Care Patterns and Outcomes for Hospitalized Patients with Diabetes in Nevada

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Abstract
This study demonstrates substantial differences between Nevada and the national average in patterns of hospital based care in patients with type 2 diabetes. Diabetic patients in Nevada are more likely to be hospitalized through the emergency department, and more likely to be admitted for a condition related to diabetes. Moreover, in Nevada, Medicaid and uninsured patients with diabetes are more likely to experience adverse outcomes then their privately insured counterparts. These differences may be primarily reflective of variances in access to ambulatory care, care seeking behavior, and availability of health services and facilities. Policies promoting expansion of health care benefits to include coverage for people at risk for type 2 diabetes and strengthening the ambulatory care services network, and system in the state, is necessary to reduce discrepancies in patterns of hospitalization and improve outcomes.

Key words: diabetes, uninsured, Nevada

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Diabetes is a widely recognized and common cause of mortality, morbidity, and excess cost within the health care system. It, like other chronic illnesses, is becoming increasingly prevalent in the U.S population. It is estimated that approximately 14 million Americans are affected by diabetes at a direct estimated cost of 45 to 86 billion (Bambauer, Soumerai, Adams, Mah, Zhang, & McLaughlin, 2004).
The Institute of Medicine (2001) report, "Crossing the Quality Chasm," outlines several essential components of a health care system that is effective in treating chronic illness. Planned physician visits with sustained follow up, availability of evidence based care, and active patient involvement are among the essential components discussed.

As one of the most predominant chronic illnesses, diabetes requires continuous care consisting of regular follow up, active patient participation, and evidence based care. Clinical outcomes in patients with diabetes are strongly related to personal choices regarding lifestyle, adherence to medications, and care seeking behavior. Studies have shown that these choices are significantly impacted by patients' belief systems, patients' interactions with environments, and other factors that are associated with differences in health behaviors and risk factors (Bautista, Molina, Montoya, & Serra, 2004; von Bothmer & Fridlund, 2005; Hepworth 1999; Wing, Shoemaker, Marcus, McDermott, & Gooding, 1990). Lack of any of the care components creates challenges for achieving optimal outcomes, which can contribute to delays in accessing care, increased reliance on emergency departments, and missed opportunities for early detection.

Diabetes is an ambulatory care sensitive (ACS) condition that can be largely treated on the outpatient basis. Adequate outpatient care makes it possible to have the condition under control and avoid unnecessary ED visits and hospitalization (Gaskin & Hoffman, 2000; Oster & Bindman, 2003). During the last decade or two, Nevada has been one of the fastest growing states in the nation. Healthcare delivery in Nevada is facing great challenges due to its fast growing economy and population including higher percentages of minorities and uninsured (Moseley and Sotero, 2006) who often encounter socioeconomic barriers to accessing the health care delivery system and to receiving adequate care (Schectman, Bovbjerg, & Voss, 2002; Sudore, et al., 2006). Lack of health care resources and the unavailability of health care providers and facilities can contribute to inadequate regular outpatient care for diabetic patients, which increases their chances of visiting the emergency department and of being hospitalized more frequently. However, with rapid population growth and economic development in Nevada, limited research has been done to evaluate differences in patterns of inpatient care for diabetic patients, which links these differences with access to ambulatory care, care seeking behavior, and the healthcare delivery infrastructure in the state.
In order to assess the appropriateness of the ambulatory care services for diabetic patients in Nevada, this study compared the types of hospitalization and the complications of hospital care for diabetic patients in Nevada with national benchmarks. The research question was whether

patients with diabetes in Nevada had different care-seeking patterns and were more likely to experience adverse effects of diabetes, using the national benchmarks as a reference.

Data and Methods

Data. Patient-level hospital discharge data were abstracted from the 2003 National Inpatient Sample (NIS), representing 20% of all hospital stays in community hospitals in the U.S.A. The NIS is maintained by the Hospital Cost Utilization Project sponsored by the Agency for Healthcare Research and Quality. All discharges with type 2 diabetes (regardless of whether this diagnosis was primary, secondary, tertiary, etc.) were selected. Non-adult discharges (age<18 years old) and discharges with pregnancy complications, as well as other diseases of the skin and subcutaneous tissue were excluded, because those patients had different clinical presentations. A total of 7,227 adult discharges from Nevada and 1,046,954 from other states with diabetes were selected.

