

Quality of Life and Associated Characteristics in a Large National Sample of Adults With Diabetes

RUSSELL E. GLASGOW, PHD
LAURIE RUGGIERO, PHD
ELIZABETH G. EAKIN, PHD

JANET DRYFOOS, MA
LISA CHOBANIAN, RN, MS, RD

OBJECTIVE — This study investigated the quality of life and the demographic, medical-history, and self-management characteristics associated with it.

RESEARCH DESIGN AND METHODS — A diabetes self-management survey was sent to 2,800 adults with diabetes throughout the U.S. who were part of a marketing company national sample. The response rate was 73%. The final sample of 2,056 persons was heterogeneous: the average age was 59 years (range, 18–92 years); 53% had high school education or less; 86% had type II diabetes; 62% were female; and 31% reported being on an intensive management plan, such as the one used in the Diabetes Control and Complications Trial. Quality-of-life items included the social, physical, and mental health dimensions of the Short Form (SF-20) of the General Health Survey.

RESULTS — Overall, respondents reported a moderate to low quality of life, relative to previous studies. Factors related to lower quality of life included: less education, lower income, older age, being female, type of health insurance (no medical insurance or Medicare/Medicaid recipients reported lower quality of life than those with either a health maintenance organization or private insurance), number of diabetes complications, number of comorbid illnesses, and lower levels of physical activity. Multiple regression analyses revealed that the level of self-reported exercise was the only significant self-management behavior to predict the quality of life, after controlling for demographic and medical variables.

CONCLUSIONS — If the findings regarding physical activity are replicated, it may be that moderate-intensity physical activity programs could be initiated with diabetic individuals at risk of low quality of life. Quality of life is an important and understudied topic in diabetes that appears to be related to demographic, medical-history, and self-management factors.

The mission of the American Diabetes Association (ADA) is “to prevent and cure diabetes and to improve the lives of all people affected by diabetes” (1). This worthy objective is certainly shared by thousands of other health care professionals and the six million individuals with diabetes in the U.S. Yet, before we can make significant progress toward achieving this goal, we need to know more about the quality of life among individuals with diabetes and about

the patient profile, disease status, health care system, and social-environmental characteristics that put people at risk for decreased quality of life. For example, what aspects of the quality of life (e.g., physical, social, emotional) are most adversely impacted by diabetes? How does the quality of life relate to different treatment regimens and self-care behaviors (especially given the current issues surrounding intensive therapy)? Which patient subgroups

with diabetes have the best and worst quality of life and why?

Although an increasing amount of research is being devoted to the quality of life of individuals with diabetes (2–8), there is still much to be learned. Important studies have evaluated the impact of treatment on the quality of life (4,9,10). However, there have been few basic investigations of the status of quality of life among relatively heterogeneous samples of people with diabetes (instead of highly selected volunteer patients in leading research centers), and few studies have large enough numbers to explore quality-of-life differences among subgroups (e.g., type I vs. type II diabetes; different ethnic groups; those with vs. without complications). The most comprehensive research to date on these issues has been conducted by Stewart et al. (11) as part of the Medical Outcomes Study (MOS), using the Short Form (SF-20) of the General Health Survey, and by Jacobson et al. (4) in a comparison of the quality of life in individuals with type I and type II diabetes, using both the MOS SF-36 and the Diabetes Quality of Life Measure (DQOL).

Stewart et al. (11) evaluated quality-of-life ratings in over 9,000 patients with a variety of chronic conditions, including 844 patients with diabetes, and compared these with quality-of-life ratings from 2,595 patients without chronic conditions. Of the patients with diabetes, 92% had type II diabetes and 44% had one or more physician-reported complications. In comparison with patients without chronic conditions and after controlling for sex, age, income, and education, those with diabetes reported significantly lower SF-20 scores on all summary quality-of-life scales (e.g., physical, role, social functioning, health perceptions), except for mental health. Overall, while persons with diabetes reported lower quality-of-life scores than those without chronic conditions, their decrements in quality of life were not as great as those reported by patients with other diseases or problems (congestive heart failure, myocardial infarction, arthritis, chronic lung problems, gastrointestinal disorders, back problems, and angina). It

From the Oregon Research Institute (R.E.G., E.G.E.), Eugene, Oregon; the Department of Psychology (L.R., J.D.), University of Rhode Island, Kingston, Rhode Island; and Johnson & Johnson Healthcare Systems (L.C.), New Brunswick, New Jersey.

