

Sex Disparity in the Management of Dyslipidemia Among Patients With Type 2 Diabetes Mellitus in a Managed Care Organization

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Objective: To determine whether there were sex-related differences in the management of dyslipidemia among managed care enrollees with diabetes mellitus.

Study Design and Methods: Retrospective analyses were conducted using medical and pharmacy claims data from a health maintenance organization during 2000 and 2001. Patients with type 2 diabetes mellitus were identified through a validated algorithm of medication and diagnosis codes. Chi-squared analysis was used to determine if women were less likely than men to receive a lipid test or a lipid-modifying drug. Logistic regression models were constructed to compare sex-related differences while controlling for age, cardiovascular disease diagnosis, and 2 proxies of illness severity (hospitalization in 2000 and the intensity of diabetes mellitus drug therapy).

Results: During 2000 and 2001, 79.4% of women received a lipid test compared with 84.2% of men ($\chi^2 = 6.69$, $P = .01$). Also, 33.2% of women received a lipid-modifying drug compared with 45.5% of men ($\chi^2 = 27.31$, $P < .01$). Logistic regression analysis revealed that men were more likely than women to receive a lipid test when controlling for age, cardiovascular disease diagnosis, and illness severity (odds ratio [OR], 1.45; 95% confidence interval, 1.13-1.81). Men were also more likely than women to receive a lipid-modifying drug when controlling for age, cardiovascular disease diagnosis, illness severity, and lipid testing (OR, 1.51; 95% confidence interval, 1.22-1.86).

Conclusion: Women with type 2 diabetes mellitus were less likely than men with type 2 diabetes mellitus to receive lipid tests or lipid-modifying drugs.

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The worldwide prevalence of diabetes mellitus is increasing, as are the demand for and the cost of medical care.¹⁻³ In 2002, there were 18.2 million people (6.3% of the population) in the United States who had diabetes mellitus.¹ The direct medical expenditures for diabetes mellitus totaled nearly \$92 billion in 2002, with cardiovascular complications comprising a substantial portion of the costs.^{2,3} The prevalence of cardiovascular disease (CVD) and its associated mortality are substantially higher among persons with diabetes mellitus than among those without diabetes mellitus.^{4,5}

Studies⁶⁻¹⁰ have examined the sex gap in CVD morbidity and mortality among persons with diabetes mel-

litus. A key epidemiological study⁶ of heart disease in persons with diabetes mellitus identified that mortality from coronary heart disease has been declining in men but rising in women. Three meta-analyses⁷⁻⁹ found that the odds ratio for CVD-related events in women with diabetes mellitus is higher than that in men with diabetes mellitus, although the most recent meta-analysis⁹ showed that the sex differences become negligible when adjusted for CVD risk factors (eg, age, smoking, and cholesterol levels). Nonetheless, a recent study¹⁰ among the participants of the Framingham Heart Study found that the relative risk for coronary heart disease mortality in women with diabetes mellitus is substantially higher than that in men with diabetes mellitus, even when controlling for the primary risk factors for coronary heart disease.

The sex differences in CVD-related mortality may be due to a greater number of risk factors among women with diabetes mellitus or a greater effect of CVD risk factors on women with diabetes mellitus.¹¹ An additional reason may be that CVD risk factors are less aggressively managed in women with diabetes mellitus compared with their male counterparts.¹² Researchers have identified sex disparities in the use of drug therapy for dyslipidemia; however, it is not clear if these disparities represent an actual sex bias in prescribing.^{13,14}

Guidelines from the American Diabetes Association recommend annual screenings for dyslipidemia in all persons with diabetes mellitus and aggressive management of dyslipidemia, with drug therapy initiation thresholds that are similar for men and women.^{15,16} The

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proportion of managed care enrollees with type 2 diabetes mellitus who are receiving drug therapy for dyslipidemia has increased substantially in recent years.¹⁷ However, it is not clear whether women with diabetes mellitus are receiving similar treatment for dyslipidemia compared with men with diabetes mellitus. The objectives of this study were 2-fold: (1) to determine if men with type 2 diabetes mellitus were more likely to be screened or monitored for dyslipidemia than women with type 2 diabetes mellitus and (2) to determine if men with type 2 diabetes mellitus were more likely to receive drug therapy for dyslipidemia than women with type 2 diabetes mellitus.

METHODS

Design and Subjects

This study used a retrospective cross-sectional design examining medical and pharmacy claims data from the commercially insured population of a university-affiliated health maintenance organization in the midwestern United States. The study was approved by the University of Michigan Institutional Review Board. Eligible subjects were at least 18 years of age, were continuously enrolled in the health plan during the entire study period, had more than 1 medical claim with a diabetes mellitus diagnosis, and had more than 1 claim for an oral diabetes mellitus drug. Patients using insulin were excluded from the analyses to increase the homogeneity of the sample.

