Psychosocial Correlates of Survival in Diabetes

Wayne K. Davis, PhD
George E. Hess, MA
Roland G. Hiss, MD

The goal of this research was to quantify the relationships between patient survival and a set of explanatory variables in a randomly selected sample of community-based patients with non-insulin-dependent diabetes mellitus (NIDDM). The sample included 343 patients with NIDDM initially entered into the study in 1981–1982 and reexamined in 1985–1986. Mortality data were collected on reexamination in 1985 and updated from death-certificate data through 1 January 1986. The data collected from the patients included demographic and clinical variables, psychosocial variables related to diabetes, measures of physiologic control, hospitalization, and mortality. The Cox proportional-hazards model was used to compute a hazard rate for each individual and to determine risk covariates. The results indicated that the variables most associated with the risk of mortality were patient age, social impact of diabetes, renal function, complexity of diet regimen, and history of smoking. Two of these variables (social impact and complexity of diet regimen) were obtained from the Diabetes Educational Profile completed by all patients on entry to the study. The five predictor variables were more closely related to mortality than diabetes control as measured by HbA_1, previous hospital admissions, previous heart attacks, and other physiologic measures frequently used as outcome measures. The only physiologic predictor was renal function. ***Diabetes Care*** **11:538–45, 1988**

Studies investigating the psychological and social aspects of diabetes have progressed from early studies that attempted to identify a diabetic personality to recent studies that have been focused primarily on the areas of patient adherence to the medical regimen and psychosocial adjustment to the disease (1). Although it has been assumed that patient adjustment and other psychosocial factors may influence patient adherence to the therapeutic regimen and health-care outcomes, there apparently are no data indicating a relationship between psychosocial variables and the long-term survival of patients with diabetes.

In other chronic diseases (e.g., cancer and end-stage renal disease) there are preliminary studies that suggest psychosocial factors are related to survival. For example, in a study of end-stage renal patients receiving dialysis, social variables were found to be associated with survival (2,3).

Several studies have examined the possible link between psychosocial processes and cancer outcomes. As has been true in diabetes, the early research attempted to use psychosocial variables as predictors of the development of malignant disease (4). Later studies examined the role of psychological and social variables in the survival of cancer patients (5–7). The results of these studies, summarized by Morgenstern et al. (7), indicate that improved cancer prognosis including longer survival is related to

> high socioeconomic status, a cohesive social support network, a strong hostile drive without loss of emotional control, the ability to externalize negative feelings and conflicts, ego strength, the will to live and, more generally, the ability to cope with the threats and changes imposed by the disease.

However, a more recent prospective study of two relatively homogeneous groups of cancer patients failed to find support for the importance of psychological and

From the Department of Postgraduate Medicine/Health Professions Education, Office of Educational Resources and Research, University of Michigan Medical School, Ann Arbor, Michigan.

Address correspondence and reprint requests to Wayne K. Davis, PhD, University of Michigan Medical School, Office of Educational Resources and Research, 1500 E. Medical Center Drive/G1113 Towsley, Box 0201, Ann Arbor, MI 48109.

social variables in predicting either relapse of cancer or length of survival (8).

Possibly the best summary of the research to date is that the results are inconclusive with regard to the influence of psychosocial variables on survival in patients with chronic diseases. The importance of this area of investigation relates primarily to the development of interventions that may produce positive health-care and survival gains for the selected patient populations. If the psychological and social impact of diabetes is demonstrated to be related to the risk of mortality, the next area of research is to determine whether interventions can bring about benefits to the patients by decreasing the psychosocial impact of the disease.

IMPACT OF DIABETES ON PATIENTS

Investigators at the University of Michigan Diabetes Research and Training Center (MDRTC) have been examining the impact of diabetes on patient psychosocial adjustment and the relationship of patient psychosocial adjustment to management and treatment outcomes (9–11). To measure the patient's adjustment to the disease, a patient-completed instrument, the Diabetes Educational Profile (DEP), has been developed and validated. This instrument has been used to study psychosocial, regimen, and adherence variables related to diabetes and health-care outcomes. Evidence has been found to support a link between demographic and diabetes-treatment variables and a patient's psychosocial adjustment to diabetes. There is also evidence that psychosocial variables are related to objective measures of diabetes control and hospitalizations (11). What has not been investigated has been the relationship between psychosocial variables and the long-term survival of patients with diabetes.

