The Ochsner Journal 7:158–166, 2007

Quality of Care Indicators, Health Behaviors, and Physical Functioning in Adults with Diabetes*

Marie Krousel-Wood, MD, MSPH,[1] David M. Radosevich, PhD, RN,[2] Clese Erikson, MP Aff,[3] Lawrence Blonde, MD,[4] Julie Sanderson-Austin, RN[3]

[1]*Director, Center for Health Research, Ochsner Clinic Foundation, and Clinical Professor, Tulane Health Sciences Center, New Orleans, LA*
[2]*Assistant Professor, Deputy Director, Clinical Outcomes Research Center, School of Public Health and Director, Transplant Information Services, Department of Surgery, University of Minnesota, Minneapolis, MN*
[3]*American Medical Group Association, Alexandria, VA*
[4]*Director, Ochsner Diabetes Clinical Research Unit, Ochsner Clinic Foundation, New Orleans, LA*

ABSTRACT

Purpose: Physical functioning is an important and often neglected outcome in patients with diabetes. Identification of quality of care indicators and health behaviors associated with higher physical functioning may lead to improved care and outcomes for adult diabetic patients.

Methods: We studied 3,521 adult persons with diabetes mellitus from 13 geographically dispersed, multi-specialty group practices in a cross-sectional survey. The outcome variable was the 10-item physical functioning scale. Independent variables included demographics, health behaviors, diabetes management, use of services, health status, risk for depression, comorbidities, and testing for albuminuria, glycosylated hemoglobin, and low-density lipoprotein. From these data, 10 quality-of-care indicators were constructed. We evaluated relationships between physical functioning and the quality of care indicators.

Results: Participants had a mean age of 64.2 +/− 12.6 years, and 52% were female, 67% married, 78% had a high school education or higher, and 73% were white. Multivariate analyses revealed several factors independently associated with higher physical functioning score on the 10-item scale (each $p < 0.05$, $R^2 = 0.54$): recent test for albuminuria or low-density lipoprotein lipids; no hospitalization or emergency admission in the prior year; being married; younger age; male gender; African American or Asian race; higher formal education; regular physical exercise; fewer comorbidities; better perceived health; not at risk for depression; not more limited in activities and health not worse compared to a year ago; nonsmoker; not being obese; and not taking insulin.

Conclusions: We identified quality of care and health behaviors associated with higher physical functioning in adult patients with diabetes mellitus. Interventions to enhance the modifiable risk factors may lead to improved physical functioning and delay the onset of disability in these patients.

Clese Erikson contributed to this article while working at the American Medical Group Association. She is presently employed at the Center for Workforce Studies, AAMC, 2450 N. St., NW, Washington, DC, 20037.

**This work, presented at the AcademyHealth Annual Meeting, June 2003, has been made possible by an educational grant from American Medical Group Association through Parke Davis and Ochsner Clinic Foundation.*

Address correspondence to:
Marie Krousel-Wood, MD, MSPH
Director, Center for Health Research
Ochsner Clinic Foundation
1514 Jefferson Highway
New Orleans, LA 70121
Tel: (504) 842-3680
Fax: (504) 842-3648
Email: mawood@ochsner.org

Key Words: Diabetes, exercise, physical functioning, PF-10, quality of care

INTRODUCTION

In a previous study of elderly persons with diabetes, impaired physical functioning was associated with advanced age, number of comorbid conditions, obesity, lack of exercise, less formal education, taking insulin, and abstinence from alcohol (1). Several factors (e.g., lack of exercise) are potentially modifiable and are driven by patient motivation for change (1). Providers rely on system-driven factors such as quality of care processes (e.g., ordering screening tests) and diabetes education in hopes that improvements in their delivery will positively impact the outcomes and quality of life of their patients. Improvements in performance on 22 quality of care processes (including three for diabetes) of Medicare beneficiaries (from 1998–1999 to 2000–2001) were reported (2); however, the improvements were not linked to improved patient functioning or quality of life.