Address correspondence and reprint requests to Russell E. Glasgow, PhD, Oregon Research Institute, 1715 Franklin Blvd., Eugene, OR 97403-1983. E-mail: russ@ori.org.

Received for publication 25 June 1996 and accepted in revised form 23 September 1996.

ADA, American Diabetes Association; DCCT, Diabetes Control and Complications Trial; DQOL, Diabetes Quality of Life Measure; MANOVA, multivariate analysis of variance; MOS, Medical Outcomes Study; SF, Short Form.

should be noted that while there was substantial variation in quality-of-life ratings among chronic illness groups, there was also significant variation within groups. Furthermore, the majority of variance in quality of life was not explained by the presence of chronic conditions.

Jacobson et al. (4) evaluated quality-of-life ratings in a sample of 240 patients with diabetes (54% had type II diabetes, 51% were female, and 67% had more than a high school education). They used both the SF-36 and a diabetes-specific quality-of-life scale, the DQOL, which was used in the Diabetes Control and Complications Trial (DCCT) (4). After controlling for age, marital status, education, illness duration, and severity of complications, individuals with type II diabetes reported less of an impact of diabetes and fewer worries about diabetes on the DQOL and better social functioning on the SF-36 than individuals with type I diabetes. Further, they found that the severity of complications was more predictive than the number of complications on both the SF-36 and DQOL scales for both type I and type II diabetic individuals.

The purpose of the present study was to evaluate, as part of the larger survey discussed in Ruggiero et al. (12), the quality of life among a large and heterogeneous sample of patients with diabetes throughout the U.S. Specific questions that were addressed were: 1) how do adults with diabetes compare with available normative data from persons with and without other chronic diseases, and which dimensions of quality of life seem to be the most and least impacted by diabetes; 2) what sociodemographic and diabetes health-status factors are related to quality of life; and 3) what diabetes self-management behaviors are related to the quality of life.

RESEARCH DESIGN AND METHODS

Subjects and survey methods

The survey included questions assessing participant characteristics, such as sociodemographic and health-status information, along with diabetes management and self-management across multiple areas. Questions assessing potential psychosocial, behavioral, and environmental correlates of self-management were also included.

Individuals with diabetes were identified based on a list available through a nationwide marketing research group. Those recruited into the marketing sample

were representative of the national diabetes population, based on the following characteristics: income, population density, geographic region, age, and number of people in the household. A total of 2,800 individuals with type I or type II diabetes were sent surveys. This included 1,300 individuals with diabetes who were believed to be representative of the U.S. population with diabetes, based on the above characteristics, and an additional 1,500 insulin-treated individuals who were recruited to obtain a sufficient sample size of type I diabetic individuals to permit a detailed examination of subgroups (e.g., type I diabetic and insulin-treated type II diabetic individuals). Type I diabetes was defined as being diagnosed at <30 years of age and having taken insulin since first diagnosed.

To maximize accurate disclosure on self-management behaviors, a self-administered questionnaire was mailed through an independent marketing group that was not linked to the individuals' medical care in any way. Individuals were informed that their individual responses would remain completely confidential. A raffle for monetary prizes was used as an incentive for participation. The final recruitment rate was 73.4% for a total sample of 2,056 participants (of 2,800 who were sent the survey). This total sample included 988 from the representative sample and 1,068 from the augmented sample of individuals taking insulin.

The sample was generally older (average age, 59 years), female (62%), married (62%), and Caucasian (95%), although there were over 100 African-American respondents (Table 1). The majority had been diagnosed for some time (>10 years for half of the respondents), 14% had type I diabetes, 56% had insulin-treated type II diabetes, and individuals with type II diabetes not on insulin constituted the remaining 30% of the sample. As would be expected, the insulin-treated sample was younger and had had diabetes longer than the more representative sample. The augmented sample was also more likely to have diabetic complications, to have been hospitalized, and to have other comorbid diseases than the representative sample (all $P < 0.001$). The survey methodology and sample are described in greater detail in Ruggiero et al. (12).