Measures. Four dependent variables were used in the study. Hospital admission through emergency department was the first. Patients lacking of ambulatory care would also be more likely to be admitted through the emergency department (ED). The second and third variables were the category 1 and category 2 admissions, respectively. Based on the primary diagnosis, patients were divided into two categories based on the likelihood that the cause of the hospital admission was related to diabetes. The first category included hospitalizations generally unrelated to diabetes (e.g. the principle diagnosis being hip fracture, blood disorders, diseases of the nervous system and sense organs, etc.). The second category included those diagnoses which are virtually always associated with diabetes (e.g. the principle diagnosis being diabetes with hyperosmolar coma, diabetes with ophthalmic disease, diabetes with renal disease). A detailed description of diagnostic codes used was adopted from a previous study (Washington & Shen, 2006). It was expected that patients lacking ambulatory care would be more likely to be admitted under the second category and less likely to be in the first category. The last dependent variable was admissions with an acute hyperglycemic condition. These admissions were caused by acute hyperglycemia or hyperosmolar coma, indicating patients with poor control of diabetes.

The primary independent variable was a dummy variable, Nevada. The variable was given a value of "1" if a discharge was in a Nevada hospital and a value of "0" if a discharge was in a hospital in other states.

Statistical Analysis. The author used the weighted multiple logistic regression to test the research question: (1) whether patients with diabetes in Nevada had different care-seeking patterns; and (2) whether patients with diabetes in Nevada were more likely to experience adverse effects of diabetes, using the national benchmarks as a reference. The weighted model was used to control for the clustering factors among patients within individual hospitals, respectively. The analysis controlled for the potential influence of a set of covariates, such as patient demographics, health insurance status, and comorbidities, as well as hospitals characteristics. Literature has shown that cardiovascular disease and other medical comorbidities are positively associated with diabetic adherence, while depression is negatively associated with diabetic adherence (Hertz, Unger, & Lustile, 2005). Cardiovascular comorbidities, as well as other comorbidities defined by the AHRQ comorbidity list (e.g., renal disease, liver disease, stroke, overweight, and depression) were included (Elixhauser, Steiner, Harris, & Coffey, 1998). In addition, hospital characteristics such as bed size, teaching hospital status, and rural hospital status were also controlled.

Results

Table 1 shows the unadjusted descriptive results for diabetic patient admissions by category and includes demographic information on age and health insurance status, as well as hospitalization characteristics. Of note, patients in Nevada with private insurance were 3½ years older than their counterparts in other states, but Medicaid patients in Nevada were 1½ years younger than the national average. Uninsured patients in Nevada were slightly older (1/2 year) than the national average. In addition, Nevada had much lower female patient percentages than the national average, across all insurance subgroups. Females were more likely to be admitted with a category 1 diagnosis, but they were less likely to be admitted with a tier 2 or tier 3 diagnosis. And, although they had longer average lengths of stay, females incurred lower costs on average than male patients.

Nevada had considerably higher percentages of hospital admissions through emergency departments than the national average, regardless of the health insurance status. For example, 73.3% of Nevada patients with private insurance were admitted to hospital through ED, whereas the national average was only 54.0%. Nevada patients also had a lower percentage of being admitted with the category 1 diagnoses than that of the national average.