The purpose of this study was to determine the impact of psychosocial variables (in combination with selected demographic, clinical, behavioral, and physiological covariates) on patient survival. One hypothesis was that problems associated with the patient's psychosocial adjustment to the disease would be predictive of an increased risk of mortality in a population of patients with non-insulin-dependent diabetes mellitus (NIDDM). A second hypothesis was that measures of diabetes control (e.g., HbA_1, self-perceived control problems) and indicators of increased disease severity (e.g., hospital admissions, renal function) would also be related to mortality.

MATERIALS AND METHODS

This was a retrospective follow-up study of 343 patients with NIDDM followed for >4 yr. All patients were enrolled over a 17-mo period in 1981–1982 and followed for survival status through 1 January 1986. The data for this study were collected from patients who were being followed by the outreach core of the MDRTC.

Sample. Five primary-care physicians were randomly identified in each of four randomly selected small communities in Michigan, and 15 primary-care physicians were randomly identified in each of four large communities. Primary-care physicians were defined as internists and general and family practitioners. The prescribed number of physicians (15 from each large and 5 from each small community) was not always obtained, because two communities did not have the requisite number of primary-care physicians and some of the randomly selected physicians declined to participate. A total of 61 primary-care physicians from the eight communities did agree to participate for an overall response rate of 81%. Each of the participating practices maintained a list of people with diabetes seen over a 6-mo period. These lists were used to identify a random cohort of patients in each practice for further study. The number of patients participating from each practice varied from a low of 4 patients in one practice to a high of 10 in each of two practice settings. The median number of patients per practice was 7 (mean 7.02). All of these patients were under the active care of a physician and were >16 yr of age (12). A total of 424 patients were entered into the data base. The 343 patients from this sample with onset of diabetes after age 30 yr were the subjects of the study.

Procedures. Each patient completed a battery of self-administered instruments, including the DEP; was interviewed by a specially trained nurse to obtain additional diabetes-related data; was weighed and had his/her blood pressure measured; and had a sample of his/her blood drawn for the determination of HbA_1, cholesterol, and creatinine levels.

Follow-up data on each of these patients were collected in the same way ~4 yr later. At that time, information regarding the patient's current condition was obtained. Of the original 343 patients who were recruited to the study, 54 (15.7%) had died, 19 (5.5%) had moved and could not be located, 21 (6.1%) refused to be seen again, 21 (6.1%) were too sick to be interviewed, 3 (0.9%) could not be scheduled or did not show up for the interview, and 225 (65.6%) were seen, allowing follow-up data to be obtained.

In August 1987 a project staff member reviewed death-certificate data to verify date of death on the study participants who were deceased and to locate any other individuals who were originally in the study who had subsequently died. As a result of this review at the Michigan Department of Public Health, Office of the State Registrar-Bureau of Vital Records, additional deaths were documented. Ten of the people who were seen in 1985 had subsequently died, as had five people too sick to be seen in 1985, one who could not be scheduled for a follow-up interview, four who had moved and could not be located, and four who refused to be interviewed. Death-certificate data were available for individuals who were residents of counties that had reported deaths as of August 1987. Because these data are forwarded to the state Department of Public Health on a periodic basis, 1 January 1986 was selected as the end date for

the study. Patient status as of that date was used in the analyses included herein.

Variables. The predictor variables examined in this study were collected in 1981–1982 and included *1*) demographic and clinical, *2*) psychosocial, and *3*) categorical variables. The means, standard deviations, and ranges for each of the variables are included in Table 1. The blood pressure of each patient was determined at the time of the 1981 interview. However, there was inadequate and/or incomplete information regarding medications the patients were taking to control hypertension at the time of the interview. Therefore, although actual blood pressure measurements were obtained, the data did not allow a determination of the impact of treated and untreated hypertension on survival. Consequently, these data were not included.

