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The Association of Patient-Physician Gender Concordance with Cardiovascular Disease Risk Factor Control and Treatment in Diabetes

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Abstract

Background: Gender concordance between patients and their physicians is related to prevention screening and other quality indicators. Research suggests female physicians may place greater emphasis on preventive care than male physicians; however, little is known about whether physician gender and patient-physician gender concordance are associated with cardiovascular disease (CVD) risk factor levels and treatment. Our objective was to examine associations between patient gender, physician gender, and their interaction with CVD risk factor control, medication adherence, and treatment intensification in diabetes.

Methods: In this study, 157,458 Kaiser Permanente Northern California adult diabetes patients with a primary care physician (PCP) were assessed for above target levels of hemoglobin A1c (HbA1c) ($\geq$8%), low-density lipoprotein cholesterol (LDL-C) ($\geq$100 mg/dL), and systolic blood pressure (SBP $\geq$130 mm Hg) in 2005. Medication adherence and appropriate CVD treatment intensification were assessed using pharmacy data. Probit models assessed the adjusted marginal effects of patient gender, PCP gender, and their interaction on control, adherence, and intensification.

Results: Female patients had lower adjusted rates of LDL-C (46% vs. 55%, $p < 0.001$) and SBP control (52% vs. 60%, $p < 0.001$) than males. Female patients of female PCPs had the highest adjusted rates of HbA1c control of the four patient-physician gender dyads (70% vs. 66%–68%, $p < 0.05$). Male patients were more likely than female patients to receive treatment intensification for high SBP (60% vs. 57%, $p < 0.001$). Female PCPs were more likely than their male counterparts to intensify therapy for hyperlipidemia and hypertension.

Conclusions: Patient and physician gender and gender concordance are modestly associated with CVD risk factor control and treatment in diabetes. Further understanding of these differences could lead to improved CVD outcomes for women.

Introduction

Research has demonstrated that male and female physicians may have differing practice and communication styles. One comprehensive meta-analysis found that female physicians communicate differently with patients than male physicians[1] and are more likely to engage in active partnership and emotionally focused conversations. Many studies also suggest that female physicians place more emphasis on the provision of preventive services and counseling[1–8] than do male physicians. Fewer studies examine if there are differences between male and female physicians in more technical qualities of care, such as performing diagnostic procedures and initiating appropriate therapies.[6,9] However, one recent study suggests that female physicians may provide higher-quality diabetes care for their patients.[10]

There are well-documented disparities in cardiovascular disease (CVD) risk factor levels, treatment, and outcomes for female patients.[11–14] One national survey found that women with hypertension were less likely than men to meet blood

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pressure targets and were also less likely to receive recommended therapies for secondary prevention of CVD, such as beta-blockers.[14] These differences are particularly acute for diabetes patients.[15–18] Women with diabetes have been shown in prior studies to have worse low-density lipoprotein cholesterol (LDL-C) control[15–17] and blood pressure control[15,17] than men with diabetes. Female patients also lag behind male patients in the receipt of appropriate process measure for diabetes. Two recent national surveys[18,19] showed that women were significantly less likely than men to have received the recommended process measures for diabetes, such as hemoglobin A1c (HbA1c) testing, lipid profile, urine microalbumin/protein testing, eye examinations, foot examinations, and influenza vaccination, and to have been advised to take aspirin for ischemic heart disease (IHD) prevention.

Research has also shown an effect of patient-provider gender concordance (defined as the patient and healthcare provider having the same gender) on increased patient trust in physician,[20] provision of preventive services, and visit duration.[2] These effects may lead to female patients of female physicians (and potentially male patients of male physicians) having better CVD outcomes than those patients in gender-discordant relationships. However, the evidence that gender concordance is an important factor in the quality of healthcare is mixed.[5,7,9,21,22] No studies have examined the association between gender concordance on CVD process of care and levels of intermediate outcomes.

The purpose of this study is to examine the association of patient gender, physician gender, and gender concordance with CVD risk factor levels, treatment intensification, and medication adherence in a large cohort of diabetes patients in an integrated delivery system.

