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Nutritionist Visits, Diabetes Classes, and Hospitalization Rates and Charges: the Urban Diabetes Study

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Abstract

Objectives—We evaluated the association of different types of educational visits for diabetic patients of the 8 Philadelphia Health Care Centers (PHCCs), (public safety-net primary care clinics), with hospital admission rates and charges reported to the Pennsylvania Health Care Cost Containment Council.

Research Design and Methods—The study population included 18,404 patients who had a PHCC visit with a diabetes diagnosis recorded between March 1, 1993 and December 31, 2001 and had at least one month follow-up time.

Results—A total of 31,657 hospitalizations were recorded for 7,839 (42.6%) patients in the cohort. After adjustment for demographic variables, baseline comorbid conditions, hospitalizations prior to the diabetes diagnosis, and number of other primary care visits, having had any type of educational visit was associated with 9.18 fewer hospitalizations per 100 person years (95% confidence interval [CI] 5.02 to 13.33), and $11,571 less (95% CI $6,377 to $16,765) in hospital charges per person. Each nutritionist visit was associated with 4.70 fewer hospitalizations per 100 person years (95% CI 2.23 to 7.16) and a $6,503 reduction (95% CI $3,421 to $9,586) in total hospital charges.

Conclusions—Any type of educational visit was associated with lower hospitalization rates and charges. Nutritionist visits were more strongly associated with reduced hospitalizations than diabetes classes. Each nutritionist visit was associated with a substantial reduction in hospital charges, suggesting that providing these services in the primary care setting may be highly cost-effective for the health care system.

Self-management is the cornerstone of modern diabetes care and providing patients with the information, skills, and support they need to manage the disease is a critical issue for health care providers and systems.(1)

Self-management education can be provided to patients with diabetes in a variety of settings, using any of a variety of models and methods.(2) Education may be provided in a one-onone format or in group settings. Patients may receive instruction incidentally to other health-care encounters, or in a single educational visit or a scheduled series of classes. In spite of the variety of educational models present in the U.S. health care system, most patients with diabetes

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receive no formal diabetes education.(3) This problem exists throughout the U.S. health care system, but is exacerbated for providers who serve low-income and other disadvantaged populations.(4)

Effective diabetes education in conjunction with effective medical management has been shown to improve glycemic control, which in turn reduces hospital admissions and a range of other adverse diabetes outcomes.(1,5,6) Few studies, however, have directly examined the association between diabetes education and hospitalizations.(7-9) Here we report on analyses of the association between diabetes education visits and hospital admissions for a large, urban, safety-net primary care system.

Research Design and Methods

Data Source

The Urban Diabetes Study linked primary care encounter form data for patients with diabetes from the Philadelphia Health Care Centers (PHCCs) with hospital discharge data from the Pennsylvania Health Care Cost Containment Council (PHC4). Death records for Philadelphia residents were examined to identify patient deaths during the study period. The PHCCs are a network of 8 neighborhood health care centers operated by the Philadelphia Department of Public Health. Patients receive primary care services, including pharmacy, without reference to insurance status or ability to pay. The Urban Diabetes Study included every PHCC patient for whom a diagnosis of diabetes was recorded at any time between March 1, 1993 and December 31, 2001. Encounter form data include up to 4 diagnostic codes for each visit. These patients were linked with data on hospital discharges from PHC4 for the same time period, using an algorithm including Social Security number, date of birth, and sex.(10) The Urban Diabetes Study was approved by the Institutional Review Board of the Philadelphia Department of Public Health.

Study Variables

The PHCC encounter form data include codes for nutritionist visits, diabetes classes, and health education visits. We examined these types of visits individually, as well as receipt of any of the 3 types of educational visit.

The content of the visits and the credentials of the personnel providing education varied between individual clinics and over time during the study period. Some patients had visits of several types because they had individual assessment counseling sessions before and after scheduled diabetes classes, which were coded as health education visits. Others were scheduled for individual nutritionist or health education visits because diabetes classes were not currently available. Nutritionist visits were one-on-one, and might have included nutrition counseling, instruction in managing insulin and other medications, or instruction in the use of blood glucose meters. Some nutritionists were registered dietitians (and also certified diabetes educators) while others had relevant training and experience but not professional registration or certification. Health education visits were also one-on-one, and may have addressed diabetes management, smoking cessation, or other topics. Health educators either had a degree in that field or relevant training and experience. Additional information on education content is available in the On-Line Only Appendix.