The psychosocial variables included in the study were derived from the patient's responses to the DEP. The DEP is a self-administered 110-item questionnaire designed to document the psychological, social, and educational status of the patient with diabetes. Factor-analytic studies of the DEP have identified six scales that have been shown to possess high reliability and validity (10,11).

TABLE 1
Descriptive statistics for study covariates

Demographic and clinical variables	
Age	62 ± 10 (31–86)
Duration of diabetes	10 ± 8 (1–42)
Age at onset	53 ± 11 (31–83)
Percent ideal body weight	140 ± 35 (78–284)
HbA_1	9.43 ± 1.99 (5.5–17.9)
High-density lipoprotein cholesterol	39.6 ± 12.4 (12–85)
Renal function	79.9 ± 33.1 (11–241)
Hospital admissions	0.44 ± 0.99 (0–9)
Number of myocardial infarctions	0.23 ± 0.52 (0–4)
Number of cerebrovascular accidents	0.12 ± 0.40 (0–3)
Psychosocial variables	
Problems controlling illness	481 ± 91 (402–738)
Problems controlling medications	478 ± 65 (452–823)
Social impact	500 ± 101 (412–779)
Emotional impact	500 ± 99 (406–811)
Barriers to adherence	505 ± 100 (270–680)
Barriers in schedule	491 ± 95 (403–749)
Regimen components	485 ± 100 (343–701)
Regimen diet	499 ± 102 (277–615)
Benefits (value)	493 ± 102 (221–654)
Benefits (extent)	499 ± 99 (371–620)
Categorical data (%)	
Female	62
Use insulin	51
History of smoking	53
Admitted to the hospital	26
Experienced myocardial infarction	20
Experienced cerebrovascular accident	10

Values are means ± SD with ranges indicated in parentheses.

Each of the psychosocial scales was standardized (mean 500, SD 100) on the total population of patients being followed by the MDRTC Outreach Core. This norming sample included patients with insulin-dependent diabetes mellitus (IDDM) not included in this study. IDDM patients were included in the norming sample because the instrument was designed for use with both NIDDM and IDDM patients, and as such, both types of patients were included so that the calibration of the scales would represent (and accommodate) these patients. Sample questions taken from each of the DEP scales are included in Table 2 (complete text of the DEP is available from W.K.D.). Each DEP scale has been named to indicate the direction of the score in the scale. For example, a high score on the social-impact scale means a large social impact. High scores on the barriers to adherence, benefits of adherence, and diet-regimen complexity scales indicate more barriers to adherence, more benefits of adherence, and more complex diet regimen, respectively.

Most of the other variables included in the study are self-explanatory with the exception of the measure of renal function. For the purposes of this research, renal function (creatinine clearance, C_{cr}) was corrected for the patient's age, weight, and sex with the following equation taken from Cockroft and Gault (13)

$$C_{cr} = \frac{(140 - \text{age}) \text{ (wt in kg)}^*}{72 \times S_{cr} \text{ (mg/dl)}}$$

where S_{cr} refers to serum creatinine.

Analysis. The Cox proportional-hazards regression model was used to determine which of the study variables were related to survival (14). This analysis was used to study the time until the occurrence of death in the study sample. The goal of the analysis was to determine the relationships between the covariates (hypothesized explanatory variables) and survival. Survival was calculated as the time span between entry into the study and date of death for the deceased sample.

Death-certificates and exact date of death were obtained for each of the deceased patients except for three patients who were reported as deceased by family members contacted at the time of the follow-up interview. For these three patients, because an exact date of death was not ascertained from the death certificate, the date supplied by the family member was used. All other participants were included in one of the following censored categories: *1*) moved and not located, *2*) refused follow-up visit, *3*) too sick to be interviewed, *4*) schedule conflict, or *5*) survived and interviewed. The study concluded with the second round of data collection on 1 January 1986. Patients who died after this date were included with the surviving sample.

*15% less for females.