Measures

Medical Outcomes Study General Health Survey. The Medical Outcomes Study (MOS) Short-Form (SF) General

Health Survey is a widely used health-related quality-of-life measure that assesses several important dimensions of the quality of life, including physical, social, and role functioning, bodily and emotional well-being, and current perceptions of health (13). Because of survey space constraints, only the physical-functioning, social-functioning, and mental health scales were used in this study. These three scales were chosen to reflect a broad range of quality-of-life dimensions likely to be impacted by diabetes. The SF-20 produces highly reliable and valid scores and has normative data with which to compare the results for patients with chronic diseases, including heart disease and diabetes, and the general population (11). While a newer MOS quality-of-life instrument (the SF-36) has been developed and is currently recommended to replace the SF-20, we chose to use the SF-20 in this study because of the availability of norms for a diabetes-specific sample. On all SF-20 dimensions, the possible range is 0–100, and higher scores reflect a higher quality of life.

Self-management measures. The survey concentrated on basic descriptive information on self-management behaviors for each of four daily self-management behaviors: diet, exercise, medication use, and glucose self-testing. The level of self-management was assessed using a composite score of the following items: 1) number of the past 7 days individuals performed the behavior of interest; 2) number of health care provider-recommended behaviors performed in the past 7 days (five-point Likert scale: none to all); and 3) frequency with which the behavior of interest was performed as recommended in the past month (five-point Likert scale: never to always). Each item was standardized using T-scores (mean \pm SD, 50 \pm 10), then all of the items available for each behavior were averaged to calculate the composite score for that behavior. Items for the scale were drawn from the Summary of Diabetes Self-Care by Toobert and Glasgow (14), who reported the reliability and validity of this scale. These self-report items have been found to correlate with more "objective" measures, such as self-monitoring logs, memory meter data, and interview data.

Statistical analyses

All analyses were conducted using SPSS[®]. After data cleaning, descriptive analyses were conducted using means and standard deviations. Subgroup comparisons were

Table 1—Quality-of-life scores by patient characteristic

Patient characteristic/level	n	Quality-of-life dimension		
		Physical functioning	Social functioning	Mental health
Sex				
Male	734	71.1 ± 34†	80.8 ± 29†	71.1 ± 20†
Female	1,191	63.8 ± 35*	75.6 ± 32*	66.4 ± 20*
Age (years)				
<40	227	82.7 ± 28*	83.5 ± 27*	64.1 ± 21*
40–49	259	76.6 ± 32*	79.5 ± 31*	66.1 ± 19*
50–59	400	65.6 ± 36†	79.4 ± 30*	67.9 ± 21*†
60–69	564	63.7 ± 34††	78.4 ± 30*	70.3 ± 19†
70+	447	58.2 ± 36†	71.9 ± 34†	69.1 ± 20†
Education				
High school or less	996	63.7 ± 36*	74.6 ± 32*	65.7 ± 21*
College or more	885	70.2 ± 34†	81.7 ± 28†	71.4 ± 19†
Income				
<\$15,000	605	56.5 ± 36*	68.4 ± 34*	63.0 ± 22*
\$15,000–\$35,000	675	66.9 ± 35†	78.3 ± 30†	69.3 ± 19†
≥\$35,000	647	75.8 ± 32†	85.5 ± 26†	72.1 ± 19†
Race and ethnicity				
Caucasian	1,796	66.5 ± 35	77.8 ± 31	68.0 ± 20
African-American	102	68.6 ± 34	72.6 ± 34	71.7 ± 17
Type of health insurance				
Government	449	52.4 ± 37*	64.4 ± 35*	63.7 ± 22*
None	178	69.9 ± 35††	76.9 ± 33†	63.0 ± 21*
Private	831	68.8 ± 34†	81.0 ± 28††	70.2 ± 19†
MCO	469	75.1 ± 32†	84.1 ± 27†	71.0 ± 19†
Living situation				
Live alone	690	60.8 ± 35.8*	71.6 ± 33.9*	67.7 ± 20.4
Live with another	1,231	69.9 ± 34.3†	81.0 ± 28.5†	68.5 ± 19.9
Type of diabetes				
Type I	247	78.6 ± 31†	82.3 ± 27†	66.7 ± 21
Overall type II	1,536	64.2 ± 35	76.9 ± 31	68.7 ± 20
Insulin	995	60.0 ± 36*	73.3 ± 32*	67.9 ± 20
Pills	455	70.4 ± 34†	82.7 ± 28†	70.5 ± 19
Diet only	86	79.6 ± 27††	86.8 ± 25†	69.9 ± 18
Years diagnosed				
<5	411	71.1 ± 33.8*	81.7 ± 29.1*	70.0 ± 18.2
5–9	407	67.3 ± 35.0*†	79.8 ± 29.4*†	67.6 ± 19.9
10–19	588	65.2 ± 35.3†	76.5 ± 30.7††	67.9 ± 21.2
20+	449	65.3 ± 35.3*†	74.4 ± 33.0†	67.3 ± 20.6
Number of diabetes complications				
None	756	77.6 ± 30.7*	85.5 ± 26.5*	72.7 ± 18.3*
One	518	68.3 ± 33.8†	80.1 ± 29.2†	68.8 ± 19.7†
Two or more	653	52.6 ± 36.2†	66.2 ± 33.6†	63.1 ± 21.4†
Number of comorbid diseases				
None	760	78.2 ± 31.2*	83.2 ± 28.9*	70.1 ± 19.9*
One	707	67.3 ± 33.6†	80.3 ± 28.5*	69.4 ± 19.6*
Two or more	460	46.4 ± 34.7†	64.1 ± 33.7†	63.4 ± 20.6†
Number of times hospitalized				
None	1,629	68.5 ± 34*	79.6 ± 30*	69.0 ± 19.8*
One or more	199	52.9 ± 37†	61.3 ± 34†	61.6 ± 21.2†