In an effort to lay the groundwork for better understanding of patient-driven and system-driven factors associated with good clinical outcomes, we studied more than 3,500 community-dwelling adults with predominantly type 2 diabetes from 13 medical group practices across the United States. We sought to identify quality of care indicators and health behaviors associated with higher physical functioning—an important and often neglected outcome for persons with diabetes.

METHODS

Study Design

As part of the American Medical Group Association Diabetes Mellitus Risk Model Development Project, we recruited diabetic patients from 13 large medical group practices in 11 geographically dispersed states to participate in an observational study. Approval from respective Institutional Review Boards was obtained. Using claims data, each practice selected a random sample of 411 subjects who were at least 31 years old and had a prior history of two or more outpatient or non-acute encounters according to the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9 CM) as diabetes (ICD-9 CM codes 250-250.93, 357.2, 362.0, 362.02, 366.41) or one acute inpatient or emergency department (ED) visit with an ICD-9 CM code for diabetes mellitus (3). We were unable to distinguish between individuals with type 1 and type 2 diabetes, although the majority (>90%) of the patients likely had type 2 diabetes based on a subgroup analysis of insulin use and age of onset of diabetes. Given that it is difficult to distinguish type 1 from type 2 diabetic patients, even when evaluating them directly, and that approximately 28% of patients with type 2 diabetes are taking insulin (4), it is not uncommon for investigators to combine these patients when reporting results of observational studies (5). Diagnosis of diabetes mellitus was subsequently affirmed by the patient survey. Discrepancies between the data sources were referred for medical record review for confirmation. If a diagnosis of diabetes mellitus was unsubstantiated in the medical record, the person was excluded from the study. Except for one clinic that over sampled for African Americans, the sample represented persons seeking diabetes care at these clinics.

Independent Variables

We derived our quality of care indicators and other risk factors from laboratory claims data for 1999 (6) and a mailed self-administered questionnaire using standardized methods (7) for the first quarter of 2000. Demographic characteristics included factors associated with physical functioning: age, gender, education, marital status, race, Hispanic background, and the presence of an informal caregiver. We constructed 10 diabetes quality-of-care measures, corresponding to standards of care for diabetes management according to the American Diabetes Association (8) using laboratory and patient survey data (Table 1).

We included hemoglobin A1C measurement (CPT 83036), any testing for albuminuria (CPT 82043, 82044, CPT 8100, 81003, 81005, 82042, 84155-micro and macro) and low density lipoprotein (LDL) (LDL-CPT 83721, lipid panel – CPT 80061) during 1999 (6). Laboratory values were not consistently collected across institutions and were not reported in this study. We separately considered number of medical services used in the prior year: hospitalizations, ED visits, and physician visits.

Self-reported intensity of treatment was classified from low to high as follows: diet and exercise only, oral hypoglycemic medication only, insulin only, combination therapy. Mental health function was measured as the risk for depressive disorder, using the three-item depression screener from the Medical Outcomes Study (9,10). We used two items from the 36-Item Short Form Health Survey (SF-36): overall perceived health and changes in health in the past year (11). In addition, we assessed limitations with usual activity level compared to 1 year ago using a single transition question. The survey included the following comorbidities: hypertension, angina, congestive heart failure, myocardial infarction, other heart conditions, stroke, chronic obstructive pulmonary disease, Crohn's disease, cancer, serious visual impairments, amputation, low back pain, arthritis of the knee or hip, and arthritis of the hand or wrist. An index of comorbidity was constructed based on a count of these conditions.

Lastly, we assessed health behaviors. Respondents were classified as non-smokers if they were former smokers or had never smoked. Based on self-reported height and weight to compute body mass index (BMI), respondents were classified as obese (BMI $\geq$ 30 kg/m^2 and $<$ 40 kg/m^2), or morbidly obese (BMI $\geq$ 40 kg/m^2). Responses to "engaging in regular physical exercise" (yes/no) were used to classify participants with regard to physical activity.