TABLE 2
Sample items from Diabetes Educational Profile

Control problems (16 items in scale)
How many times in the last three months did you have *severe* insulin (low sugar) reactions? (Check one)
(During a *severe* reaction a person may lose consciousness, have his/her normal activity interrupted, and need the help of someone else to treat the reaction.)
___ None
___ Once
___ 2–4 times
___ More than 4 times

How many times have you been hospitalized in the past year for diabetes-related reasons? (Check one)
If hospitalized, describe why: _____
___ None
___ Once
___ 2–4 times
___ More than 4 times

Social impact (8 items in scale)
My diabetes and its treatment keep me from
. . . having enough money.
. . . doing my work and other responsibilities.
. . . going out or traveling as much as I want.
. . . being as active as I want.
. . . having good relationships with people.
. . . having a schedule that I like (e.g., sleeping late).

Barriers to adherence (12 items in scale)
When you have trouble with your diet, how often is it because
. . . you are still hungry after eating?
. . . you are eating away from home?
. . . you crave food you should *not* eat?
. . . it is a special occasion (e.g., birthday, holiday)?

Benefits of regimen (10 items in scale)
How much does each of the following help you control your diabetes?
. . . following your meal plan (eating the right foods at the right times).
. . . getting enough exercise.
. . . testing urine as often as instructed.

Diet regimen complexity (7 items in scale)
Are you supposed to follow a diet to control your diabetes or to lose weight?
Have you been told to follow a schedule for your meals and snacks?
Are you supposed to weigh or measure your food?
Have you been told to use exchange lists (food groups) to plan your meals?
Do you (or the person who cooks your food) use the food groups (exchange lists) to plan your meals?
How often are you able to follow your meal plan closely (i.e., you eat the right *types* and *amounts* of food at the right *times*)?

Risks of complications (4 items in scale)
If I stopped taking care of my diabetes
. . . I could get eye problems.

RESULTS

The Cox technique allows the use of data from cases for which death has not yet occurred. Data included in the analysis that came from surviving patients (i.e., patients who were seen in 1985, were too sick to be seen, had moved, or refused) are referred to as censored (14). The data on all cases were complete with the exception of 32 cases for which there was no serum creatinine, 15 cases for which cholesterol was not recorded, and 2 cases for which HbA_1 was not available. There were no significant differences in the distributions of these missing data between censored and noncensored groups. Therefore, the mean value for the entire group was inserted for the missing values and the analyses completed on the entire sample.

Table 1 lists the variables that were entered into the computation of the Cox model and includes descriptive statistics for each of these variables. The mean age of the patients in the sample was 62 yr with a range of 31–86; 62% were female. The duration of diabetes ranged from 1 to 42 yr at the time of the first assessment. Age at the time of onset ranged from 31 to 83 yr with a mean age of onset of 53 yr. Fifty-one percent of the patients were taking insulin in 1981, and 53% had a history of smoking. Twenty percent reported a previous myocardial infarction (MI), and 10% had had a cerebrovascular accident (CVA).

Table 3 compares these data for the deceased, seen, and lost-to-study patients. As can be seen, there were no differences between the patients seen in 1985 and those lost to the study, which supports the inclusion of the lost subjects with the survivors. There were differences between the surviving subjects and those who were deceased on the following 1981 data: age, duration, onset age, percent ideal weight, renal function, hospital admissions, social impact, barriers to adherence, previous MIs, and previous CVAs.

The results of step 0 of the survival analysis are summarized in Table 4. This table indicates the strength of the relationship between each of the study variables and mortality without regard to the other possible covariates. Variables were entered into the prediction equation in a stepwise manner. Therefore, the single variable that contributed the most to the prediction equation, given the values of the covariates, was added at each step of the solution. With the level of inclusion set at $P = .05$, five variables were entered: age, social impact, renal function, diet-regimen complexity, and history of smoking.

Table 5 contains the summary data on the Cox model solution. The relative risk included in this table is the risk associated with each specified unit for the measure (year or SD). For example, a 6.6% increase in risk is associated with each additional year of age. A 61% increase in risk is associated with each SD increase in reported social impact (100 points on the DEP scale). A 43% increase in risk is associated with a 1SD decrease in calculated renal function, and a 30% increase in risk is associated with a 1SD decrease in diet-regimen complexity.