Materials and Methods

Study population

This study was developed and approved by the Steering Committee of the Translating Research in Action for Diabetes (TRIAD) Study and conducted in one of TRIAD's six Translational Research Centers, Kaiser Permanente Northern California (KP). KP is an integrated healthcare delivery system providing comprehensive medical care to approximately 3.2 million members in Northern California. Patients were selected for the study from the KP diabetes registry if they were identified as having diabetes prior to January 1, 2005, and were continuously enrolled with an active drug benefit during all of 2004 and 2005. Eligible patients were further assessed for the presence of clinically recognized hypertension and hyperlipidemia prior to January 1, 2005, using KP automated clinical databases.[23] The sample of patients was identical to that in a previously published study of medication adherence and treatment intensification in diabetes,[23] with the exception that the current study was restricted to the 97% of patients who had an assigned primary care provider (PCP) within KP.

Definitions of target levels

Patients were defined as being above target levels if they had an HbA1c laboratory value $\geq$8.0% at any point during 2005. Similarly, those diabetes patients with hyperlipidemia were defined as above target for LDL-C if they had any LDL-C value $\geq$100 mg/dL during the year. Those with hypertension were defined as above target for blood pressure if they had at least two consecutive systolic blood pressure (SBP) readings of $\geq$130 mm Hg during the year.

Adherence to medications

Adherence to medications was calculated with KP prescription databases using the validated continuous, multiple interval measure of gaps in therapy (CMG) method[24,25] for medications for each individual condition (hyperglycemia, hypertension, hyperlipidemia). This method is defined as the proportion of days the patient should have been on medication therapy during which the patient did not have medication available. Individual drug class adherence for each medication filled at least twice in the year before the above target laboratory date for patients in poor control for each risk factor and for the last laboratory date of the year for patients in good control for each risk factor was combined into a single measure for all medications prescribed for the single condition. These estimates were weighted for each medication class by the number of days from the first to last fill in the 12-month period. Medications filled only once were not included in the analysis because CMG cannot be calculated from single fills. Good adherence for each condition was defined as a weighted adherence measure of $\geq$80% across all medications prescribed for the condition, as prior work has shown adherence at this level to be associated with improved outcomes, such as hospitalization rates, mortality, and morbidity.[23]

Treatment intensification

Treatment intensification was assessed for each condition from KP prescription databases during the 3 months before and the 3 months after first measurement of above target levels in 2005. Intensification was defined as any one of the following three occurrences: (1) an increase in the number of drug classes, (2) an increase in the daily dosage of at least one ongoing drug class, or (3) a switch to a medication in a different drug class.[23,26] Combination pills were considered as consisting of two classes.

In assessing both medication adherence and treatment intensification in diabetes, we excluded patients who were using insulin at the time above target HbA1c levels were noted because neither can be accurately identified for insulin users in prescription databases. Further information on the study population, definitions of adherence, and definitions of treatment intensification are available elsewhere.[23]

Multivariate analyses

Multivariate analyses were used to examine the relationship of CVD risk factor control, medication adherence, and likelihood of treatment intensification with patient gender and physician gender. In addition, a global patient-PCP gender interaction term was used in each analysis to test whether the relationship between CVD risk factor levels, adherence, and treatment intensification and patient gender differed depending on the gender of the patient's physician. These multivariate probit models assessing the marginal effect of patient gender, PCP gender, and patient-PCP gender interaction on control, adherence, and intensification were

adjusted for the following as fixed effects: patient age, gender, baseline laboratory values, number of comorbidities, race/ethnicity, preferred language, number of primary care visits in 2005, number of medication classes taken for condition, Medicare status, geocoded education, and geocoded income, and physician age, gender, race/ethnicity, languages spoken, number of patients in panel, and number of diabetes patients in panel. Models predicting treatment intensification also adjusted for good vs. poor patient adherence to medications.

For the one patient-level variable where missing values comprised >2% of the overall values (race), missing was coded as a category of the race variable and included in all analyses. PCP was adjusted for as a random effect in these same models to account for patient clustering at the PCP level. The resulting marginal effects were converted into adjusted percentages of patients at or below target, patients at above target CVD risk factor levels who received treatment intensification, and patients in good medication adherence in each patient-PCP gender dyad for each of the three CVD risk factors.

All analyses were performed using Stata version 10 (Stata Corp., College Station, TX). This study was reviewed and approved by KP's Institutional Review Board.

