
Editorial

Hospitalizations for Patients With Diabetes Mellitus: Changing Perspectives

Diabetes mellitus (DM), a prevalent condition in the United States, leads to extensive morbidity, mortality, and use of expensive health-care resources. The Centers for Disease Control¹ estimated that almost 7 million Americans have been diagnosed with DM by a physician, and Harris² suggested that an additional 4 to 5 million adults would fulfill the criteria for DM but have not been so diagnosed. DM is a common cause of blindness, renal disease, amputations, stroke, coronary artery disease, and death.³ Persons with diabetes have more ambulatory-care visits, more hospital admissions, and longer durations of stay per hospital admission than their nondiabetic counterparts.⁴ Annual costs associated with caring for patients with DM may exceed \$20 billion, most of which is spent on non-insulin-dependent diabetes mellitus (NIDDM).^{5,6}

Elderly Patients.—Nowhere is the effect of NIDDM more evident than among elderly persons, the fastest-growing segment of the population in the United States. The prevalence and incidence of NIDDM increase with advancing age, 18% of persons 65 to 74 years of age having NIDDM.^{2,3} In elderly patients, NIDDM causes major complications, including retinopathy, neuropathy, and nephropathy.^{7,8}

Achieving adequate glycemic control involves adherence to a complicated regimen that frequently balances hypoglycemic agents, exercise, diet, and self-monitoring of glucose status. Because the complexity of a regimen is inversely correlated with compliance, patients with NIDDM, as a group, are at increased risk for

noncompliance. Compliance and glycemic control are likely to be even more difficult for elderly patients with NIDDM. Their already complex diabetic regimens may be further complicated by the presence of multiple chronic diseases. In addition, age-related physical, neurologic, and social factors can adversely affect glycemic control in elderly patients with NIDDM. For example, accurate insulin dosing and performance of self-monitoring of glucose may be compromised by diminished visual acuity, increased arthritis or tremors, and memory deficits.⁹ The clinical status of these patients may also be negatively affected by nonmedical factors, such as decreased social support⁹ and lack of reimbursement by health insurance for many expenses that are critical to the management of diabetes.^{4,9} As the American population ages, these problems will be exacerbated.

Prospective Payment Systems.—Although many patients with DM and hyperglycemia were previously hospitalized to achieve glycemic control, the inpatient setting has become less feasible to achieve euglycemia. For example, technical developments, such as self-monitoring of blood glucose and glycosylated hemoglobin assays, permit more informed outpatient judgments. In addition, however, certain economic realities discourage hospitalization. Notably, prospective payment systems (PPS) were implemented to decrease the duration of hospital stays for Medicare patients. Although originally only Medicare patients were targeted, the promulgation of PPS to third-party payers other than Medicare has broadened their effect to virtually all patients. When PPS were introduced, advocates believed they would eliminate only unnecessary hospital resources and force hospitals to be more efficient. Critics, however, suggested that financial incentives to dismiss patients prematurely would compromise patient care.

Because PPS for Medicare patients were introduced during a single fiscal year, the influ-

Address reprint requests to Dr. Morris Weinberger, Center for Health Services Research in Primary Care (152), Veterans Affairs Medical Center, 508 Fulton Street, Durham, NC 27705.

ence could not be rigorously evaluated by using a randomized controlled trial. The sole alternative was to conduct a series of studies in which historical controls were used with before and after PPS comparisons. One such study suggested that, since the implementation of PPS, patients with DM and uncontrolled hyperglycemia were hospitalized less frequently and, when admitted to the hospital, were being educated less often and dismissed with higher blood glucose levels than was the case before PPS.¹⁰ Moreover, glycemic control 1 year after dismissal was significantly worse in the post-PPS cohort.¹⁰