To graphically demonstrate the relationship between patient-reported social impact of diabetes and mortality (without regard to the other covariates), Fig. 1 was gen-

TABLE 3
Comparison of subjects deceased, seen, and lost to study on explanatory variables

	Deceased (n = 54)	Seen (n = 225)	Lost to study (n = 64)
Demographic and clinical variables			
Age	68.6	61.0*	58.7*
Duration of diabetes	12.8	9.4*	9.0*
Age at onset	57.0	52.6*	50.8*
Percent ideal body weight	131.8	141.9†	140.9
HbA_1	9.4	9.3	9.8
High-density lipoprotein cholesterol	39.6	40.1	37.8
Renal function	62.3	82.7*	84.9*
Hospital admissions	0.70	0.38†	0.44
Psychosocial variables			
Problems controlling illness	493	479	478
Problems controlling medications	484	477	477
Social impact	544	492*	495*
Emotional impact	508	501	491
Barriers to adherence	477	514†	499
Barriers in schedule	477	494	494
Regimen components	499	479	495
Regimen diet	471	499	523*
Benefits (value)	496	496	478
Benefits (extent)	502	498	505
Categorical data (%)			
Female	52	65	58
Use insulin	44	55	44
History of smoking	57	50	61
Previous myocardial infarction	32	17†	17
Previous cerebrovascular accidents	22	8	8
Hospital admissions	35	24†	28

Values are means. There were no significant differences between the group seen and the group lost to follow-up. The differences indicated are between the deceased group and the group footnoted.
*$P \leq .01$
†$P \leq .05$

erated. This figure contains a plot of the survival function for the three groups created by dividing the study sample based on social-impact scores. The group labeled "high" included subjects >0.5SD above the mean on the social-impact scale. The group labeled "low" included those >0.5SD below the mean, and the middle group included those within 0.5SD of the mean. There were statistically significant differences over the course of the study in survival rates for these three groups. The generalized Wilcoxon (Breslow) statistic was 13.86 (P = .001; df = 2).

DISCUSSION

We describe the relationships among demographic, clinical, and psychosocial variables and patient mortality in a sample of community-based patients with NIDDM. The ability to generalize the data and results reported herein should be great, given that the patients were randomly selected from a community-based population and were not being followed in a tertiary-care referral center. If any bias existed in the sample, patients who were being followed in large academic medical centers, tertiary-care referral centers, and large metropolitan areas were underrepresented.

The most important finding is that patient-reported social impact of a chronic disease (in this case diabetes) appears to be substantial and is related to mortality. Although the causal nature of the relationship is not demonstrated by this study, the finding that social impact correlates with mortality is potentially of great importance. The importance of the finding is enhanced if interventions can be developed to decrease the social impact of the disease. The importance is diminished if social impact is merely a reflection of decreased mobility or increased disease severity, thereby making intervention less amenable.

Perhaps the most surprising finding of this study is that HbA_1, the usual indicator of the severity of diabetes and an indicator of diabetes control, was not found to be a significant predictor of mortality. This finding calls for a

TABLE 4
Step zero of Cox regression model

Variable name	Approximate χ^2 to enter	P	Log likelihood
Sex	2.73	.0984	−305
Age	29.62	.0000	−292
Duration of diabetes	7.92	.0049	−303
Age at onset	8.39	.0038	−302
Percent ideal body weight	4.01	.0452	−305
HbA_1	0.00	.9697	−307
History of smoking	0.77	.3809	−306
High-density lipoprotein cholesterol	0.00	.9833	−307
Had admissions to the hospital	2.22	.1361	−306
Problems controlling illness	0.97	.3252	−306
Problems controlling medications	0.54	.4641	−306
Social impact	10.96	.0009	−301
Emotional impact	0.40	.5269	−306
Barriers to adherence	4.89	.0270	−304
Barriers in schedule	1.38	.2397	−306
Regimen components	1.16	.2815	−306
Regimen diet	5.52	.0188	−304
Benefits (value)	0.10	.7469	−307
Benefits (extent)	0.10	.7511	−307
Use insulin	1.38	.2408	−306
Experienced myocardial infarction	4.86	.0275	−304
Experienced cerebrovascular accident	8.78	.0030	−302
Renal function	22.06	.0000	−296