Variables

Drug use data were extracted from the pharmacy claims, while laboratory tests were identified from *Current Procedural Terminology* codes within the medical claims. All the variables were recoded into categorical data for the purpose of statistical analysis. A dichotomous variable for lipid testing was coded as 1 if the patient had a medical claim containing a *Current Procedural Terminology* code for any lipid test (eg, total cholesterol, low-density lipoprotein, or lipid panel) and as 0 if the patient did not have any claims for these tests. The lipid drug variable was coded as 1 if the patient had at least 1 claim for any prescription lipid-modifying drug and as 0 if there were no claims for these drugs. Sex was coded as 1 for male and as 0 for female. Age in 2000 was stratified into 4 age categories (18-44, 45-54, 55-64, and ≥ 65 years) for comparison across the age groups. A dichotomous variable was constructed to indicate whether the patient had a CVD diagnosis during 2000 or 2001. The variable was coded as 1 if the patient had at least 1 medical claim with an

International Classification of Diseases, Ninth Revision, Clinical Modification code for selected CVDs (an appendix listing these codes is available from the author). Finally, 2 proxies for severity of illness were created: (1) a hospitalization event in 2000 (yes or no) and (2) multiple-drug therapy versus single-drug therapy for diabetes mellitus.

Statistical Analysis

Descriptive analyses were conducted to assess the distribution of each variable. Bivariate comparisons of lipid testing and lipid-modifying drug use across sex categories were conducted using cross-tabulations and χ^2 tests. Multivariate modeling of data was done using logistic regression models to assess the relationship of sex with lipid testing and lipid-modifying drug use while adjusting for covariates such as age, CVD diagnosis, hospitalization, and multiple-drug therapy. All statistical analyses were performed using SPSS version 11.0 (SPSS Inc, Chicago, Ill).

RESULTS

Descriptive Analysis

There were 1729 patients identified in 2000 and 2001 who met the inclusion criteria. Of these, 50.1% were women and 49.9% were men. The mean age for women was 49 years, while the mean age for men was 52 years. Among all patients, 1429 (82.6%) received a lipid test in 2000 or 2001. In 2000 and 2001, 675 patients (39.0%) received a lipid-modifying drug. Descriptive data for the entire sample are found in **Table 1**.

Descriptive data regarding sex differences in the use of lipid tests and lipid-modifying drugs were evaluated. During 2000 and 2001, 79.4% of women received a lipid test compared with 84.2% of men ($\chi^2 = 6.69$, $P = .01$). Also, 33.2% of women received a lipid-modifying drug compared with 45.5% of men ($\chi^2 = 27.31$, $P < .01$).

Multivariate Models

Logistic regression was used to control for several variables that could confound the results. For model 1 (dependent variable, lipid test in 2000-2001), the control variables included the subject's age, hospitalization in 2000, multiple-drug therapy, and a CVD diagnosis (**Table 2**). When controlling for these variables, men were 1.45 times (95% confidence interval [CI], 1.13-1.81 times) more likely than women to receive a lipid test during 2000 or 2001.

For model 2 (dependent variable, lipid-modifying drug use in 2000-2001), the control variables included

the subject's age, hospitalization in 2000, multiple-drug therapy, a CVD diagnosis, and a lipid test in 2000 or 2001 (Table 3). When controlling for these variables, men were 1.51 times (95% CI, 1.22-1.86 times) more likely than women to receive a lipid-modifying drug during 2000 or 2001.

DISCUSSION

Women with type 2 diabetes mellitus were less likely than men with type 2 diabetes mellitus to receive lipid tests or lipid-modifying drugs when controlling for age, CVD diagnosis, and 2 proxies for severity of illness (hospitalization and diabetes mellitus drug intensity). The reasons for these differences could not be determined from claims data alone, and the sex disparity in lipid testing and treatment may reflect clinical differences in the patients. However, prior research has shown that women with diabetes mellitus are at a higher risk of cardiovascular complications than men with diabetes mellitus; thus, the disparities in testing and treatment warrant further investigation.⁶⁻¹⁰

A recent study¹⁷ revealed that diabetic patients with coronary artery disease are less likely to receive lipid testing or lipid-modifying therapy than nondiabetic persons with coronary artery disease. Additional studies have identified that women are less likely to receive diagnostic procedures^{18,19} or drug therapy¹²⁻¹⁴ for CVD. Although women with diabetes mellitus appear to have an elevated risk of cardiovascular morbidity and mortality compared with men with diabetes mellitus,⁶⁻¹⁰ the present study reveals that women are also less likely to receive lipid tests or lipid-modifying drugs. Therefore, women with diabetes mellitus may be at high risk for undertreatment of CVD.