Dependent Variable

We measured physical functioning using the Medical Outcomes Study 10-item Physical Functioning Scale (PF-10) (11–13). The PF-10 score is based on questions about activity limitations for a range of activities: vigorous activities (e.g., running, lifting);

Table 1. Quality of care indicators for diabetic patients.

Quality of Care Indicator	Source
Hemoglobin A1C testing	Laboratory
Testing for albuminuria	Laboratory
Low density lipoprotein (LDL) testing	Laboratory
Eye examination by an optometrist or ophthalmologist in the past year	Survey
Examination of feet and legs (test for numbness, tingling, feeling) in past year	Survey
Angiotensin converting enzyme (ACE) inhibitor use	Survey
Advice to quit smoking or referral for smoking cessation counseling	Survey
Visit for diabetes education in the past year	Survey
Follows a diet plan	Survey
Daily testing of blood sugar levels	Survey

moderate activities (e.g., moving a table, pushing a vacuum, bathing, or dressing). Previous work has shown the PF-10 scale is reliable and demonstrates construct validity in diabetic populations (1,11). The PF-10 responses were transformed and expressed on a 0–100 scale, with a higher score indicating better physical functioning.

Statistical Analyses

We performed bivariate analyses (SAS System Software™, Release 8.2, Cary, NC) using Student's *t* tests, one-way analysis of variance (ANOVA), and Pearson correlation coefficients. Independent variables associated with PF-10 at the 10% level were included in the multivariate analysis. Smoking was also included because it is associated with weight (5).

We used stepwise least squares regression to construct the general multivariate model, regressing PF-10 on each of the factors. Independent variables significantly associated ($\alpha < 0.05$) with PF-10 were kept in the final model. Finally, we used the SAS™ PROC MIXED procedure to retest the model under the mixed effects assumption, treating the clinic as a random effect. This approach takes into consideration the nested nature of the study design, i.e., patients within clinics.

RESULTS

The initial criteria for inclusion in the study were met by 5,359 patients. Of the 5,186 patients remaining after individuals known deceased (n = 30) and without confirmed diagnosis of diabetes (n = 143, see Methods section) were dropped, 3,521 diabetic patients returned surveys (response rate = 65.7%) and were included in the analysis. Response rates differed across the clinics, (55.5% to 68.7%; $p < 0.001$), but not by census region. Respondents were older than non-respondents (mean of 63.8 versus 59.1 years, respectively, $p < 0.001$). No statistically significant gender differences were found.

The average score for the PF-10 was 60.1 ± 30.9. Table 2 summarizes the mean PF-10 scores according to demographic characteristics. Our study sample represented the broad range of patients visiting large medical group practices with nearly one-half 65 years of age or older, slightly more females than males, and 27% non-white. The apparent over-representation of patients from the Midwest and West census regions corresponds to the distribution of large medical group practices nationally.

Mean PF-10 scores for each diabetes mellitus quality-of-care measure are presented in Table 3. Most of the respondents (i.e., 50.9%) were on oral anti-diabetic agents only; use of services in the prior year by mean PF-10 scores is provided in Table 4. In the past year, 22.3% had a hospitalization and 36.7% had at least one or more emergency room visits. Most of the respondents (65.2%) had visited their physician four or more times in the past year. The health status and health behaviors of the respondents by mean PF-10 scores are shown in Table 5. We found 37.2% of the respondents reporting their health as either fair or poor and 35.9% of the respondents at risk for a depressive disorder. Health was worse compared to 1 year prior for 16.3% of the respondents, and 24.3% reported activity levels decreased over the same interval of time. In addition to diabetes mellitus, the median number of comorbidities among the respondents was three. We noted that 11.7% of the respondents were current cigarette smokers, and 47.2% were obese based on a self-reported BMI > 30 kg/m^2. Regular physical exercise was reported by 53.2% of the respondents.