TABLE 5
Summary table of stepwise results of Cox model

Variable entered	Improvement (χ^2)	P	Coefficient	SE	Relative risk
Age	29.62	.000	.064	.017	1.07
Social impact	10.19	.001	.477	.126	1.61
Renal function	8.03	.005	−.559	.199	0.57
Diet regimen	6.80	.009	−.360	.131	0.70
History of smoking	4.12	.042	−.287	.143	0.75

reexamination of the role of HbA_1 and blood glucose level determinations as dependent variables in studies of patient education, behavioral interventions, and studies of the clinical outcomes of diabetes care.

With regard to the lack of relationship between blood glucose control and mortality, it is possible that HbA_1 and other clinical variables related to diabetes control are so highly intercorrelated that no unique contribution was made by these control variables.

Given the stepwise manner in which variables are included in the Cox model, the variable that predicts the most unique variance is entered first. Variables highly correlated with any previously entered variables are unlikely to be added into the equation on subsequent steps. However, an examination of the approximate χ^2-values at step 0 indicated that HbA_1 was not related at all to survival in this sample (Table 4).

The results of the Cox model calculated in this study should be interpreted as follows: for each additional year of age, the risk of death increased 6.4%. In addition to this increased risk, the patient's risk of death was increased by 61% for an increase of 1SD on the social-impact scale of the DEP. In addition to these two variables, if the patient has a complex diet, the relative risk of death was decreased by 30% per SD on the diet-complexity scale (relative risk = 70%). Conversely, a less complex diet regimen (1SD below the mean) is associated with a 30% increase in relative risk. Decreased renal function was also related to increased risk. For each SD decrease in renal function, the relative risk of mortality increased 41%. The difference in creatinine clearance levels between patients that survived (83.7 ml/min) and those who died over the course of the study (63.3 ml/min) was statistically significant.

Limitations. Although the data obtained for this study were examined and reported in a way that implied a causal relationship (i.e., variables examined in 1981–1982 predicted mortality), there may be reverse causality among selected study variables. For example, although the study design was longitudinal and psychosocial and other predictor variables measured in 1981 were examined in relation to mortality through 1986, the concurrent relationships among psychosocial and disease variables in 1981 cannot be investigated to determine underlying causality. It is possible that the patients who were most ill in 1981 were the ones who reported the largest social impact because of the severity of their illness. It is also possible that patients who had more complications resulting from diabetes reported higher social impact. Therefore, increased mortality in

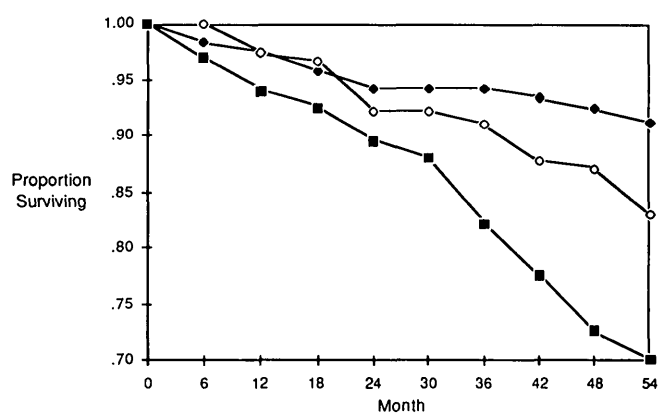

FIG. 1. Survival roles for 3 groups of patients as function of reported social impact of diabetes. Low (♦), medium (◇), and high (■) refer to measurement of social impact as described in text.

the high social-impact group may be a direct result of higher disease severity, which is only indirectly measured by the social-impact scale. People who were more ill may have reported larger psychosocial impact, and because they were more ill, they had a higher risk of mortality. This interpretation is quite different from the interpretation that patients who reported larger social impact due to their diabetes had higher mortality.

