnesses. Analogous connections can be found when comparing patients with shorter versus longer illness

(<15 years vs. ≥ 15 years) because of a great confounding effect with secondary illnesses. The fact that metabolic disturbances occurred more often and had to be professionally treated (≥ 1 year vs. <1 year) had no impact, either on the expressed ailments or on other dimensions of QOL.

The importance of the existence of secondary illnesses was further evaluated with respect to its influence on the overall model of QOL measurements (Fig. 2). As we have seen in model A, there were relatively high correlations between the residual variables (Fig. 1), which indicates that there might be a common hidden factor influencing all variables in a certain direction. On the basis of the literature reported, this factor could be the existence of second illnesses, which appears to play a role in the expression of complaints (8), depressive anxiety (12), and daily life functioning (33). As a result, we extended model A into model B (Fig. 2) to evaluate the importance of existing second illnesses for the different aspects of QOL.

We found that the inclusion of objective findings explained the variance of ailment articulation to some extent (11%), but their importance for a depressive-anxious mood or for diminished levels of daily life functioning could not be verified.

With slightly improved goodness-of-fit indices ($C_{min}/df = 1.13$), this model could nevertheless be accepted ($P = 0.31$). However, the correlation between objective findings and subjective ailments is relatively small ($r = 0.33$), which suggests that other

factors are influencing the expression of complaints. If we look at the correlation coefficients between residual variables (Fig. 2), we must admit that they remain relatively high, leaving the aforementioned problem concerning a hidden factor unsolved.

Psychological variables. Consequently, we analyzed whether or not this hidden factor could be explained by the influence of personality traits (20) or certain aspects of coping (19). We, therefore, expanded the model further to include these variables. The relevant scales of GT and FCQ were chosen by the three highest correlations to QOL instruments (ACSA, LSI) to create two latent variables, here called “coping” and “personality traits.”

It can be shown in the extended model C (Fig. 3) that coping strategies in connection with particular personality traits, such as social competence, can predict a relevant part of the complaint articulation as well as mood expression, experienced daily life functioning, and social support. Trait parameters in model C explained 32% of the variances of complaints, 21 or 28% of moods, 23% of daily life functioning, and 35% of experienced social support, where the minimal effect of the objective findings for variance explanation (see model B) was still included. Here, too, statistics checks allowed for the acceptance of model C ($P = 0.47$), with satisfying goodness-of-fit indices ($C_{min} = 1.01$). (Note that a C_{min} of 1.01 proves a nearly ideal fit, whereas an adjusted goodness of fit index (AGFI) of

0.83 can be described only as sufficient. The two calculation methods of the indices vary in their sensitivity to distribution conditions and take the complexity of a model into account differently [32]. Therefore, in comparison with model B, we found divergences in the goodness-of-fit indices in divergent directions. If, however, the expanded information in model C is considered, the extension seems to be justified even with a smaller AGFI.) When we now look at the correlation coefficients between residual variables (Fig. 3), we can see that they drop in comparison to model B by approximately -0.20 . It can, therefore, be concluded that personality traits and coping styles can indeed be seen as one of the hidden factors for QOL. Although there is still unexplained variance in model C, it is nevertheless best able to describe the fundamental relationships involved in QOL and therefore best able to predict the patients' reported QOL.

Social variables. With respect to all basic social factors tested in this context, only the older group of patients showed more "neurological complaints," which can be explained by the fact that belonging to this group is confounded with longer persistence and therefore more often with polyneuropathy.