The independent factors included in the final multivariate model account for 54% of the variability in physical functioning (see Table 6). Since the respondents were sampled from within geographically dispersed clinics, we tested the statistical significance of the same set of factors while blocking for clinic effects by using mixed model methods. The

Table 2. Physical functioning (PF-10) scores according to respondent demographic characteristics (n=3521).

	%	Physical Functioning (PF-10) Score Mean	Standard Deviation
Physical functioning score (PF-10)	100.0	60.1	30.9
Age, years			
31–44	7.6	80.4*	23.8
45–54	17.8	72.1	28.5
55–64	24.1	63.7	30.2
65–74	28.8	56.4	29.4
75–84	18.9	45.7	28.5
85 and over	2.9	35.7	29.2
Gender			
Male	48.5	65.0*	30.2
Female	51.5	55.5	30.8
Education			
No high school diploma	21.3	47.7*	29.5
High school graduate	78.7	63.5	30.4
Race			
White	72.6	60.2*	31.2
African American	15.6	57.4	29.8
Asian or Pacific Islander	6.3	71.7	26.6
Other	5.9	56.8	31.3
Hispanic			
Hispanic background	7.0	64.0	30.4
No Hispanic background	93.0	60.7	30.8
Marital status			
Married	67.8	63.5*	30.4
Not married	32.2	53.1	30.7
Informal caregiver			
Support of family and friends	90.3	61.4*	30.7
No support	9.7	51.0	31.2
Census region			
Northeast region	12.6	68.1*	29.1
Midwest region	43.8	58.3	30.9
South region	14.6	60.0	31.3
West region	29.0	60.0	30.9

* $P < 0.0001$

results (not reported here) confirmed the findings for the general least squares regression.

DISCUSSION

In this larger, more diverse study population than previously studied, we identified findings in our cross-sectional analysis that support several of the conclusions by Caruso and associates (1). In addition, we identified other factors in our model that were positively associated with physical functioning. With the inclusion of the quality of care indicators and prior use of healthcare services in the multivariable model, we were able to account for 54% of the variation in physical functioning; this is higher than what has been previously reported (1,5). The discussion will focus on the results of the multivariate analysis.

Demographics and PF-10

Our results were consistent with other research in that women are more likely to report worse physical functioning compared to men (5,12); these differences are likely due to differences in survival between men and women (14). We found a positive association between being married and PF-10 scale. An associ-

Table 3. Physical functioning scale (PF-10) scores according to diabetes mellitus quality of care indicators (n = 3521).

	%	Physical Functioning Score (PF-10) Mean	Standard Deviation
Recent hemoglobin A1C			
Yes	80.0	61.6	31.9
No	20.0	59.8	30.6
Recent albuminuria test			
Yes	24.7	65.4*	29.3
No	75.3	57.5	31.2
Recent LDL test			
Yes	56.0	61.7**	29.7
No	44.0	58.1	32.2
Recent ophthalmoscopic examination			
Yes	75.6	60.8	30.4
No	24.4	58.7	31.9
Examination of the feet and legs			
Yes	59.8	60.7	31.1
No	40.2	61.0	30.4
ACE inhibitor use			
Yes	37.8	55.8*	30.9
No	62.2	63.3	30.5
Referral for smoking cessation counseling			
Yes	10.0	59.5	30.5
No	90.0	61.6	31.5
Recent visit for diabetes education			
Yes	37.7	60.9	31.3
No	62.3	60.0	30.6
Follows diet plan			
Yes	78.5	61.2***	30.9
No	21.5	58.3	30.8
Daily testing of blood sugar levels			
Yes	68.2	59.9***	31.2
No	31.8	62.3	28.9

ACE = angiotension converting enzyme; LDL = low density lipoproteins;
* $p < 0.0001$; ** $p < 0.001$; *** $p < 0.05$

ation between quality of marriage and adaptation to diabetes and health-related quality of life (HRQOL) has been previously reported (15,16). Similar to other studies (17), in our bivariate analyses African Americans reported poorer physical functioning when compared to Caucasians. Interestingly, the multivariate analyses revealed that being African American was positively related to PF-10, after controlling for other risk factors. A similar association was found for Asians. Further research is needed to examine the relationship between race and physical functioning among those with diabetes. In addition, increasing age, less than a high school education, and increased number of comorbidities were negatively associated with higher physical functioning.