Examination of Table 3 indicates that the deceased and surviving patients did not differ in HbA_1, high-density lipoprotein cholesterol, insulin use, or history of smoking. They did differ in age at onset, duration of diabetes, renal function, and number of previous CVAs. This suggests that cardiovascular and microvascular complications of diabetes may be related both to social impact and to increased risk of mortality in patients with diabetes. An alternative interpretation of these findings would be that patients with more severe disease experienced a larger social impact because of their increased disability. Therefore, the social-impact scale was actually measuring only this increased disease severity. Following this line of reasoning, the social-impact scale adds little to understanding the relationship between social aspects of diabetes and patient mortality.

To test this interpretation, an illness index was developed that included previous MIs, previous CVAs, renal function, percent ideal weight, and admissions to the hospital. These variables were coded dichotomously (e.g., 1 = previous MI, CVA, low renal function, below ideal weight), resulting in a score for each patient between 0 and 5, where 0 indicated little evidence of disease severity and 5 indicated high disease severity. The mean value for this illness variable for the surviving patients was 1.6 (SD = 0.98, n = 289). The mean value for the deceased patients was 2.26 (SD = 0.85, n = 54). The correlation matrix of these variables showed that the illness scale was more highly correlated with survival (r = .32) than was the social-impact scale (r = .20). The social-impact scale, although related to the patient's illness, obviously measures more than disease severity alone.

Another technique was employed to examine the proper interpretation of the social-impact scale. An all-possible-subsets regression analysis was computed to determine the variables that predicted social-impact scale scores. Variables introduced into the analysis included sex, age, duration of diabetes, percent of ideal body weight, HbA_1, cholesterol, admissions to the hospital, insulin use, number of MIs, number of CVAs, and renal function. These variables were thought to be highly related to disease severity. The results of the analysis indicated that four variables predicted social-impact scores: sex, age, hospital admissions, and insulin use. These variables predicted 20% of the variance in social-impact scores, leaving substantial variance unaccounted for in the study. Apparently, social impact is related to disease severity to some extent, but this scale measures much more. Further research will be needed to determine whether the social impact of a disease is subject to change through intervention.

Another limitation of this study was the unavailability of accurate data on hypertension and patient medication to control blood pressure. In 1981, when the original blood pressure measurements were made, data on medication use for hypertension were not collected. Even though data were obtained 2 yr later, the incidence of mortality in the 2-yr period (half of the total mortality) and lack of data on the entire sample (data were available on 322 of the 343 subjects) made the inclusion of these data impractical.

Implications. The results of this study demonstrate an association between psychosocial variables and the risk of mortality in a sample of patients with NIDDM even when other demographic, physiologic, and diabetes-control variables are included in the prediction equation. Of particular interest is the relationship between perceived social impact and increased mortality. With the data from this variable alone, significant differences were seen in the survival function.

These findings have direct implications for both clinicians and researchers working with individuals with diabetes. Scores on measures of social impact of diabetes and ratings of the complexity of the diet regimen were associated with increased risk of mortality. Therefore, clinicians should recognize these aspects of patient adjustment to diabetes in treatment programs. It is conceivable that for patients with diabetes [as has been suggested for patients with end-stage renal failure (15,16) and cancer patients (8)], social support and networking activities that are aimed at meeting psychological and social needs may decrease the risks of mortality.

The relationship between diet-regimen complexity and mortality (higher diet complexity as rated by the patient was related to decreased risk of mortality) may have psychological or treatment implications. Possibly, adherent patients report more complex diet regimens than nonadherent patients, or a more complex diet program may be an indication of a more thorough treatment program.

If future research demonstrates that these variables are subject to change as a result of intervention, health-care professionals should encourage patient participation in social-support interventions and sessions designed to produce increased adherence with the treatment program.

The results also indicate directions for future research. The findings with regard to predictors of mortality should be verified on other populations. The lack of evidence that diabetes control (HbA_1), hospitalization, and other factors predict mortality also needs further study. Whereas the results indicate relationships between study variables and survival, there is no evidence that interventions to alter patient perceptions and behaviors will reduce the risk of mortality. Specific interventions need to be developed and evaluated in terms of risk reduction.

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