The reasons for the sex disparity in testing and treatment for CVD in patients with diabetes mellitus are not clear. It is possible that the lower rates of treatment for dyslipidemia in women with diabetes mellitus occur for several reasons. Women, in general, may not be highly concerned about heart disease and may not raise the issue with their physicians.²⁰ Women may also experience symptoms of CVD that are different from those of men, and these "atypical" symptoms may not be discussed in a clinical encounter or may not prompt further evaluation of cardiovascular causes of the symptoms.²¹

Table 1. Characteristics of the 1729 Patients in the Sample

Characteristic	No. (%)
Sex	
Female	867 (50.1)
Male	862 (49.9)
Age, y	
18-44	460 (26.6)
45-54	636 (36.8)
55-64	511 (29.5)
≥ 65	122 (7.1)
Lipid test in 2000-2001	1429 (82.6)
Lipid-modifying drug use in 2000-2001	675 (39.0)
Multiple-drug therapy in 2000-2001	532 (30.8)
Hospitalization in 2000	217 (12.6)

Table 2. Multivariate Results for Prediction of Lipid Test in 2000 or 2001 Among the 1729 Patients in the Sample

Independent Variable	Odds Ratio (95% Confidence Interval)
Variable of interest	
Sex	
Male	1.45 (1.13-1.81)
Female	1.00
Covariates	
Age, y	
18-44	1.96 (1.43-2.77)
45-54	2.44 (1.68-3.53)
55-64	0.37 (0.24-0.57)
≥ 65	1.00
Diabetes mellitus medications	
Multiple-drug therapy	1.37 (1.01-1.84)
Single-drug therapy	1.00
Cardiovascular disease diagnosis	
Yes	1.27 (0.91-1.76)
No	1.00
Hospitalization in 2000	
Yes	1.21 (0.79-1.85)
No	1.00

Middle-aged women with diabetes mellitus, or their clinicians, might also place higher priority on treating the symptoms of other health problems (eg, menopause). If women place higher priorities on noncardiovascular issues in discussions with their clinicians, it is possible that cardiovascular concerns may not receive adequate attention.

Table 3. Multivariate Results for Prediction of Lipid-Modifying Drug Use in 2000 or 2001 Among the 1729 Patients in the Sample

Independent Variable	Odds Ratio (95% Confidence Interval)
Variable of interest	
Sex	
Male	1.51 (1.22-1.86)
Female	1.00
Covariates	
Age, y	
18-44	0.19 (0.12-0.30)
45-54	0.44 (0.29-0.68)
55-64	0.56 (0.36-0.87)
≥ 65	1.00
Diabetes mellitus medications	
Multiple-drug therapy	1.68 (1.35-2.19)
Single-drug therapy	1.00
Cardiovascular disease diagnosis	
Yes	1.98 (1.56-2.52)
No	1.00
Lipid test	
Yes	2.32 (1.68-3.29)
No	1.00
Hospitalization in 2000	
Yes	1.65 (1.22-2.23)
No	1.00

The aforementioned explanations for sex disparity may be intertwined with the general problem of clinical inertia (ie, failure to prescribe or intensify therapy when indicated).²² Therefore, efforts to combat clinical inertia (eg, physician feedback and reminder systems) could help to alleviate the sex disparities in monitoring or treating dyslipidemia in women with diabetes mellitus.²³ Specifically, reminders that prompt physicians to order lipid tests for patients with diabetes mellitus may be particularly helpful for women if sex disparities have occurred because of a greater number of competing priorities in clinical encounters with women. Flagging elevated low-density lipoprotein levels may also help to stimulate prescribing of lipid-modifying therapy when appropriate.

Bird and colleagues²³ have suggested that sex disparities are an important concern in quality of care for managed care organizations. They suggest that health plans consider sex-stratified reporting of performance measures and feedback to physicians. The Women's Health Measurement Advisory Panel of the National Committee for Quality Assurance recommends that research be done to examine sex differences in health

plan performance on conditions that are highly prevalent among men and women (eg, diabetes mellitus).²⁴ Further education of physicians on the high risk of cardiovascular mortality in women with diabetes mellitus may be warranted.

It is important to note that the data used in this study were derived from only the commercially insured population of one health plan. Although the health plan represents a large, diverse group of patients, caution should be used in generalizing the findings beyond the managed care population. In addition, the claims data set did not include laboratory test results (eg, low-density lipoprotein levels), so it is difficult to evaluate the appropriateness of the prescribing patterns for lipid-modifying drugs. However, the analyses controlled for the presence of medical claims with CVD diagnoses, age, and 2 proxies for severity of illness.

CONCLUSIONS

Women with type 2 diabetes mellitus were less likely than men with type 2 diabetes mellitus to receive lipid tests or lipid-modifying drugs. Given the higher rate of CVD mortality among women with diabetes mellitus compared with men with diabetes mellitus, the lower rate of lipid testing and lipid-modifying drug therapy for women warrants further attention.

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