

RISK MODIFICATION FOR DIABETIC PATIENTS ARE OTHER RISK FACTORS TREATED AS DILIGENTLY AS GLYCEMIA?

Baiju R. Shah,¹ Muhammad Mamdani,² Liisa Jaakkimainen,³ Janet E. Hux¹

¹Department of Medicine and Clinical Epidemiology and Health Care Research Program, University of Toronto, Institute for Clinical Evaluative Sciences, Toronto, ²Faculty of Pharmacy, University of Toronto Institute for Clinical Evaluative Sciences, Toronto, ³Department of Family and Community Medicine, University of Toronto Institute for Clinical Evaluative Sciences, Toronto

Corresponding Author: baiju.shah@ices.on.ca

ABSTRACT

Background

The importance of glucose control is recognized both by patients with diabetes and their physicians. However, other preventative interventions, such as using medications to manage lipid and blood pressure levels, are underused for diabetic patients.

Objectives

To determine whether patients with diligent glucose management are more likely to use medications that treat lipids and blood pressure.

Methods

Administrative data records were evaluated for all diabetic patients aged 65 or older residing in Ontario in 1999 without pre-existing coronary artery disease (n=161,553). Measures of diligent glucose management were insulin use and frequent capillary glucose testing (≥ 2 per day). Outcomes were prescription of a lipid-lowering drug or antihypertensive drug. Using multivariate modeling, odds ratios for each diligence measure were determined for each outcome, adjusting for age, sex, comorbidities, and other covariates.

Results

Patients using insulin did not have a clinically important difference in lipid-lowering drug use (adjusted odds ratio 0.9, 99% confidence interval 0.9–1.0, P=0.002) or antihypertensive drug use (adjusted odds ratio 1.1, 99% confidence interval 1.0–1.1, P<0.001) versus non-users. Adjusted odds ratios for frequent glucose testing were not significantly different from unity for either lipid-lowering or antihypertensive drug use.

Conclusions

Patients who required and were capable of diligent glucose management, which is invasive, expensive and time-consuming, were no more likely to use medications to control lipids or blood pressure. Preventative care for patients with diabetes may be too focused on glycemic control, and may be neglecting the management of other cardiovascular risk factors.

Key Words: diabetes mellitus; risk modification; drug prescriptions; administrative data

The optimal treatment of diabetes is complicated and time-consuming for patients and their physicians. It requires patients to employ self-management strategies, and to commit to regular physician visits, frequent laboratory

testing, and multiple pharmaceutical agents. This diligence is hoped to maintain and improve patient health.¹

However, many preventative interventions for diabetic patients are underutilized, despite

compelling evidence of their value. A survey of nearly 100,000 diabetic Medicare recipients found that fewer than half had received recommended ophthalmologic screening.² Data from the Third U.S. National Health and Nutrition Examination Survey indicated that more than one-third of diabetic patients had blood pressures above 140/90 mm Hg and more than half had LDL-cholesterol levels above 130 mg/dL.³ Another study showed that only 25% of diabetic seniors received lipid-lowering drugs (LLDs), despite the fact that 90% would have LDL-cholesterol levels above target values.⁴

Like glycemia regulation, screening for and management of these related conditions are important for maintaining patient health. Indeed, the UK Prospective Diabetes Study found that intensive blood pressure control was more efficacious at reducing both macrovascular and microvascular endpoints than was intensive glycemic control.^{5,6}

In this study, we sought to understand what factors predict treatment for dyslipidemia and hypertension among diabetic patients. We hypothesized that the receipt of LLDs and antihypertensive drugs (AHDs) would be associated with diligent glucose management. We posit this hypothesis not because dyslipidemia and hypertension are more prevalent among patients with diligent glucose management, but because lipids and blood pressure should be managed at least as diligently as glycemia, since glucose regulation requires considerably more effort, expense and time from both patients and physicians.

METHODS

Patient selection

This cross-sectional study used administrative data from Ontario. Because the government-administered health system provides insurance coverage to all residents, these data contain information on health service utilization for the population.

