

Effect of a Nurse-Directed Diabetes Disease Management Program on Urgent Care/Emergency Room Visits and Hospitalizations in a Minority Population

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OBJECTIVE — To evaluate whether nurse-directed diabetes care reduced preventable diabetes-related urgent care/emergency room visits and hospitalizations in a minority population.

RESEARCH DESIGN AND METHODS — Diabetic patients who receive care in a county public health clinic were randomly selected for a Diabetes Managed Care Program (DMCP) in which a specially trained nurse followed detailed treatment algorithms to provide diabetes care for 1 year. Preventable diabetes-related urgent care/emergency room visits and hospitalizations for these patients incurred during the intervention year and the year before enrollment were compared. Preventable diabetes-related causes were defined as metabolic (diabetic ketoacidosis, hyperglycemia, or hypoglycemia) or infection (cellulitis, foot ulcer, osteomyelitis, fungal infection, or urinary tract infection).

RESULTS — Use of the urgent care/emergency room and hospitalizations during the intervention year and the year prior were available for 331 patients who completed the DMCP intervention. There were 94 total urgent care/emergency room visits and hospitalizations in the year before entering the DMCP and 46 during the DMCP year, a 51% reduction. Preventable diabetes-related episodes were far fewer. During the prior year, 14 patients made 15 urgent care/emergency room visits and 5 patients incurred 6 hospitalizations. During the DMCP year, four different patients made five emergency room/urgent care visits and one other patient was hospitalized. Preventable diabetes-related use was significantly ($P < 0.001$) lower during the intervention year compared with the prior year. Total charges for urgent care/emergency room visits and hospitalizations only (not other charges related to diabetes care) during the year before entering the DMCP were \$129,176 compared with \$24,630 during the DMCP year.

CONCLUSIONS — When compared with usual care, nurse-directed diabetes care resulted in significantly fewer urgent care/emergency room visits and hospitalizations for preventable diabetes-related causes. Policy makers seeking to improve diabetes care and conserve resources should seriously consider adopting this approach.

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The American Diabetes Association (ADA) has promulgated evidence-based guidelines that lead to improved diabetes care processes and outcome measures (1). Disappointingly,

all three outcome measures (A1C, LDL cholesterol, and blood pressure levels) are met in <10% of people with diabetes (2–4). Unfortunately, most approaches used to improve diabetes outcome measures

have been ineffective in practice. These include: 1) reminding patients about appointments (5,6); 2) providing feedback information on patients to their treating physicians (7–10), even when treatment recommendations for the patient were included (11,12); 3) case management (when the case manager could not make treatment decisions) (13,14); 4) physician education (15,16); and 5) multifaceted quality improvement interventions in the practice setting (17,18).

Outcomes of diabetes care are generally worse in minority populations (19), though there are very few intrinsic racial/ethnic differences that can account for the increased complications of diabetes in these populations. With the exception of a slight increase in renal disease, complications among minorities were similar to those in Caucasians when everyone had access to the same medical care (20,21).

To improve diabetes care in an inner-city population, we completed and recently published the results of a Diabetes Managed Care Program (DMCP) in which a specially trained registered nurse treated 367 patients following detailed treatment algorithms for diabetes care for 1 year (22). An endocrinologist (M.B.D.) was available by phone and met with the nurse once a week. ADA process measures were met 98% of the time, and the mean and median A1C levels were 7.0 and 6.7%, respectively. Sixty percent of the patients met the ADA A1C goal and 82% the LDL cholesterol goal.

This article describes the effect of nurse-directed diabetes care on preventable diabetes-related urgent care/emergency room visits as well as hospitalizations in the 331 diabetic patients who completed the DMCP intervention and also received usual care in the same clinic for the year before program enrollment.