CONCLUSIONS

Comparison of QOL between groups

The diabetic patients without secondary illnesses in our study reported similar values in almost all QOL areas to those reported by healthy individuals, who were, in fact, younger and, for this reason alone, should have exhibited greater satisfaction with respect to their state of health (17,34). In fact, the diabetes patients complained even less of physical discomforts than a comparable representative sampling. Considering that the QOL areas here under investigation could also be defined as characteristics of health, one must conclude that diabetic patients without secondary illnesses obviously do not see themselves as "ill." Even those patients with secondary illnesses present a more positive picture in terms of QOL than do other chronically ill individuals in outpatient care, as also seen in the Medical Outcomes Study (35). Although all of these patient groups report comparable levels of general physical discomfort, the diabetic patients answered the more global questions concerning, for example, mood, bodily functioning, or health-related life satisfac-

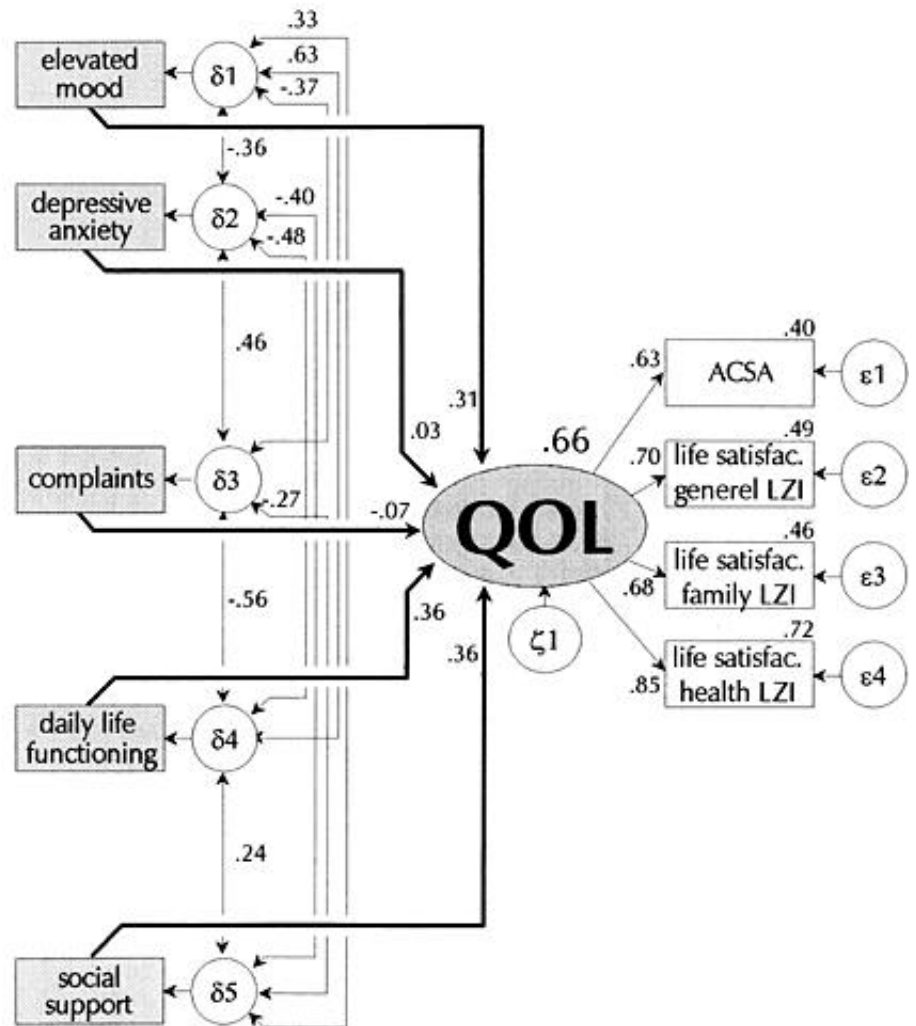


Figure 1—Model A: Different aspects of QOL with their weight for the global QOL quote. Circles, unobserved residual variables with fixed regression weight of 1; rectangles, observed indicator variables (the highest positioned rectangle received a fixed regression weight of 1); oval, unobserved latent variables; numbers at lines with arrows at each end are correlation coefficients; numbers at lines with arrows at one end are squared regression coefficients; numbers at variables are squared multiplication coefficients, no constrained parameters; $\chi^2 = 22.8$, $df = 17$, $P = 0.16$; no indefinite matrices, SEM regression weights < 0.23 . Fit indices: $G_{min}/df = 1.34$, AGFI = 0.85, GFI = 0.94 (32).