For example, the drug insurance program database lists prescriptions filled by all Ontario residents aged 65 or older for all medications under the provincial formulary. Individuals were linked deterministically between databases using an anonymized identification number.

Patients were identified from the Ontario Diabetes Database, a validated administrative data-derived registry of diabetic patients.⁷ The database does not distinguish type 1 from type 2 diabetes. The study population was defined as all individuals aged 66 or older who were diagnosed with diabetes on or before March 31, 1999, and who survived at least another six months. To ensure all patients were at similar cardiovascular risk, we selected a primary prevention cohort by excluding those who had had any hospital admissions for acute myocardial infarction, unstable angina, congestive heart failure or stroke within the previous five years.

Explanatory and outcome variables

Rather than examining the intensity of glucose control achieved, we chose measures that marked patients who were diligently managing their glucose levels using invasive and expensive interventions. These two explanatory variables were: insulin use, defined as the filling of at least one prescription for any insulin preparation between April 1 and September 30, 1999; and frequent monitoring, defined as the filling of prescriptions for at least 360 capillary glucose monitoring strips between those dates (approximately 2 strips per day).

The outcomes of interest were the receipt of LLDs or AHDs between April 1 and September 30, 1999. We counted all patients receiving medications that lowered blood pressure, including those who were prescribed AHDs primarily for other indications, such as angina or heart failure. We did not have patients' actual lipid or blood pressure measurements; instead, we were measuring risk modification behavior reflected by medication use.

Statistical analysis

Data were analyzed using SAS statistical software (SAS Institute, Cary, NC). For each drug class, the overall frequency of utilization was determined. Using multivariate logistic regression, each outcome variable was modeled against each explanatory variable and several pre-specified covariates.

These covariates included age, sex, duration of diabetes, rural residence, residence in a long-term care facility, eligibility for the low-income drug insurance program (annual income less than

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\$16,018 for a single person or \$24,175 for couples), visits to various medical specialists, and Bice and Boxerman's COC measure of continuity of primary care (dichotomized at the median).⁸

Also included were two measures of comorbidity: the number of drugs prescribed in the

previous year⁹ and number of hospitalizations in the previous year. All variables except age and number of drugs were dichotomous. The adjusted OR and 99% CI for the explanatory variable was determined in each model. Statistical significance was determined at the P = 0.01 level.

TABLE 1 Baseline differences between included and excluded patients, and between patients with diligent glucose management and those without. (Mean ± SDs or %.)

	Included patients (n=161,553)				Excluded patients [†]
	Insulin use		Frequent monitoring		
	Yes* (n=19,683)	No (n=141,870)	Yes* (n=9,748)	No (n=151,805)	
Age (years)	74.1 ± 6.2	74.8 ± 6.5	73.1 ± 5.4	74.8 ± 6.5	74.9 ± 7.2
Male sex	43.6	46.5	44.0	46.3	52.3
Rural residence	19.2	15.7	16.9 [§]	16.1	11.9
Long-term care facility residence	6.7	3.7	1.5	4.2	2.2
Low income	37.0 [§]	36.3	39.0	36.2	31.5
Duration of diabetes > 4 years	92.9	61.7	81.9	64.5	71.9
Higher continuity of primary care	50.6 [§]	50.8	48.1	50.9	59.6 [#]
Number of drugs prescribed	12.1 ± 6.5	9.1 ± 5.9	13.0 ± 7.1	9.3 ± 5.9	2.9 ± 5.1
Any hospital admission	20.1	13.6	19.1	14.1	6.9
Visit to an endocrinologist [‡]	40.2	17.9	41.6	19.3	11.9
Visit to a cardiologist	8.8	7.7	10.3	7.7	3.4
Visit to a nephrologist [‡]	26.2	15.3	26.8	16.0	9.7

* P < 0.001 vs. "No" except where indicated

† n = 19,567 except where indicated. P < 0.001 vs. included patients in all cases

‡ Includes general internists and geriatricians

§ P not significant vs. "No"

|| n = 7,099

n = 5,187

TABLE 2 Frequency of utilization of risk modifying drugs among elderly diabetic patients in Ontario, and adjusted odds ratios for drug utilization for each measure of diligent glucose management. (NS = not significant)