Diabetes classes, covering all of these topics, were group classes led by a nurse, nutritionist, or health educator. Curricula were developed and refined during the study period under the direction of a Master's prepared registered nurse/ certified diabetes educator. Programs at 6 of the PHCC clinics received recognition through a state program in 2000 and 3 of the clinics were in the process of obtaining ADA education recognition at the end of the study period in 2001.

PHC4 receives data on each hospital admission from every hospital in Pennsylvania, as mandated by state law. All hospitalizations for the patients identified were included, whether any diabetes-related condition was coded in the hospital discharge record or not.(10)

Demographic variables were taken from the PHCC encounter form records, with age calculated as the time from date of birth to the first diabetes diagnosis in PHCC. Comorbid conditions, including heart disease, kidney disease, lower extremity ulcers, stroke, eye disease, and hypertension, were assessed based on diagnoses in either the primary care or hospital discharge records.(11) The total number of PHCC visits other than educational visits was also calculated for each patient.

Follow-up time for each patient was defined as the time from the first date of a diabetes diagnosis in the PHCCs to the date of death, if a death was recorded, or until the end of the study period.

Analysis

Two different outcome variables were modeled in separate linear regression models: hospitalization rate (number of hospitalizations during follow-up / follow-up time) and hospital charges (total charges for all hospitalizations during follow-up). Each of 6 educational visit variables was tested: having had at least one educational visit of any type; the number of educational visits of any type; having had at least one diabetes class; having had at least one nutritionist visit; the number of diabetes classes; and the number of nutritionist visits.

The associations of each educational visit variable with the two outcomes were tested in unadjusted analyses and in models controlling for other factors potentially associated with hospitalizations. Adjusted models included both demographic and clinical variables. The demographic variables controlled were sex, race/ethnicity, age at baseline, date of initial diagnosis and the interaction between gender and age, which had previously been found to be associated with hospitalization rates. (10) The baseline patient clinical variables included the number of hospitalizations recorded prior to the first outpatient diabetes diagnosis and comorbid conditions (heart disease, kidney disease, lower extremity ulcers, stroke, neuropathy, eye disease, and hypertension) recorded prior to the first outpatient diabetes diagnosis and, in order to minimize confounding by access to care and patient engagement, the number of PHCC visits other than educational visits.

Models including interactions between educational visit variables and sex or race/ethnicity were examined. Models restricted to patients who had some type of educational visit were also analyzed. All analyses were carried out using SAS 9.1.(12)

Results

Study Population

During the study period, 19,437 patients were diagnosed with diabetes in the PHCCs; 18,404 of these patients (94.7%) had adequate information to allow linkage to hospital discharge records and follow-up time of at least one month. Mean follow-up time was 4.7 years. The study population was 56.7% female (Table 1). Most patients (73.0%) were African-American; 12.2% were non-Hispanic whites, 9.8% were Hispanic, and 3.0% were Asian.

Of these patients, 1,054 (5.7%) had at least one diabetes class visit, 1,683 (9.1%) had at least one nutritionist visit, and 332 (1.8%) had a health education visit; 2,465 (13.4%) patients had at least one of any of these educational visits. Among the patients who had at least one diabetes class, the mean number of classes was 5.7; among those who had at least one nutritionist visit,

the mean number of such visits was 1.6; among those who had other health education visits, the mean number of such visits was 1.5.

Differences in baseline comorbidities between patients who had educational visits and those who did not were small; hypertension was more prevalent among patients who did receive educational visits while kidney disease and lower extremity ulcers were more prevalent among those who did not. The two groups did not differ significantly in the baseline prevalence of heart disease, stroke, or eye disease.

The mean number of PHCC visits other than educational visits was 25.2. This variable was strongly correlated with the number of educational visits ($r = 0.20$, $p < 0.001$).

Aggregate Rates and Charges

A total of 31,653 hospitalizations were recorded for the study population, for a rate of 36.4 hospitalizations per 100 person years. Aggregate hospital charges were $848,103,288, an average of $46,083 per person, or $9,760 per person year, averaged across all patients including the majority who were not hospitalized at any time during follow-up.