Table 1. Patients' Sociodemographic and Hospitalization Characteristics by Insurance Status: Nevada vs. the National Average*

	All Patient**		Private Insurance		Medicaid		Uninsured	
	Nevada	U.S.***	Nevada	U.S.***	Nevada	U.S.***	Nevada	U.S.***
Total sample	7227	1061408	2249	221834	1035	103169	220	33116
Socio-demographic characteristics								
Age at admission, mean years	63.2	66.7	59.7	56.2	52.9	54.5	52.3	51.8
(S.D.)	(13.6)	(10.9)	(12.3)	(11.1)	(11.6)	(12.5)	(11.5)	(11.8)
Age group								
18 – 39	2.4	3.7	10.3	13.3	24.0	20.0	22.3	25.1
40 – 49	5.8	9.0	22.3	28.4	28.6	29.3	28.6	33.1
50 – 59	11.6	17.4	35.0	42.5	36.8	35.4	42.7	33.1
60 – 69	40.9	23.0	19.6	9.9	6.6	8.7	5.5	5.2
70 – 79	30.9	27.4	10.7	4.7	3.3	5.0	0.9	2.7
>= 80	8.5	19.6	2.2	1.3	0.8	1.6	-	0.7
Female	46.3	54.0	44.6	46.6	47.3	63.3	45.9	47.2
Hospital Care								
Admission through ED	76.3	61.1	73.3	54.0	82.3	70.9	86.4	77.9
Category 1 admission	57.5	58.1	59.7	62.0	58.5	61.7	50.5	56.7
Category 2 admission	5.6	4.5	3.8	4.1	8.3	6.0	6.4	6.5
Outcome								
Average length of stay	6.0	5.6	5.2	4.7	7.6	6.0	4.5	4.9
(S.D.)	(7.5)	(6.4)	(6.1)	(5.5)	(12.2)	(9.0)	(5.8)	(6.3)
Median hospital cost ($)	6104	5874	6141	5684	5647	5481	4374	5053
Acute hyperglycemic condition	0.33	0.20	0.13	0.29	1.1	0.39	1.36	0.73
Discharge status equals death	3.1	3.0	2.2	1.8	1.4	2.0	2.3	1.7

S.D. – standard deviation

* Data are expressed as percentage unless otherwise indicated.

** Include Medicare patients and patients with other insurance statuses.

*** Include patients in Nevada

Table 2 shows the covariate adjusted results for the comparison between Nevada and the nation, which largely confirm the above unadjusted results. As compared to the national average, Nevada patients were less likely to be admitted with a category 1 condition (Odds ratio (OR), [95% confidence interval OR (CI)], 0.72 [0.69, 0.75]); they were more likely to be admitted through the ED (OR [CI], 2.11 [1.79, 2.47]); to be admitted with a category 2 condition (OR [CI], 1.29 [1.01, 1.65]); and to be admitted with an acute hypoglycemic condition (OR [CI], 1.73 [1.02, 2.93]).

Table 2. Comparison of Nevada with the National Average for Diabetes Care (n = 1061408)

	National	Nevada		
Response Variable	Odds Ratio	Odds Ratio [95% C.I.]	c-Score
Admission through ED	1.00	2.11 [1.79, 2.47]	0.63
Category 1 admission	1.00	0.89 [0.82, 0.96]	0.62
Category 2 admission	1.00	1.29 [1.01, 1.65]	0.67
Acute hyperglycemic condition	1.00	1.68 [0.94, 3.00]	0.77

C.I.: Confidence Interval

Table 3 shows the Nevada results across different insurance statuses. Compared to patients having private insurance, uninsured patients were less likely to be admitted with a category 1 condition, (OR [CI], 0.64 [0.48, 0.85]); were more likely to be admitted through the ED (OR [CI], 2.91 [1.93, 4.38]); and to be admitted with acute hyperglycemia complications (OR [CI], 9.34 [1.78, 49.00]). Furthermore, Medicaid patients, as compared to patients with private insurance, were more likely to be admitted through the ED (OR [CI], 2.12 [1.73, 2.61]); to be admitted with a tier 2 condition (OR [CI] 1.91 [1.37, 2.65]); and to be admitted with acute hyperglycemia (OR [CI], 7.53 [2.02, 28.6]).