	Frequency of drug utilization	Insulin use		Frequent monitoring	
		Adjusted OR (99% CI)	<i>P</i> -value	Adjusted OR (99% CI)	<i>P</i> -value
Lipid lowering drugs	23.2%	0.9 (0.9–1.0)	0.002	1.0 (0.9–1.1)	NS
Antihypertensive drugs	65.7%	1.1 (1.0–1.1)	< 0.001	1.0 (0.9–1.0)	NS

RESULTS

There were 181,120 people with diabetes over the age of 66 in Ontario on March 31, 1999 who were still alive and resident in Ontario six months later, and who had no history of coronary artery disease. Of them, 19,567 (10.8%) were excluded because of missing values for one or more covariates.

The characteristics of the excluded patients and the remaining 161,553 patients are presented in Table 1. LLDs were used by 23.2% of elderly diabetic patients in the province, while AHDs were used by 65.7% (Table 2). Table 2 also shows the adjusted odds ratios for each measure of diligent glucose control from the models predicting LLD and AHD utilization. The associations between insulin use and both LLD use and AHD use were statistically significant, but their magnitudes were clinically unimportant. Frequent glucose monitoring was not statistically significantly associated with the receipt of either LLDs or AHDs.

DISCUSSION

Less than one quarter of elderly diabetic patients used LLDs, and less than two-thirds used AHDs. These utilization rates were much lower than expected, given the prevalence of dyslipidemia and hypertension in this population.^{3,10,11}

Several explanations for this finding can be postulated: physicians may be unaware of the importance of cardiovascular risk modification or of the recommendations in clinical practice

guidelines; risk modification may be perceived to be less beneficial given the patient's other medical conditions; or patients themselves may be unwilling to take additional medications.

Diligent glucose management is invasive and requires significant effort from patients and physicians. Therefore, those patients who bother to implement diligent management should be those at highest risk of complications. As a result, these patients should also be more conscientious with lipid and blood pressure management, since the prevention of diabetes complications requires management of all risk factors. In this study, however, these patients used LLDs and AHDs as infrequently as other elderly diabetic patients, indicating that diligent glucose management was not associated with more vigilant treatment of other cardiovascular risk factors. Those using diligent glucose management ought not to have differences in lipid and blood pressure levels from other patients.

Therefore, the lack of an association between lipid or blood pressure treatment and diligent glucose management may simply reflect appropriate risk factor treatment for all patients, regardless of glucose management. However, the much lower-than-expected utilization rates of the risk modifying medications render this explanation insufficient. While the use of a large, population-based cohort is a strength of this study, there are some limitations. First, the drug insurance database only contains information on prescriptions filled; it captures neither medication compliance, nor medications that were offered

and declined. Second, patients could theoretically have received a sufficient quantity of pills prior to the study period to allow them to avoid filling a prescription again during the six-month period under investigation. However, the drug insurance program reimburses only three months' worth of medication at a time, minimizing the possibility of medication "hoarding." Third, the administrative data do not include actual lipid and blood pressure levels, so appropriateness of prescribing could not be assessed.

Based upon landmark studies like the Diabetes Control and Complications Trial and the UK Prospective Diabetes Study, the importance of glycemia regulation for diabetic patients has been highlighted. However, this focus may lead practitioners and patients to neglect other important elements of care. For example, women with diabetes were less likely to receive mammograms,¹² estrogen replacement therapy (when it was believed to be protective)¹³ or colorectal cancer screening¹⁴ than those without the disease.

As cardiovascular disease is the primary cause of death among diabetic patients, preventative management of all risk factors is paramount, and has been emphasized in clinical practice guidelines.¹⁵⁻¹⁷ Yet, this message has not been effectively translated given that hypertension control is no better for people with diabetes than those without.^{18,19} We have illustrated that diabetic patients who required and were capable of difficult and invasive diligent glucose management were no more likely than others to receive cardiovascular risk modifying medications. Diabetes care must be broadly encompassing, addressing all elements of preventative care, and not merely be preoccupied with glycemic control.

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