tion, consistently more positively than did the comparable groups of patients with chronic hepatitis C or inflammatory bowel disease, who, like diabetic patients, also live with the fear of the possible onset of secondary illnesses or further complications. It may, in fact, be the case that the early onset of illness in type 1 diabetes—before or during adolescence—makes it significantly different from other chronic illnesses in terms of potential illness coping strategies (36,37). Bruch (37), for example, postulated that in emotionally healthy families, the illness can be accepted to such an extent that the therapy is experienced as a taken-

for-granted fact, a natural aspect of self. It is possible, then, that the experience of the functioning of one's body in this case is indeed comparable to a nondiabetic person. The fact that the average level of physical ailments is even lower than the normal population suggests something else, however. In our opinion, at least with respect to some of the patients, the tendency to deny the illness is here being expressed—a stance often taken by many patients immediately after the announcement of their diagnosis (38). The uniqueness of the psychological demands on diabetic patients as compared with other patients lies precisely in the

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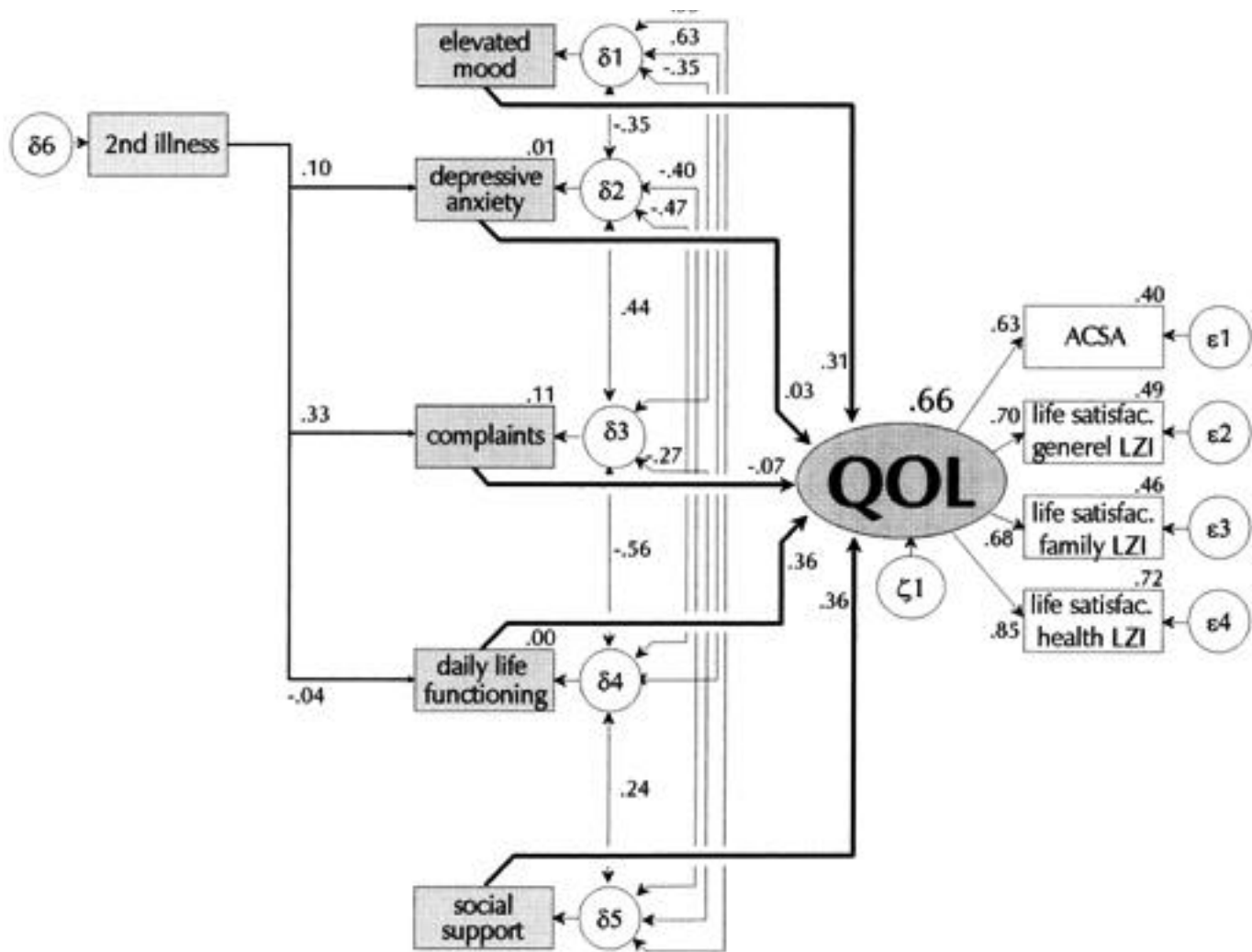