Table 3. Comparison of Diabetes Care across Insurance Status in Nevada (n = 7227)

	Private Insurance	Medicaid	Uninsured	
Response Variable	Odds Ratio	Odds Ratio [95% C.I.]	Odds Ratio [95% C.I.]	c-Score
Admission through ED	1.00	2.12 [1.73, 2.61]	2.91 [1.93, 4.38]	0.64
Category 1 admission	1.00	0.86 [0.73, 1.02]	0.84 [0.48, 0.85]	0.60
Category 2 admission	1.00	1.97 [1.37, 2.65]	1.45 [0.79, 2.68]	0.68
Acute hyperglycemic condition	1.00	7.53 [2.02, 28.06]	9.34 [1.78, 48.10]	0.85

C.I.: Confidence Interval

Discussion

Looking at Nevada from the national perspective, Nevada diabetic patients were more likely to be admitted through the emergency department. Given that diabetes is an ambulatory care sensitive condition, many ED visits and ED admissions are preventable if the patient has adequate regular outpatient care (Gaskin & Hoffman, 2000; Oster & Bindman, 2003). The high hospital admission rate through the ED is an indication of lack of adequate outpatient care, which may result from both the demand and supply sides. On the supply side, Nevada is ranked at the bottom regarding almost all of the health care professionals (e.g., physicians, nurses, and hospital beds) and population ratios in the nation (Flowers, Gross, Kuo, & Sinclair, 2005). On the demand side, Nevada has high percentages of minorities, uninsured, and people with relatively low socioeconomic status, all of whom may be faced with barriers to access to outpatient care (Moseley & Sotero, 2006).

Nevada diabetic patients were more frequently admitted with conditions more directly related to the diagnosis of diabetes, and they were more likely to have diabetes associated complications. The consistent pattern of more diabetes related admissions among Nevada residents for category 2 patients suggests that patients in Nevada generally have more poorly controlled disease, as literature suggests in other places (Schectman, Nadkarni, & Voss, 2002). This may partly relate to the lack of health care providers and facilities (Flowers et al., 2005), and it may partly relate to the fact that Nevada has one of the highest percentages of minority and uninsured populations (Moseley & Sotero, 2006).

It is not surprising that, in Nevada, Medicaid and uninsured patients had a much higher chance of admission through the emergency department and for conditions associated with acute complications associated with uncontrolled diabetes like hyperosmolar coma. This finding suggests that Medicaid and uninsured patients are less likely to have access to regular ambulatory care and/or they may be less likely to adhere to treatment recommendations once care is accessed due to socioeconomic barriers or culturally related life styles and behavior. This merits further research.

Limitations of the study include: the NIS data did not allow for the examination of readmission; information about ambulatory care could not be traced through the linkage with other datasets; and that data on Latino/Hispanic patients with diabetic were not available. Given that Latinos/Hispanics have the highest uninsured rate among all racial/ethnic groups in the United Sates and approximately 20% of residents in Nevada are of Latino/Hispanic ethnicity, it would be important to examine patterns of care for Latino/Hispanic patients.

In conclusion, type 2 diabetes is a chronic illness where regular outpatient care and self management, including diet, lifestyle, and adherence to medications and medical follow up, are the keys to optimal outcomes (American Diabetes Association, 2007). Differences between Nevada and the other states may provide useful insight into modifying systems of diabetic care that take into account differences in adherence to care, access to care, treatment, lifestyle recommendations and follow up.

Findings in this study were consistent with the idea that patients in under-served areas or with socioeconomic disadvantages are more likely to suffer complications related to diabetes and to be admitted with a diagnosis directly related to acutely uncontrolled diabetes. Further research to evaluate the extent to which discrepancies in outcomes are related to access to care, care seeking behaviors, adherence to lifestyle and treatment recommendations versus the health care delivery resources and infrastructure are needed to determine how these various factors impact care outcomes in Nevada.

Policy initiatives that enhance the access to regular outpatient services for socioeconomically disadvantaged populations are likely to favorably impact care for type 2 diabetes in Nevada. Incentives should be created for health care providers to enroll Medicaid beneficiaries or uninsured into diabetic screening programs and to develop creative mechanisms for promoting regular follow up for Medicaid and uninsured patients with diabetes. More resources need to be allocated to actively recruit high risk populations into diabetic screening programs and into care at early stages, in order to improve the effectiveness and efficiency of the diabetic care.

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