Quality of Care Indicators, Use of Services, and PF-10

In the multivariable model, LDL test in the past year and test for albuminuria in the past year were associated with higher PF-10. Although the mechanism for the positive impact on either physical functioning or quality of life is unclear, it is possible that those who had these tests may have had better treatment for dyslipidemia, hypertension, or glycemia,

Table 4. Physical functioning (PF-10) scores according to intensity of treatment and self-reported use of services (n = 3,521).

	%	Physical Functioning Score (PF-10) Mean	Standard Deviation
Intensity of treatment for diabetes			
Diet and exercise only	14.2	66.0*	29.4
Oral hypoglycemics only	50.9	63.2	29.6
Insulin only	24.8	55.1	32.5
Combination therapy	10.0	51.2	31.4
Hospitalizations in the past year			
No hospitalization	77.7	65.4*	29.1
Any hospitalization	22.3	42.8	32.8
Physician visits in the past year			
Not at all	1.1	72.6*	29.3
One time	4.3	70.0	30.0
2 to 3 times	29.4	67.5	28.6
4 to 6 times	35.5	61.5	30.4
More than 6 times	29.7	49.8	30.8
Emergency department visits in the past year			
Not at all	63.3	66.2*	28.6
One time	21.6	53.5	31.7
2 to 3 times	12.1	47.5	31.4
More than 3 times	3.0	39.4	32.6

* $p < 0.0001$

which can be translated into better outcomes and higher physical functioning.

Use of hospitalization and emergency services in the past year were negatively associated with physical function. Use of these services may be a surrogate for more severe disease or acute events whose sequelae subsequently impair physical functioning. That is, patients who are hospitalized or go to the emergency department may be sicker and, thus, have lower quality of life than those who are not hospitalized or do not go to the emergency department.

Although the association between angiotensin-converting enzyme (ACE) inhibitor use and physical functioning was not significant in the multivariate analysis, the bivariate analyses revealing that patients on ACE inhibitors had poorer physical functioning compared to those who did not report use of ACE inhibitors warrant some discussion. This is interesting in light of the findings from the Heart Outcome Prevention Evaluation (HOPE) Trial, which revealed individuals with diabetes and at least one other cardiovascular risk who were taking ACE inhibitors had a 25% reduced risk of myocardial infarction, cardiovascular death, or stroke over the 4.5 year follow-up (18,19). However, the relationship between reductions in risk and physical functioning and quality of life was not assessed in the HOPE trial. Moreover, ACE inhibitor use may be a marker of patient severity, where patients with higher blood pressure, the presence of diabetic nephropathy, and/or cardiovascular disease are more likely to have the medication prescribed and more likely to have poorer physical functioning. In exploring the relationship between ACE inhibitor use and physical functioning, it may be important to consider the effect of potential confounders such as comorbidity.

Health Status, Health Behaviors, and PF-10

Patients at risk for depression had lower physical functioning in our sample of adults with diabetes. Other studies have suggested that adults with diabetes have higher rates of depression, more severe depression, and longer episodes of depression than adults without diabetes (20–23). There is sufficient evidence to suggest that depression reduces adherence to pharmacologic treatment of diabetes, which can contribute to poorer glycemic control (24,25) leading to diabetic complications, which may negatively impact physical functioning. In a randomized controlled trial, treatment of depression improved both physical functioning and pain control in patients with arthritis (26). It is possible that efforts focused on identifying and treating diabetic patients at risk for depression would improve physical functioning and other outcomes (20).