The study by Panser and colleagues reported in this issue of the *Proceedings* (pages 1171 to 1184) supports the previous finding that hospital use by patients with NIDDM decreased after implementation of PPS. Specifically, between 1980 and 1985, the adjusted rate for diabetes-related hospitalizations among persons with NIDDM decreased by 37%, whereas the adjusted rate for all other hospitalizations remained essentially unchanged. Although the magnitude of this difference is impressive, two caveats must be emphasized, both of which are acknowledged by the authors. First, the number of dismissal diagnoses recorded varied with the cohort: 3 in 1970 and 1976; 5 in 1980; and 15 in 1985. In fact, their analyses suggested that some portion of the change in hospitalization may have been attributed to changes in coding practices related to the number of diagnoses recorded; thus, the size of the difference may have been exaggerated. Second, a decrease in the number of hospitalizations should not necessarily be equated with poor quality of care. Decreased hospital admissions and shortened hospital stays were anticipated consequences of PPS. Indeed, one could argue that before PPS the inpatient setting was overused. Without data on patients' clinical outcomes before and after PPS, this hypothesis cannot be discounted. Nevertheless, the previously cited study of DM supports the hypothesis that glycemic control may have worsened after PPS.¹⁰

Targeted Interventions.—An alternative to hospitalizing patients with DM is to increase the

investment of resources in the less expensive ambulatory-care setting and to reserve more resource-intensive (and expensive) interventions for patients at greatest risk for morbidity or hospital admission. Such a strategy is consistent with good clinical practice and does not provoke questions of jeopardizing the quality of care in order to contain costs. Identifying patients at greatest risk for admission to the hospital would maximize the cost-effectiveness of the interventions.¹¹

In order to target interventions, clinically useful models that identify patients at increased risk for morbidity, mortality, or hospital admission must be developed. Moreover, such predictive models must be validated to ensure their accuracy. Importantly, potential predictors should be reliable, inexpensive, and easy to obtain and should include a wide range of factors (for example, physiologic, clinical, social, functional status, and prior utilization variables).

In the literature, only Smith and associates^{12,13} have developed and validated such a model in patients with DM. Specifically, this model suggests that patients with DM have the following risk factors for nonelective hospitalizations: more emergency room visits during the preceding 6 months, hypoalbuminemia, cardiomegaly, anemia, systolic hypotension, and hyperglycemia.^{12,13} The current study by Panser and colleagues is an additional important contribution to the literature in that it focuses specifically on patients with NIDDM. Although the population of Rochester, Minnesota, may not be representative of the United States, the data base used to develop their model is extraordinarily rich and complete. Their model may have been strengthened by validation in patients randomly selected from the sample. Moreover, distinguishing between elective and nonelective hospital admission may have been beneficial, the latter being more common and, perhaps, more likely to be prevented by treatment delivered in the ambulatory-care setting.^{12,13}

Ambulatory Care.—On the basis of the foregoing discussion, the ambulatory-care setting will assume even greater importance for most patients with DM. In order to be successful, the

first priority is to ensure that patients keep their scheduled appointments. In addition to removing barriers to access (such as transportation and cost), low-cost strategies to encourage attendance may be used. Studies have shown that simple interventions can decrease missed appointments and increase the number of ambulatory-care contacts; however, more potent interventions may be needed to reduce hospital admissions or improve glycemic control.¹⁴

If patients with DM visit their ambulatory-care physicians, determining what should be done to improve their clinical outcomes represents a critical issue. Even intensive education programs that are tailored to the knowledge deficits of patients with DM, by themselves, seem unlikely to improve glycemic control.¹⁵ This finding indicates that merely increasing patients' knowledge may not be sufficient to alter clinical outcomes. Moreover, because the time-consuming task of outpatient education is often not reimbursable, the incentive to complete such a program is decreased.

Increased Patient Participation.—An alternative strategy is to increase patients' involvement in their care. When patients are taught to review their medical charts, identify relevant medical decisions, and use negotiation skills during their clinical encounters, substantial improvements in glycemic control have been observed.¹⁶ Although these results are impressive, pragmatic barriers to implementing such an intervention in an already hectic clinical environment are formidable. Alternative strategies that balance the intensity, feasibility, and expense of an intervention must continue to be evaluated.