Data are means ± SD. Groups sharing the same footnote symbol are not significantly different. Groups having different footnote symbols were significantly different as assessed by least significant difference tests at $P < 0.01$ following a significant overall MANOVA result. MCO, managed care organization.

conducted using a multivariate analysis of variance (MANOVA), followed by least significant difference post hoc comparison tests when there was a significant MANOVA. Relationships between demographic, medical-history, and self-management variables and quality of life were conducted using Pearson's correlations and hierarchical multiple regression analyses. In the latter, after checking for collinearity, demographic and medical-history factors were entered in a first step. Then self-management variables were entered in a second step to determine the amount of incremental variance they explained beyond the demographic-medical variables. This analysis strategy identifies the independent effects of each of the predictor variables, after controlling for potential confounders.

RESULTS

Descriptive data

Overall scores on the SF-20 dimensions were 70.3 for physical functioning, 77.5 for social functioning, and 59.7 for mental health. In the Stewart et al. (11) sample from the MOS, the 844 patients with diabetes reported scores of 78.4 for physical functioning, 87.0 for social functioning, and 77.7 for mental health.

Subgroup data. Table 1 summarizes SF-20 quality-of-life scale scores across several different patient categories. In this table, subgroups having a different superscript are significantly different based upon least significant difference post hoc comparison tests at the $P < 0.01$ level, following a significant overall F on a MANOVA across all three quality-of-life dimensions. For example, on the physical functioning scale, persons aged <50 years had significantly higher scores than did those who were older. In addition, those aged 50–59 years had significantly higher scores than those aged ≥70 years.

Males reported significantly higher quality of life than did females on all three quality-of-life dimensions. In general, younger persons reported fewer impairments in physical and social functioning and greater impairment in mental health. Less-educated respondents reported lower scores on all quality-of-life dimensions than did more highly educated respondents. There were significant and relatively large differences between respondents having different income levels. On all three quality-of-life dimensions, individuals having less income reported reduced quality of

life, compared with those with higher income. The results of race and ethnicity analyses revealed no differences between Caucasians and African-Americans on any quality-of-life dimension.

There were significant results on comparisons of type of health insurance coverage on all three SF-20 dimensions (Table 1). In general, the pattern of results revealed that respondents having private insurance or managed care coverage were similar and that those having solely government (Medicare or Medicaid) or no insurance coverage were also similar. However, there were large differences between these two sets of respondents, with those having no health insurance, and especially those having only government health insurance, reporting markedly lower quality-of-life scores than those with private and/or managed-care coverage. The physical- and social-functioning scales revealed an additional effect, with patients with government insurance (only) reporting significantly lower quality of life than those with no insurance.