Table 5. Physical functioning scores (PF-10) according to respondent health status and health behaviors (n = 3,521).

	%	Physical Functioning Score (PF-10) Mean	Standard Deviation
Perceived health			
Excellent, very good, good	62.8	72.0*	26.0
Fair, poor	37.2	40.1	28.0
At risk for depressive disorder			
Yes	35.9	48.4*	31.0
No	64.1	66.9	28.7
Change in health			
Health same or better	83.7	64.6*	29.0
Health worse	16.3	36.9	29.9
Change in activity			
Activity level same or improved	75.7	63.3*	29.8
Activity level more limited	24.3	50.2	32.0
Number of comorbidities			
None	8.9	81.8*	25.8
One	17.1	78.7	23.6
Two	18.3	69.1	27.0
Three	16.1	59.3	27.3
Four	14.7	53.7	28.1
Five or more	25.0	37.5	27.0
Cigarette smoker			
Former smoker or never smoked	88.3	60.0	30.8
Current cigarette smoker	11.7	61.0	31.7
Body mass index			
< 30 kg/m^2	52.8	63.8*	30.7
≥ 30 kg/m^2–<40 kg/m^2	36.8	59.4	30.0
≥ 40 kg/m^2	10.4	48.2	30.6
Physical exercise			
Engages in regular exercise	53.2	70.5*	27.4
No regular exercise	46.8	50.0	30.9

* $p < 0.0001$

Current smokers had lower physical functioning status in the multivariate analysis. Others have alluded to potential benefits of smoking cessation on HRQOL (27–29). Our findings regarding obesity and lower physical functioning are consistent with results of other published studies (5,17). Data from longitudinal studies support a causal relationship between obesity and diminished HRQOL (30,31). Educational or other programs directed at reducing or preventing obesity in individuals with diabetes may help minimize reductions in physical functioning for these persons. Recent changes in the Health and Human Services Center for Medicare and Medicaid Services Medicare Coverage Issues Manual, which no longer includes language stating that obesity is not an illness, lay the groundwork for possible coverage of obesity-related treatments (32). Regular physical exercise was significantly associated with higher physical functioning in this study. Opportunities may exist for improving physical functioning in diabetic individuals through regular physical exercise. One should keep in mind when designing interventions to improve physical functioning that there are some illnesses (e.g., joint conditions), perhaps related to obesity, which might hinder exercise and, hence, negatively impact physical functioning.

Limitations of the Study

The results of this study should be considered with the following limitations in mind. Although we achieved a response rate of 67%, the results could under-represent some of the participating medical

Table 6. Multivariate linear regression model: factors associated with higher physical functioning (PF-10).

Variable	Parameter	P-value	Standardized Parameter
Constant	124.91		
Demographics			
Age (in years)	−0.65	<.0001	−0.269
Female	−4.31	<.0001	−0.071
Married	2.32	.0136	0.035
Race (versus White)			
African American	2.58	.0338	0.030
Asian	3.51	.0428	0.028
Other	−2.11	.2395	−0.016
Not high school graduate	−4.18	.0001	−0.056
Number of comorbidities	−4.56	<.0001	−0.248
Quality of Care Measures			
Test for albuminuria in the past year	2.04	.0341	0.029
Test for LDL in the past year	2.17	.0113	0.035
Use of Services			
Any hospitalization in prior year	−4.27	.0003	−0.058
Emergency department visits in prior year			
One	−2.68	.0146	−0.036
Two or more	−3.90	.0035	−0.04
Health Status			
Fair or poor perceived health	−14.38	<.0001	−0.227
At risk for depression	−4.98	<.0001	−0.078
Health worse compared to I year ago	−7.84	<.0001	−0.095
More limited in activities compared to 1 year ago	−3.39	.0007	−0.047
Health Behavior			
Smoker	−3.67	.0054	−0.039
Regular physical exercise	9.22	<.0001	0.151
Obese (BMI 30 kg/m^2 and <40 kg/m^2)	−3.37	.0003	−0.055
Morbidly obese (BMI >40 kg/m^2)	−7.82	<.0001	−0.078
Intensity of Treatment			
Oral hypoglycemics only	1.01	.4144	0.017
Insulin only	−3.34	.0169	−0.047
Combination therapy	−4.13	.0173	−0.041