The hospitalization rate for patients who had no educational visits during follow-up was 38.1 per 100 person years (Table 2). For patients who had at least one educational visit, the hospitalization rate was 34% lower at 25.0 per 100 person years. Patients who had at least one visit with a nutritionist had a hospitalization rate of 21.1 per 100 person years, 45% lower than the rate for patients who had no education visits. Rates for patients who attended a diabetes class or saw a health educator were intermediate between the rates for those who saw a nutritionist and those who had no educational visits.

Associations with Educational Visits of Any Type

In both unadjusted and adjusted models, having had any educational visit was strongly associated with lower rates of hospitalization, as were the number of educational visits (Table 3).

In the adjusted models, having had at least one educational visit was associated with 9 fewer hospitalizations per 100 person years (95% confidence interval (CI), 5 to 13). Each educational visit of any type was associated with 1 fewer hospitalization per 100 person years (95% CI 0 to 2). Hospital charges were substantially reduced among patients who had an educational visit. At least one educational visit was associated with hospital charges that were $11,571 lower (95% CI −$6,377 to −$16,765). Each educational visit was associated with a reduction of $1,793 (95% CI −$817 to −$2,770) in hospital charges.

Associations with Specific Types of Educational Visits

Although nutritionist visits, diabetes classes, and health educator visits were each associated with reduced hospitalizations in unadjusted models, nutritionist visits were consistently associated with the greatest reductions in hospitalizations and hospital charges. Having had at least one nutritionist visit was associated with 11 fewer hospitalizations per 100 person years (95% CI, 6 to 16) and $13,872 less in hospital charges (95% CI, $7,799 to $19,945) in the adjusted model. Each nutritionist visit was associated with 5 fewer hospitalizations per 100 person years (95% CI, 2 to 7) and $6,503 less in hospital charges (95% CI, $3,421 to $9,586). Each diabetes class was associated with a reduction of $1,396 in hospital charges (95% CI, $254−$2,538).

Restricting the analyses to patients who had at least one educational visit did not alter the conclusions. There was no evidence of interaction between the study variables and sex or race/ethnicity.

Conclusions

In this large, unselected cohort of low-income primary care patients with diabetes, attending at least one visit devoted specifically to patient education was associated with significantly lower rates of hospitalization and hospital charges. Having had any educational visit, as opposed to none, was associated with 8 fewer hospitalizations per 100 person years; each educational visit was associated with $1,684 less in total hospital charges per patient over the course of follow-up.

Other investigators have found that diabetes education was associated with decreased hospital admissions in trials in managed care organizations (8) and mixed-income primary care systems. (7) A small program for Medicaid recipients in Arkansas found that over a one year time period participants had an estimated 0.37 fewer hospital admissions after adjustment for demographic variables, prior drug treatment, and prior period Medicaid costs. Total Medicaid expenditures, including the costs of the diabetes education program, were not significantly different from those of non-participants.(9)

Our finding that individual nutritionist visits were more strongly associated with improved outcomes than were group diabetes classes differs from most other studies (13,14) Most studies that have compared group with individual diabetes education strategies have found equivalent outcomes, with some finding improved short-term intermediate outcomes for group participants.(14) Greisinger, et al., found that diabetes classes were associated with improved outcomes but individual sessions with a Certified Diabetes Educator were not.(7) The difference in our findings may reflect differences in the specific services offered or in the time period. Our study covered hospitalizations 1993−2001, while Greisinger, et al., assessed hospitalizations in 2002. Alternatively, the inner-city, low-income patients served by the PHCCs may respond differently to these services than higher-income patient populations, or nutritionists in this public health system may have been more focused on the educational needs of patients with diabetes than most clinicians in other health care systems. A review of interventions designed to improve diabetes care for socially disadvantaged populations identified one-on-one interventions with individualized assessment and reassessment as one of the features associated with the most positive effects (15) and patients with low literacy were found to derive greater benefits in an assessment of a disease management program emphasizing one-on-one counseling.(16) Our findings are consistent with the evidence that group-based diabetes education results in better outcomes than “usual care,” or no formal diabetes education.(17)

Most other studies of diabetes education have included only intermediate clinical outcomes such as glycemic control, cholesterol levels, and body mass index, and have included relatively short follow-up periods. Some studies suggest that the intermediate clinical effects of diabetes education on these intermediate outcomes declined substantially within a few months after the end of the intervention.(18) This study offers additional evidence that participation in diabetes education is associated with significant differences in important clinical outcomes over a mean 4.7 year follow-up period.