Figure 2—Model B: Second illness with its weight for the QOL quality of life. Circles, unobserved residual variables with fixed regression weight of 1; rectangles, observed indicator variables (the highest positioned rectangle got a fixed regression weight of 1); oval, unobserved latent variables; numbers at lines with arrows at each end are correlation coefficients; numbers at lines with arrows at one end are squared regression coefficients; numbers at variables are squared multiple-correlation coefficients, no constrained parameters. $\chi^2 = 25.4$, $df = 23$, $P = 0.31$; no indefinite matrices, SEM regression weights = 0.31. Fit indices: $C_{min}/df = 1.13$, AGFI = 0.86, GFI = 0.94.

opportunity as well as the necessity for self-therapy. Coupled with the sense of personal responsibility is also the danger of feelings of failure and guilt should unsatisfactory therapy results occur—feelings that are often, in fact, intensified through the consequent reprimands of many physicians in the event of poor blood glucose levels. This could be the prerequisite for the observable tendency of diabetic patients to deny failures in dietary regulation and therapy, both to themselves and to their treating physicians (39)—a situation which is then later labeled as poor compliance (38). The motivation behind belittling the seriousness of the illness, with its accompanying symptoms and physical consequences, could have a similar basis: to ward off feelings of guilt and failure.

In contrast, the chronic hepatitis patients used as comparison in this research were hardly able to influence their illness and could hope only for the vague chance of the development of a new medical treatment. In their case, a more palliative-passive strategy of coming to terms with the illness could be observed, more likely being accompanied by depressive affect (40). In the case of type 2 diabetic patients, as a result of the usual presence of adiposity, the patients often experience an additional sense of responsibility for the very development of the illness and are not infrequently accused of this, directly or indirectly, from their surrounding social environment.

The fact that the examination of patients took place in a treatment context may have

led to an increased tendency to give socially desired answers when compared with the examination of healthy individuals, as has already been discussed concerning study conditions in general (14–16,41). However, these factors could not have played a role in the differences between chronically ill patients, as the contexts in which all of these groups were examined were identical.

Interaction between QOL measurements

The covariation between the individual scales of physical condition, psychological state, level of independence, and social support and the more global scales concerning life satisfaction or QOL supports the conceptual assumption of an interactive model (2). A