We compared four different subgroups regarding type of diabetes (Table 1). Type II diabetic individuals taking insulin reported lower quality of life on the physical- and social-functioning scales than did other patient subgroups, including those with type I diabetes. Those diagnosed with diabetes for a greater number of years reported lower physical and social functioning than persons diagnosed more recently.

Finally, there were clear differences on all three quality-of-life dimensions for all three measures of disease severity: number of diabetes complications, number of comorbid diseases, and whether hospitalized in the past year. Respondents having more complications, more chronic diseases in addition to diabetes, and having been hospitalized in the past year reported a considerably reduced quality of life on all three dimensions (Table 1).

Relationship of self-management to quality of life

Table 2 summarizes the relationship of self-management behaviors (diet, physical activity and exercise, and blood glucose testing) and quality-of-life scores. Only physical activity was significantly related to all three quality-of-life dimensions, while mental health scores were significantly related to all three self-management behaviors.

Multivariate analyses. Table 3 summarizes the results of hierarchical multiple

Table 2—Relationship of quality-of-life scores to the level of diabetes self-management Pearson's correlation coefficients

Self-management variable	Quality-of-life dimension		
	Physical functioning	Social functioning	Mental health
Diet	0.03	0.00	0.12†
Physical activity	0.20†	0.10†	0.21†
Blood glucose testing	-0.05	-0.05	0.07*

* $P < 0.01$; † $P < 0.001$.

regression analyses to predict the three quality-of-life dimensions. A total of 1,188 individuals had complete data on all variables and were included in these analyses. This table presents the impact of sociodemographic and medical-history variables on quality of life followed by incremental contributions of self-management variables. We present at each stage the multiple R and the significance level of improvement in R^2 . This is followed in the last three columns by data for each variable on the bivariate correlation with that quality-of-life dimension, the partial correlation after controlling for other variables, and the significance of the beta for that variable.

In general, the combination of 11 demographic and medical-history variables entered at step 1 explained a moderate amount of the variance (R^2 for mental health, 12%; for social functioning, 18%; and for physical functioning, 25%). Of the self-management composites entered at step 2, only level of exercise significantly improved the prediction equation for all three quality-of-life dimensions.

CONCLUSIONS— This study was designed to address three primary questions, as described above. Below we discuss and interpret findings related to each of these questions. First, the diabetic patients in this sample had substantially lower quality-of-life scores, compared with diabetes-specific norms from the MOS. This was seen for all three quality-of-life dimensions measured in this study (physical functioning: 66.6 vs. 78.4; social functioning: 77.5 vs. 87.0; mental health: 68.2 vs. 77.0). One possible explanation for the lower quality-of-life scores found in our study may be that the patients with diabetes in the MOS sample had fewer diabetic complications. This has also been discussed by Jacobson, deGroot, and Samson (5), who, like us, found that the quality of life decreased in relation to the number of complications (4).

Second, except for race and ethnicity, all of the demographic and medical-history variables evaluated in this study were related to multiple quality-of-life dimensions in bivariate analyses (Table 1). Regarding the demographic variables, males reported a higher quality of life than females, as did younger respondents versus older respondents (physical and social functioning only), those living with others versus alone, those with college education versus high school or less, those with higher income, and those with private or managed-care insurance versus those with no health insurance or government insurance only. In terms of medical history and disease severity, respondents diagnosed with diabetes for fewer number of years reported higher quality of life than those with more years since diagnosis, as did those with fewer diabetes complications, fewer comorbid diseases, and those who were not hospitalized in the past year. Consistent with the results of Jacobson et al. (4), we also found that type II diabetic patients on insulin reported a greater impact on the quality of life than did those on oral medications, diet only, and patients with type I diabetes. Type II diabetic patients on insulin may have lower quality-of-life scores because most have had to be started on insulin either after a course of dietary and oral medications had failed or after complications appeared. Inspection of Table 3 suggests that insulin-treated individuals may well have been "sicker" (e.g., more comorbidities and complications). The regression analyses revealed that, in general and across all three quality-of-life scores, while a number of demographic variables were predictive of quality-of-life dimensions, the number of comorbid illnesses and diabetes-related complications were the strongest independent predictors after controlling for other factors (4).