RESEARCH DESIGN AND METHODS

A total of 367 diabetic patients were randomized and followed by a specially trained nurse in the DMCP for 1 year (22). Of those, 331 patients had

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Abbreviations: ADA, American Diabetes Association; DMCP, Diabetes Managed Care Program.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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been followed in this county clinic during the year before entering the DMCP. The algorithms used to treat patients enrolled in the DMCP covered glycemic control including those for diet therapy alone; sulfonylurea agents and metformin, either alone or in combination; a glitazone added to maximal (tolerated) doses of metformin and a sulfonylurea agent; bedtime NPH insulin plus daytime oral antihyperglycemia drugs; and a split-mixed insulin regimen with NPH and regular insulin. There were also algorithms and protocols for evaluating and managing lipid disorders, evaluating nephropathy, and treating microalbuminuria (see online appendix, available at <http://dx.doi.org/10.2337/dc06-2022>).

Urgent care and emergency room visits were analyzed together because patients access the urgent care center when it is open at the community clinic and use the emergency room at the hospital when the clinic is closed. Thus, reasons for using one or the other is logistical, not medical. The urgent care/emergency room visits and hospitalizations during the DMCP year in these 331 patients were compared with the year before enrolling into the DMCP. This study received approval from the institution review board at Charles R. Drew University. Urgent care/emergency room and hospitalization data for these 331 patients were obtained from the county's management information system. The first five discharge diagnoses and the total charges specific for each visit or hospitalization (not charges related to diabetes care per se) were recorded. Preventable diabetes-related visits and hospitalizations were defined as either metabolic (diabetic ketoacidosis, hyperglycemia, or hypoglycemia) or infection (cellulitis, foot ulcer, osteomyelitis, fungal infection, or urinary tract infection). Other possible diabetes-related diagnoses that could not be realistically affected by 1 year of appropriate diabetes care, such as angina, myocardial infarction, stroke, and non-diabetes-related causes (e.g., gynecological surgery or psychiatric visits), were excluded from the analysis. The assignment of causes for visits and hospitalizations was carried out by one of the authors (A.A.) who was blinded to when (year prior or DMCP year) the visit or hospitalization occurred. When the primary reason for the urgent care/emergency room visit or hospitalization was not clear, she obtained the chart for review.

Continuous variables were analyzed

Table 1—Baseline demographic characteristics

Total patients (n)	331
Age (years)	51.8 ± 11.9
Duration of diabetes (years)	7.6 ± 7.1
Female (%)	84
Race/ethnicity	
African American	72 (21.8)
Latino	255 (77.0)
Caucasian	2 (0.6)
Asian	2 (0.6)
Type 1 diabetes	2 (0.6)
Type 2 diabetes	329 (99.4)

Data are years ± SD or n (%) unless otherwise indicated.

with the Student's paired *t* test. Categorical variables were analyzed with the χ^2 test. The rates of emergency room/urgent care visits and hospitalizations were analyzed with a Z test for the difference of two Poisson rates. Significance was accepted at a 0.05 level (two tailed).

Table 2—Preventable diabetes-related urgent care and emergency room visits and hospitalizations

Patient	Activity	Diagnosis	Charges (\$)
Year prior			
1	UC/ER	Otitis externa and interna	350
2	UC/ER	Cellulitis/abscess	500
3	UC/ER	Hyperglycemia	125
4	UC/ER	Candidiasis	700
5	UC/ER	Hyperglycemia	300
5	Hospitalization	Hyperglycemia	13,670
6	Hospitalization	Hyperglycemia	6,835
7	UC/ER	Hyperglycemia	350
8	UC/ER	Hyperglycemia	1,300
9	UC/ER	Hyperglycemia	700
9	UC/ER	Hyperglycemia	500
10	UC/ER	Urinary tract infection	700
11	UC/ER	Hyperglycemia	700
12	UC/ER	Hyperglycemia	700
13	UC/ER	Hyperglycemia	700
14	UC/ER	Hyperglycemia	700
15	UC/ER	Hyperglycemia	175
16	Hospitalization	Pyelonephritis and DKA	13,670
17	Hospitalization	Cellulitis/abscess	20,505
18	Hospitalization	Cellulitis/abscess	18,856
18	Hospitalization	Osteomyelitis	47,140
DMCP year			
19	UC/ER	Fungal infection	125
20	UC/ER	Cellulitis/abscess	700
20	UC/ER	Follow-up cellulitis/abscess	700
21	UC/ER	Foot ulcer	700
22	UC/ER	Hyperglycemia	1,900
23	Hospitalization	Cystitis and hyperglycemia	20,505

DKA, diabetic ketoacidosis; UC/ER, urgent care/emergency room.