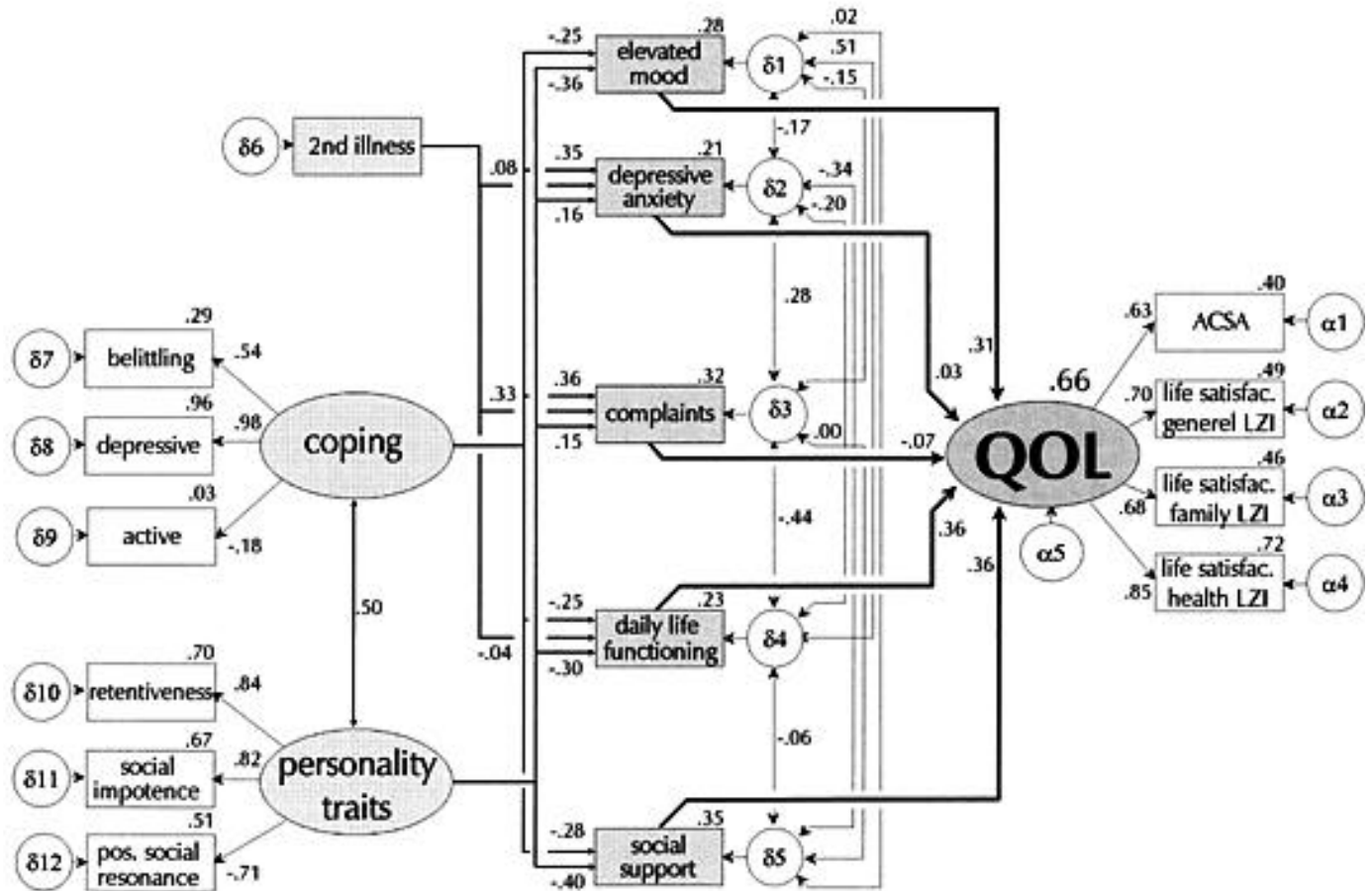


Figure 3—Model C: Coping and other personality traits with their weight for the QOL quote. Circles, unobserved residual variables with fixed regression weight of 1; rectangles, observed indicator variables (the highest positioned rectangle got a fixed regression weight of 1); ovals, unobserved latent variables. Numbers at lines with arrows at each end are correlation coefficients; numbers at lines with arrows at one end are squared regression coefficients; numbers at variables are squared multiple correlation coefficients, no constrained parameters. $\chi^2 = 81.5$, $df = 81$, $P = 0.47$; no indefinite matrices, SEM regression weights < 0.32 . Fit indices: $G_{min}/df = 1.01$, $AGFI = 0.83$, $GFI = 0.90$.

major aspect of general QOL or life satisfaction can be depicted by the concrete areas of physical and psychological condition, level of independence, and social relationships.