Adjusted R^2 = 0.54

BMI = body mass index; LDL = low density lipoprotein

groups, over-represent the aged with diabetes, and under-represent delivery systems other than multi-specialty medical group practices with primarily managed care patients. This is a cross-sectional study meant to explore potential associations among quality of care indicators, health behaviors, and physical functioning; thus, no conclusions regarding causality can be drawn. Future studies should include assessment of duration of diabetes, glycemic control and other laboratory values, explore the causal nature of these associations in a longitudinal study, and include a more detailed measure of comorbidity.

CONCLUSION

The results of this study indicate associations among quality of care indicators, health behaviors, and physical functioning in adults with diabetes (1,5). In promoting health through lifestyle modification, screening, and treatment, there are patient-driven and system-driven factors to consider. Based on our analyses, a number of potentially modifiable factors seem promising: regular testing for LDL lipids and urine proteins; assessment of the risk for depression and its treatment when discovered; assessment of smoking status and advice to quit, including referral for smoking cessation counseling; weight management; and programs that foster regular physical exercise. Overall, these same activities would be included in any comprehensive health promotion program. However, the implementation in populations with diabetes could represent greater paybacks for medical institutions and health plans than are found in relatively healthy groups without diabetes.

Implications for Diabetes Counseling

The relationship of these mutable factors to physical functioning may be useful in the healthcare professional-patient interactions, where patients are advised or counseled regarding their diabetes and educators have the opportunity to follow practice guidelines. These factors present an opportunity for actively involving the patient in his or her care. Further research is necessary to explore successful interventions (33). The findings from this study support the importance of quality care monitoring and health behaviors to diabetes outcomes.