As with any observational study, our analyses are vulnerable to confounding. Diabetic patients who attend educational visits may be systematically different from those who do not, in ways that are associated with improved outcomes. However, we did find that in this patient population, patients with comorbid conditions were more likely than other patients to have had

an educational visit, suggesting that the factors influencing selection into the "intervention" group were not one-sided. In addition, we controlled for a wide range of baseline clinical factors, including the number of hospitalizations recorded prior to the diabetes diagnosis as well as major comorbid diagnoses. We also controlled for the number of primary care visits other than educational visits each patient had during the course of followup as an indicator of patient engagement and access to care. This variable was also strongly associated with better patient outcomes, and was responsible for much of the attenuation of the education effects seen in the adjusted models. Although residual confounding associated with patient characteristics could still have affected the results, inclusion of these patient variables substantially reduces the magnitude of any remaining bias.(19)

Patients who received educational visits were more likely to be between the ages of 45 and 64 at baseline than were those who did not. However, restricting the analyses to this age group did not alter the conclusions.

Patients were offered one type of education or the other based on what was available at that time at the health care center they attended. Confounding by indication is unlikely to occur in this situation,(20) although we cannot exclude the possibility that the availability of diabetes education classes was associated with other factors that affected outcomes. The finding that nutritionist visits had a stronger association with hospital admissions and charges than diabetes classes is strengthened by its robustness irrespective of the model used. There is no reason to believe that patients were selected into one or the other type of visit based on their preexisting characteristics. None the less, we cannot rule out the possibility that our findings are vulnerable to selection bias.

Our analyses are based on administrative data, which are prone to error, and did not include some important clinical variables, such as body mass index, blood pressure, or glucose values. The data are, however, not subject to biases associated with self-reporting of health care use. Although the long time period covered allows us to examine outcomes over a mean 4.7 years of follow-up, the availability and content of diabetes education was not uniform throughout the period and does not reflect more recent practices.

These data reflect outcomes not in a controlled clinical trial environment but in the real-world practice of a large, urban public health care system. Outcomes were hospital admissions—a clinical event representing substantial patient morbidity and burden—and hospital charges. The finding that, for this large population, attendance at even one educational visit was associated with substantially reduced hospitalization rates and hospital charges provides important evidence that providing formal diabetes education is an important and cost-effective imperative in primary care settings.

We have no data on how many patients were offered diabetes education but did not take advantage of it. This occurs frequently (21,22), although there are few data available on patient recruitment to diabetes education outside of the research setting. This problem may be especially severe for low-income and less-educated patients.(23) A program offered to 1968 eligible Medicaid patients in Arkansas succeeded in enrolling only 212 patients.(9) Retention of patients in diabetes education programs that involve multiple sessions is also problematic. (9,23,24) The finding that any type of educational visit was beneficial suggests that health care providers will do well to provide diabetes education in whichever format providers can support and patients will attend. The ideal form of diabetes education may well vary between systems and between patient populations. These findings underscore the importance of focusing on both feasibility for health care systems and acceptability to patients (or "adoption" and "reach," in the "RE-AIM" evaluation framework) in designing and evaluating educational interventions. (21)

Our most important finding is that either diabetes classes or nutritionist visits in any quantity were strongly associated with reductions in patient hospitalizations in hospital charges. The average annual hospital charges for patients who received any educational visit were $6,244, 39% less than the $10,258 per year average for patients who had no such visits. If the proportion of diabetic patients receiving education could be raised to the Healthy People 2010 goal of 60%,(3) the data suggest that tens of millions of dollars in hospital charges and tens of thousand of hospitalizations could be avoided each year, just among patients of one large primary care system. Many safety-net providers find that obtaining payment for diabetes education from insurers is so burdensome that the payments do not effectively compensate for the effort required.(25,26) Both public and private insurers would be well advised to invest in efforts to improve the “reach” of diabetes education in order to reduce both long-term costs and human suffering for the large and growing population of patients with diabetes.