Summary.—NIDDM is prevalent, leads to substantial morbidity, mortality, and use of health-care resources, and necessitates complex regimens for patients to manage their disease. The current study by Panser and associates provides additional evidence that patients with NIDDM have been hospitalized less often since the implementation of PPS. Because a reversal in the trend of decreased inpatient treatment is improbable and may not necessarily be desirable, increased emphasis must be placed on the

ambulatory-care setting. Multifaceted strategies are likely to be needed to improve clinical outcomes and to reduce hospital use further in patients with DM. For enhancement of the cost-effectiveness of interventions, research validating predictive models that can easily be used by clinicians must be encouraged. Furthermore, algorithms should be developed to identify patients with NIDDM most likely to benefit from hospitalization.

Morris Weinberger, Ph.D.
Center for Health Services Research
in Primary Care, Veterans Affairs
Medical Center
Center for the Study of Aging and
Human Development, Duke
University Medical Center
Durham, North Carolina

REFERENCES

1. Centers for Disease Control, Division of Diabetes Translation: Diabetes Surveillance: Policy Program Research, 1990 Annual Report. Atlanta, Centers for Disease Control, 1990
2. Harris MI: Prevalence of noninsulin-dependent diabetes and impaired glucose tolerance. *In* Diabetes in America. Edited by MI Harris, RF Hamman. NIH Publication No. 85-1468. Washington, DC, US Government Printing Office, August 1985, pp VII-VI3, 1985
3. Carter Center of Emory University: Closing the gap: the problem of diabetes mellitus in the United States. *Diabetes Care* 8:391-406, 1985
4. Taylor AK: Medical expenditures and insurance coverage for people with diabetes: estimates from the National Medical Care Expenditure Survey. *Diabetes Care* 10:87-94, 1987
5. Center for Economic Studies in Medicine: Direct and Indirect Costs of Diabetes in the United States in 1987. Alexandria, Virginia, American Diabetes Association, 1988
6. Huse DM, Oster G, Killen AR, Lacey MJ, Colditz GA: The economic costs of non-insulin-dependent diabetes mellitus. *JAMA* 262:2708-2713, 1989
7. Greene DA: Acute and chronic complications of diabetes mellitus in older patients. *Am J Med* 80 (Suppl 5A):39-53, 1986
8. Nathan DM, Singer DE, Godine JE, Perlmutter LC: Non-insulin-dependent diabetes in older patients. *Am J Med* 81:837-842, 1986
9. Funnell MM: Role of the diabetes educator for older adults. *Diabetes Care* 13 (Suppl 2):60-65, 1990

10. Weinberger M, Ault KA, Vinicor F: Prospective reimbursement and diabetes mellitus: impact upon glyce-mic control and utilization of health services. *Med Care* 26:77-83, 1988
11. Safran C, Phillips RS: Interventions to prevent read-mission: the constraints of cost and efficacy. *Med Care* 27:204-211, 1989
12. Smith DM, Norton JA, Roberts SD, Maxey WA, McDonald CJ: Unexpected hospital admissions among patients with diabetes mellitus. *Arch Intern Med* 143:41-47, 1983
13. Smith DM, Weinberger M, Katz BP: Predicting nonelective hospitalization: a model based on risk factors associated with diabetes mellitus. *J Gen Intern Med* 2:168-173, 1987
14. Smith DM, Weinberger M, Katz BP: A controlled trial to increase office visits and reduce hospitalizations of diabetic patients. *J Gen Intern Med* 2:232-237, 1987
15. Mazuca SA, Moorman NH, Wheeler ML, Norton JA, Fineberg NS, Vinicor F, Cohen SJ, Clark CM Jr: The Diabetes Education Study: a controlled trial of the effects of diabetes patient education. *Diabetes Care* 9:1-10, 1986
16. Greenfield S, Kaplan SH, Ware JE Jr, Yano EM, Frank HJL: Patients' participation in medical care: effects on blood sugar control and quality of life in diabetes. *J Gen Intern Med* 3:448-457, 1988