REFERENCES

1. Caruso LB, Silliman RA, Demissie S, et al. What can we do to improve physical function in older persons with type 2 diabetes? J Gerontol A Biol Sci Med Sci 2000;55:M372–M377.
2. Jencks SF, Huff ED, Cuerdon T. Change in the quality of care delivered to Medicare beneficiaries, 1998–1999 to 2000–2001. JAMA 2003;289:305–312; Erratum in: JAMA 2002;289:2649.
3. Schmidt KM, Hart AC, Aaron WS. ICD-9-CM Code Book for Hospitals. Reston, VA: St. Anthony Publishing, 1999.
4. Harris MI. Health care and health status and outcomes for patients with type 2 diabetes. Diabetes Care 2000;23:754–758.
5. Katz DA, McHorney CA, Atkinson RL. Impact of obesity on health-related quality of life in patients with chronic illness. J Gen Intern Med 2000;15:789–796.
6. American Medical Association, Current Procedural Terminology (CPT) 2000. Chicago: American Medical Association, 1999.
7. Dillman DA. Mail and Telephone Surveys: The Tailored Design Method. New York: John Wiley & Sons, 2000.
8. American Diabetes Association, Standards of medical care for patients with diabetes mellitus. Diabetes Care 2003;26(suppl 1): S33–S50; Erratum in: Diabetes Care 2003;26:972.
9. Burnam MA, Wells KB, Leake B, et al. Development of a brief screening instrument for detecting depressive disorders. Med Care 1988;26:775–789.
10. Rost K, Burnam MA, Smith GR. Development of screeners for depressive disorders and substance disorder history. Med Care 1993;31:189–200.
11. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care 1992;30:473–483.
12. Ware JE Jr, Snow KK, Kosinski M, et al. SF-36 Health Survey: Manual and Interpretation Guide. Boston: The Health Institute New England Medical Center, 1993.
13. Ware JE Jr, Kosinski M, Bayliss MS, et al. Comparison of methods for the scoring and statistical analysis of the SF-36 health profile and summary measures: summary of results from the Medical Outcomes Study. Med Care 1995;33(suppl 4):AS264–AS279.
14. Manton KG. A longitudinal study of functional change and mortality in the United States. J Gerontol 1988;43:S153–S161.
15. Trief PM, Himes CL, Orendorff R, et al. The marital relationship and psychosocial adaptation and glycemic control of individuals with diabetes. Diabetes Care 2001;24:1384–1389.
16. Trief PM, Wade MJ, Britton KD, et al. A prospective analysis of marital relationship factors and quality of life in diabetes. Diabetes Care 2002;25:1154–1158.
17. Hill-Briggs F, Gary TL, Hill MN, et al. Health-related quality of life in urban African Americans with type 2 diabetes. J Gen Intern Med 2002;17:412–419.
18. Heinig RE. What should the role of ACE inhibitors be in the treatment of diabetes? Lessons from HOPE and MICRO-HOPE. Diabetes Obes Metab 2002;4(suppl 1):S19–S25.
19. Gerstein HC. Reduction of cardiovascular events and microvascular complications in diabetes with ACE inhibitor treatment: HOPE and MICRO-HOPE. Diabetes Metab Res Rev 2002;18(suppl 3):S82–S85.
20. Lustman PJ, Griffith LS, Clouse RE. Depression in adults with diabetes. Semin Clin Neuropsychiatry 1997;2:15–23.
21. Anderson RJ, Freedland KE, Clouse RE, et al. The prevalence of comorbid depression in adults with diabetes: a meta-analysis. Diabetes Care 2001;24:1069–1078.
22. Talbot F, Nouwen A. A review of the relationship between depression and diabetes in adults: is there a link? Diabetes Care 2000;23:1556–1562.
23. Peyrot M, Rubin RR. Levels and risk of depression and anxiety symptomatology among diabetic adults. Diabetes Care 1997;20:585–590.
24. Lustman PJ, Anderson RJ, Freedland KE, et al. Depression and poor glycemic control: a meta-analytic review of the literature. Diabetes Care 2000;23:934–942.
25. Ciechanowski PS, Katon WJ, Russo JE. Depression and diabetes: impact of depressive symptoms on adherence, function and costs. Arch Intern Med 2000;160:3278–3285.
26. Lin EH, Katon W, Von Korff M, et al. Effect of improving depression care on pain and functional outcomes among older adults with arthritis: a randomized controlled trial. JAMA 2003;290:2428–2429.
27. Taira DA, Seto TB, Ho KK, et al. Impact of smoking on health-related quality of life after percutaneous coronary revascularization. Circulation 2000;102:1369–1374.
28. Wilson D, Parsons J, Wakefield M. The health-related quality of life of never smokers, ex-smokers, and light, moderate, and heavy smokers. Prev Med 1999;29:139–144.
29. Tillmann M, Silcock J. A comparison of smokers' and ex-smokers' health-related quality of life. J Public Health Med 1997;19:268–273.
30. Stafford M, Hemingway H, Marmot M. Current obesity, steady weight change and weight fluctuation as predictors of physical functioning in middle aged office workers: The Whitehall II Study. Int J Obes Relat Metab Disord 1998;22:23–31.
31. Fine JT, Colditz GA, Coakley EH, et al. A prospective study of weight change and health-related quality of life in women. JAMA 1999;282:2136–2142.
32. Medicare Removes Ban on Treating Obesity. ConsumerAffairs.com, July 16, 2004. www.consumeraffairs.com/news04/medicare_obesity.html. Accessed 8 November 2006.
33. Wing RR, Goldstein MG, Acton KJ, et al. Behavioral science research in diabetes: lifestyle changes related to obesity, eating behavior, and physical activity. Diabetes Care 2001;24:117–123.