RESULTS— The baseline demographics of the 331 patients at time of entry into the DMCP are shown in Table 1. Baseline A1C levels were $8.8 \pm 2.5\%$ (SD), which fell to $7.1 \pm 1.4\%$ after 1 year in the DMCP ($P < 0.001$). At entry into the DMCP, 28% met the ADA A1C goal of $<7.0\%$ compared with 64% after 1 year ($P < 0.002$). At entry into the DMCP, 37% met the ADA LDL cholesterol goal, whereas 80% met it after 1 year ($P < 0.04$).

There were 95 total urgent care/emergency room visits and hospitalizations in the year before entering the DMCP compared with 52 during the DMCP year, a 45% reduction. However, there were far fewer visits and hospitalizations for preventable diabetes-related causes (Table 2). During the prior year, 14 patients made 15 emergency room/urgent care visits (11 for metabolic reasons and 4 for infections) and 5 patients had 6 hospitalizations (2 for a metabolic reason and 4 for infection). One patient had two ur-

gent care/emergency room visits, one had two hospitalizations, and a third had one of each.

During the DMCP year, four different patients made five urgent care/emergency room visits (one for a metabolic reason and four for infection) and another one was hospitalized for an infection. Note that there was only 1 episode of hyperglycemia during the DMCP year resulting in an urgent care/emergency room visit compared with the year before entering the DMCP in which 11 episodes of hyperglycemia caused urgent care/emergency room visits and 2 resulted in hospitalizations (Table 2). This difference highlights the marked effect of nurse-directed care on preventable diabetes-related metabolic causes of patients interacting with the medical care system outside of regular clinic hours. The difference between the year prior and the DMCP year for all preventable diabetes-related urgent care/emergency room visits and hospitalizations was significantly different ($P < 0.001$). Total charges specific for these urgent care/emergency room visits and hospitalizations during the year before entering the DMCP were \$129,176 compared with \$24,630 during the DMCP year.

CONCLUSIONS— Nurse (23–34)- and pharmacist (35–37)-directed care have been shown to yield better process and surrogate outcome measures when compared with standard medical care. Only one study evaluated a clinical outcome. Fewer patients cared for by a nurse developed diabetic retinopathy than those receiving standard care (38). This is the first study to compare urgent care/emergency room use and hospitalizations by patients with diabetes receiving nurse-directed care compared with standard care. The results convincingly demonstrate lower resource use among diabetic patients under nurse-directed care. Although there was no control group followed under standard care for 2 years to rule out the possibility that a learning curve accounted for these results, this seems highly unlikely. The average duration of diabetes was 7.6 years, surely long enough for patients to have learned how to take measures to avoid urgent care/emergency room visits and hospitalizations for preventable diabetes-related causes if they could. More likely, one of the reasons for the success of the DMCP was the self-management skills taught to the patients by the nurse during their year under her care.

There are several limitations to this study. Although it is possible that the patients used other centers that were not part of the county system resulting in an underestimate of actual services used, this is unlikely to have influenced the results for two reasons. First, only 15% of the population cared for in this county clinic have any medical insurance, making it unlikely for them to seek care elsewhere. Second, to account for these results, seeking care outside of the system would have had to occur much more frequently during the DMCP year than in the year prior, also very unlikely. The differences between nurse-directed and standard care may be greater in this minority population when compared with other populations. Finally, total charges do not reflect actual costs of care or reimbursement; therefore the amount of cost savings cannot easily be determined from these data.

In conclusion, nurse-directed diabetes care in this minority population resulted in less use of urgent care/emergency room centers as well as fewer hospitalizations for preventable diabetes-related conditions. Policy makers who seek to improve diabetes care and conserve resources should seriously consider adopting this approach.

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