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Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Table 1

Study Population

	Total N (%)	No diabetes education visits N (%)	One or more diabetes education visits N (%)
Sex			
Female	10432 (56.7)	8865 (55.6)	1567 (63.6)
Male	7972 (43.3)	7074 (44.4)	898 (36.4)
Race/ethnicity			
Black	13426 (73.0)	11492 (72.1)	1934 (78.5)
White	2252 (12.2)	1985 (12.5)	267 (10.8)
Hispanic	1799 (9.8)	1619 (10.2)	180 (7.3)
Asian	559 (3.0)	525 (3.3)	34 (1.4)
Other	356 (1.9)	306 (1.9)	50 (2.0)
Unknown	12 (0.1)	12 (0.1)	0 (0.0)
Age Group			
0−34	2493 (13.6)	2290 (14.4)	203 (8.2)
35−44	3490 (19.0)	3033 (19.0)	457 (18.5)
45−54	4577 (24.9)	3806 (23.9)	771 (31.3)
55−64	4732 (25.7)	3959 (24.8)	773 (31.4)
65−74	2248 (12.2)	2025 (12.7)	223 (9.0)
75+	864 (4.7)	826 (5.2)	38 (1.5)
Baseline Comorbidities			
Prior hospitalization	4899 (26.6)	4208 (26.4)	691 (28.0)
Hypertension	3348 (18.2)	2784 (17.5)	564 (22.9)
Heart disease	1542 (8.4)	1326 (8.3)	216 (8.8)
Stroke	376 (2.0)	332 (2.1)	44 (1.8)
Kidney disease	211 (1.1)	200 (1.3)	11 (0.4)
Lower extremity ulcers	160 (0.9)	149 (0.9)	11 (0.4)

Table 2

Hospitalization Rates and Charges

	Patients	Hospitalizations per 100 Person Years	Hospital Charges per Person Year
All patients	18404	36.43	$9,760
No educational visits	15939	38.05	$10,258
Any educational visit*	2465	24.96	$6,244
Any nutritionist visit*	1683	21.06	$4,744
Any diabetes class*	1054	29.12	$7,788
Any other health educator visit*	332	24.26	$5,961

* These groups are not mutually exclusive

Table 3

Associations with Hospitalization Rates and Charges

	Unadjusted Models				Adjusted Models*			
Educational Variable	**Hospitalizations per 100 Person Years**		**Hospital Charges**		**Hospitalizations per 100 Person Years**		**Hospital Charges**	
each educational variable was modelled separately	**parameter (95% CI)**	**p-value**	**parameter (95% CI)**	**p-value**	**parameter (95% CI)**	**p-value**	**parameter (95% CI)**	**p-value**
Any educational visit**	−18.84 (−23.21,−14.46)	<.001	−$21710 (−$26974,$16446)	<.001	−9.18 (−13.33,−5.02)	<.001	−$11571 (−$16765,−$6377)	<.001
Any nutritionist visit	−22.49 (−27.66,−17.33)	<.001	−$30730 (−$36943,−$24517)	<.001	−10.72 (−15.58,−5.86)	<.001	−$13872 (−$19945,−$7799)	<.001
Any diabetes class	−10.51 (−16.93,4.09)	0.001	−$5778 (−$13505,$1949)	0.14	−5.49 (−11.47,0.49)	0.07	−$6913 (−$14386,$559)	0.07
Number of educational visits** (per visit)	−2.26 (−3.09,−1.43)	<.001	−$2545 (−$3544,−$1546)	<.001	−1.12 (−1.90,−0.33)	0.01	−$1793 (−$2770,−$817)	<.001
Number of nutritionist visits (per visit)	−9.46 (−12.11,−6.82)	<.001	−$13043 (−$16222,−$9864)	<.001	−4.70 (−7.16,−2.23)	<.001	−$6503 (−$9586,−$3421)	<.001
Number of diabetes classes (per class)	−1.75 (−2.73,−0.77)	<.001	−$1467 (−$2646,−$289)	0.01	−0.82 (−1.71,0.10)	0.08	−$1396 (−$2538,−$254)	0.02

* Adjusted for demographic variables and baseline hospitalizations, heart disease, kidney disease, stroke, lower extremity ulcers, neuropathy, eye disease, and hypertension and number of other primary care visits

** These include dietitian visits, diabetes classes, and health educator visits.