Finally, the level of physical activity was the only self-management factor that significantly enhanced prediction of the

Table 3—Results of hierarchical regression using demographic and diabetes self-management variables to predict the quality of life

Dependent variable, step, and independent variable	Multiple R	Significance of improvement in R ²	r	Partial correlation	Significance of beta
Physical functioning (n = 1,188)					
Step 1	0.50	0.00			
Sex			-0.11	-0.10	0.00
Age			-0.24	-0.13	0.00
Education			0.13	0.01	0.65
Duration of diabetes			-0.05	0.05	0.07
Insulin taking			0.10	0.05	0.03
Number of comorbidities			-0.36	-0.23	0.00
Number of complications			-0.30	-0.19	0.00
Number of hospitalizations			-0.12	-0.05	0.05
Income			0.22	0.04	0.10
Insurance type			0.20	0.07	0.01
Live with other			0.16	0.05	0.03
Step 2	0.54	0.00			
Glucose testing self-care			-0.04	-0.02	0.52
Exercise self-care			0.21	0.18	0.00
Diet self-care			0.03	0.00	0.84
Social functioning (n = 1,191)					
Step 1	0.42	0.00			
Sex			-0.09	-0.07	0.01
Age			-0.14	-0.07	0.01
Education			0.14	0.04	0.15
Duration of diabetes			-0.06	0.02	0.44
Insulin taking			0.11	0.06	0.03
Number of comorbidities			-0.25	-0.13	0.00
Number of complications			-0.25	-0.14	0.00
Number of hospitalizations			-0.19	-0.12	0.00
Income			0.23	0.05	0.05
Insurance type			0.23	0.10	0.00
Live with other			0.16	0.07	0.01
Step 2	0.44	0.00			
Glucose testing self-care			-0.06	-0.04	0.15
Exercise self-care			0.13	0.12	0.00
Diet self-care			0.00	0.00	0.87
Mental health (n = 1,195)					
Step 1	0.35	0.00			
Sex			-0.12	-0.10	0.00
Age			0.08	0.14	0.00
Education			0.18	0.11	0.00
Duration of diabetes			-0.03	0.02	0.57
Insulin taking			0.07	0.01	0.62
Number of comorbidities			-0.14	-0.10	0.00
Number of complications			-0.18	-0.13	0.00
Number of hospitalizations			-0.13	-0.07	0.01
Income			0.17	0.08	0.00
Insurance type			0.17	0.06	0.03
Live with other			0.01	-0.04	0.15
Step 2	0.41	0.00			
Glucose testing self-care			0.08	0.03	0.30
Exercise self-care			0.24	0.18	0.00
Diet self-care			0.13	0.04	0.14

quality of life when added to the socio-medico-demographic factors. More recent publications from the MOS have also found that self-reported levels of physical activity were related to a number of quality-of-life dimensions (15). Such findings are consistent with a growing body of literature documenting the benefits of regular moderate physical activity for both healthy and chronic disease populations (16).

The primary strength of this study was the relatively large sample from across the U.S. and from a variety of different health care systems and types of insurance coverage. Another strength was the measure used to assess the quality of life, the SF-20 instrument, which has been validated with a variety of populations. This measure also allowed comparison with diabetes-specific normative data (11). A final strength of the study was the richness of the data set, which supported detailed examination of the relationship of the quality of life to various demographic, medical-history, and self-management factors.

The various demographic and medical-history variables accounted for a moderate amount of the variance in all three quality-of-life dimensions (R² from 0.12 to 0.25). This finding has at least three implications for diabetes care and self-management research. First, it emphasizes the importance of social and environmental factors such as socioeconomic status that are consistently related to a host of health-status and health-behavior factors (17). Second, it suggests the need to include and control for socio-demographic and medical-history factors in diabetes education research. Given the consistency and strength of the sociodemographic and medical-history-disease-severity relationship with the quality of life, it is not surprising that few diabetes education and self-management interventions have produced significant changes in patient quality of life. Third, these measures may allow the early identification of persons with diabetes at risk of decreased quality of life for preventive intervention. It should be noted, however, that the magnitude of several of the relations were not large (see Table 3). While statistically significant in a large sample such as this and important from a public health perspective, correlations of 0.10–0.20 are not particularly useful at an individual level.