Surprising, however, is the finding that the physical condition should be given a comparatively lower weighting for the overall assessment of QOL or life satisfaction. It is possible that despite the new scaling specified for the particular sampling, the relevant areas were not sufficiently covered by the applied questionnaires. In connection with the considerations discussed in the following section, it seems indeed possible that patients, after successfully coming to terms with their illness, can realistically acknowledge and express specific physical symptoms while at the same time not have them influence their general QOL. The subjectively experienced daily life functioning, however, obviously played a much greater role for the QOL (42,43). This is, in our

opinion, connected to the fact that diabetic patients live in fear of the onset of secondary illnesses, particularly retinopathy and nephropathy, as has been reported by many other authors (7–9). It seems, therefore, understandable that the current level of functioning receives such significance, at least from the perspective of the patients examined here, who had decided on an intensified therapy with its improved prognosis at the cost of greater investment of time and energy (14,41).

We were also able to confirm that social support—in particular, practical support—has a far-reaching and predominantly independent influence on the global QOL (44–46) and serves, in our experience, as a buffer (9) to negative emotions.

Determinants of the QOL

As expected, the existence of secondary illnesses was found to play a significant role

in the reporting of physical ailments and latent, depressive affect (7–9). However, it played only a subordinate role in the reporting of the more global QOL, which indicates that the objective existence of a secondary illness affected the QOL to a much lesser extent than the patient’s psychological strategies for coming to terms with his or her illness.

Socially less competent and emotionally more reserved patients tended to belittle their illness and take a more passive-depressive stance. They report a more negative emotional attitude, greater physical ailments, a lower level of independence, and less social support, whereas those patients who portray themselves as more socially approachable, with more active coping strategies, report “better” scores in the QOL dimensions.

Irrespective of the particular physical state, socially more competent patients are obviously better able to experience their ill-

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ness as manageable and thereby avoid feelings of depression. This corresponds to results found in adolescents, where a connection between low self-efficacy expectations, depression, and reduced QOL was demonstrated by Grey et al. (47). Achieving such a positive attitude toward the manageability of an illness surely depends on the state of psychological development (48). Marrero et al. (49) point out, for example, that even denial and detachment in adolescents can be adaptive strategies for metabolic regulation; one interpretation for this is that these defense mechanisms make the situation appear more manageable. Our results support the assertion that a person who has more mature forms of coping available will more likely be able to avoid a depressive reaction by taking on an accepting, problem-oriented coping attitude—an attitude that in our group, as already mentioned, is connected with a higher QOL value.

Furthermore, an improved QOL is not only a goal in and of itself but, according to research performed by Testa and Simonson (50), is also connected with a greater adherence to therapy. What results is a kind of feedback loop, in which an active coping strategy leads to improved QOL, which leads to greater therapy adherence, a more positive illness progression, and once again to an improved QOL and a more active coping strategy.

Patients who are unable to actively come to terms with their situation are then of particular interest. Our findings suggest that the condition of these patients results from their lack of social competence, which leads to a more emotionally reserved self-presentation. It seems to be of particular importance, therefore, for the physician treating these more difficult-to-reach patients to avoid cognitive and/or emotional overtaxation and to avoid the incitement of guilt feelings. Thereby, physicians can prevent the patient from falling into the opposite direction of the aforementioned loop—that is, from a sense of failure, depression, denial, and passivity to reduced QOL, poor therapy adherence, negative illness progression, and once again a sense of failure, guilt, and further depression.

In terms of the significance of these results for research, the strong covariance between the psychological parameters and their determination through individual personality characteristics makes formulating monocausal hypotheses or statements about general QOL of only limited relevance. The operationalization of the more

global QOL issues, as examined in this research, appears more suitable for more complex questions or evaluations of psychosocial interventions, because this operationalization takes into account the additional areas of obvious relevance. A global QOL value that does not take the weighting of individual aspects into account appears to be under no circumstances justifiable. In cases where more simple effects of medical intervention are the target of study, the concept of "health-related QOL" or, in particular, "illness-related QOL" is taken into account with emphasis on the illness-related symptoms and their specific significance for daily living; but the subjective, individually relevant aspects of QOL are neglected. In other words, for the study of medical interventions, the fundamental, personal disposition of an individual seems to be viewed as an undesirable source of variance, and it must be considered in the sense of a confounding variable, but only to avoid inadvertently interpreting effects of selection.

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