This investigation also had limitations that should be addressed in future research. The primary limitations concern the cross-

sectional nature of the study (regarding the quality of life) and the use of only three dimensions from one general quality-of-life instrument. Another limitation is that this study did not differentiate between hospitalizations for acute versus chronic complications. Future longitudinal studies should address questions regarding the natural history of the quality of life among diabetes patients, the direction of effect from self-care to quality of life, the effects of different interventions on different quality-of-life dimensions, and how diabetes-specific quality of life relates to more general quality of life (2,4).

Acknowledgments— The data used in this study are from a database developed by Lifescan and Johnson & Johnson Healthcare Systems. Preparation of this manuscript was also supported by Grant #R01 DK-35524 from the National Institute of Diabetes and Digestive and Kidney Diseases.

We would like to thank numerous colleagues at all our institutions, especially Drs. Tracy Orleans and Kim Kelly for making this research possible and steering it to fruition and Lisa Strycker for her tireless and conscientious work on data management and analysis.

References

1. ADA: Standards of medical care for patients with diabetes mellitus. *Diabetes Care* 20 (Suppl. 1):S5–S13, 1997
2. Bradley C, Lewis KS: Measures of psychological well-being and treatment satisfaction developed from responses of people with tablet-treated diabetes. *Diabet Med* 7:445–451, 1990
3. DCCT Research Group: Resource utilization and costs of care in the Diabetes Control and Complications Trial. *Diabetes Care* 18:1468–1478, 1995
4. Jacobson AM, deGroot M, Samson JA: The evaluation of two measures of quality of life in patients with type I and type II diabetes. *Diabetes Care* 17:267–274, 1994
5. Jacobson AM, deGroot M, Samson J: Quality of life research in patients with diabetes mellitus. In *Quality of Life in Behavioral Medicine Research*. Dimsdale JE, Baum A, Eds. Hillsdale, NJ, Lawrence Erlbaum Associates, 1995, p. 241–262
6. Lloyd C, Wilson R: Quality of life, health and daily functioning in an IDDM population (Abstract). *Diabetes* 45 (Suppl. 2):110A, 1996
7. Peyrot M, Rubin RR: Quality of life among spouses of diabetic adults (Abstract). *Diabetes* 45 (Suppl. 2):110A, 1996
8. Revicki DA: Quality of life and non-insulin-dependent diabetes mellitus. *Diabetes Spectrum* 3:269–276, 1990
9. DCCT Research Group: Influence of intensive diabetes treatment on quality-of-life outcomes in the Diabetes Control and Complications Trial. *Diabetes Care* 19:195–203, 1996
10. Simonson DC, Testa MA: Beneficial effects of improved glycemic control with Glipizide GITS on quality of life and symptom distress in NIDDM (Abstract). *Diabetes* 45 (Suppl. 2):123A, 1996
11. Stewart AL, Greenfield S, Hays RD, Wells K, Rogers WH, Berry SD, McGlynn EA, Ware JE Jr: Functional status and well-being of patients with chronic conditions: results from the Medical Outcomes Study. *JAMA* 262:907–913, 1989
12. Ruggiero L, Glasgow RE, Dryfoos JM, Rossi JS, Prochaska JO, Orleans CT, Prokhorov AV, Rossi SR, Greene GW, Reed GR, Kelly K, Chobanian L, Johnson S: Diabetes self-management: self-reported recommendations and patterns in a large population. *Diabetes Care* 20:568–576, 1997
13. Stewart AL, Hays RD, Ware JE: The MOS short-form general health survey: reliability and validity in patient population. *Med Care* 26:724–735, 1988
14. Toobert DJ, Glasgow RE: Assessing diabetes self-management: the summary of diabetes self-care activities questionnaire. In *Handbook of Psychology and Diabetes*. Bradley C, Ed. Berkshire, U.K., Harwood Academic, 1994, p. 351–375
15. Stewart AL, Hays RD, Wells KB, Rogers WH, Spritzer KL, Greenfield S: Long-term functioning and well-being outcomes associated with physical activity and exercise in patients with chronic conditions in the Medical Outcomes Study. *J Clin Epidemiol* 47:719–730, 1994
16. Pate RR, Pratt M, Blair SN, Haskell WL, Macera CA, Bouchard C, Buchner D, Etinger W, Heath GW, King AC: Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA* 273:402–407, 1995
17. Marmot M, Elliot P: *Coronary Heart Disease Epidemiology: From Aetiology to Public Health*. New York, Oxford Univ. Press, 1995