Results

Approximately half of the adult diabetes patients ($n = 157,458$) in this study were female (Table 1). Patients had a mean age of 61 years, and 47% were white. Of the 1,750 PCPs of patients in the sample, 43% were female and 47% were white. These physicians had a mean panel size of 1904 patients, with a mean of 136 diabetes patients per panel. Male patients were much more likely to have a male PCP (73%) than a female PCP. Half of the female patients in the study had a female PCP (data not shown).

Table 2 shows the adjusted proportion of patients at or below target levels for each of the three CVD risk factors (HbA1c, LDL-C, and SBP) in each patient-PCP gender dyad after adjusting for patient and physician characteristics. Female patients were more likely than male patients to be in control of HbA1c but less likely than male patients to be in control of LDL-C and SBP. Female patients of female PCPs were the most likely to have HbA1c < 8% (70% vs. 66%–68%, $p < 0.05$). Patient and physician gender interaction was also associated with significant LDL-C control, with male patients of male PCPs having the highest proportion of patients at or below target in the four dyads.

Table 3 shows the percentage of patients at above target risk factor levels who received treatment intensification within 3 months in each patient-PCP gender dyad after adjusting for patient and physician characteristics. Male patients were more likely than female patients to receive treatment intensification for high SBP regardless of PCP gender. However, female PCPs were more likely than their male counterparts to intensify therapy for both hyperlipidemia and hypertension.

Table 4 shows the percentage of patients considered in good adherence to their medication regimens for hyperglycemia, hyperlipidemia, and hypertension medications after adjusting for patient and physician characteristics. Patient and physician gender and gender concordance were not associated with adherence.

To test the robustness of our findings, we reanalyzed the data using different risk factor cutoff points (HbA1c <7%, LDL-C < 130 mg/dL, SBP < 140 mm Hg) as well as analyzing risk factor and adherence levels as continuous variables and found the relationships between risk factor control, adherence, and intensification with patient and physician gender and gender concordance to be extremely similar (data not shown). Unadjusted levels of risk factor control, adherence, and intensification were very close to adjusted levels (data not shown).

Table 1. Characteristics of Diabetes Patients and Their Primary Care Providers (PCPs)

Characteristic	*Patients* (n = *157,458*) n *(%)*	*PCPs* (n = *1,750*) n *(%)*
Gender		
Male	82,139 (52)	972 (54)
Female	75,291 (48)	778 (43)
Missing	n/a	50 (3)
Race/ethnicity		
White	73,331 (47)	834 (47)
African American	15,668 (10)	66 (4)
Hispanic	17,297 (11)	83 (4)
Asian American/Pacific Islander	22,342 (14)	712 (40)
Multiple	8,457 (5)	n/a
Native American	1,037 (1)	14 (1)
Missing	19,161 (12)	81 (4)
Mean age, years (SD)	61.0 (12.9)	45.0 (8.9)
Mean No. of comorbidities (SD)	2.6 (1.4)	n/a
Mean No. of primary care visits in 2005 (SD)	5.8 (6.7)	n/a
Mean No. of patients in panel (SD)	n/a	1904 (1,314)
Mean No. of diabetes patients in panel (SD)	n/a	136 (113)
Family practitioner	n/a	252 (15%)
Internist	n/a	999 (57%)
Specialist/subspecialist[a]	n/a	499 (28%)

[a]<2% of all PCPs practiced endocrinology or cardiology.

Table 2. Adjusted Proportions[a] of Patients at or Below Target for CVD Risk Factor Levels by Patient and Primary Care Physician Gender

	Female patients		*Male patients*		p *values*		
	Female MDs	*Male MDs*	*Female MDs*	*Male MDs*	*MD gender*	*Patient gender*	*Interaction*
HbA1c < 8.0%	70%	68%	66%	66%	NS	$p < 0.0001$	$p < 0.05$
LDL-C < 100 mg/dL	47%	46%	54%	55%	NS	$p < 0.0001$	$p < 0.05$
SBP <130 mm Hg	53%	52%	60%	60%	NS	$p < 0.0001$	NS

[a]Adjusted percentages from models adjusted for patient age, gender, baseline laboratory values, number of comorbidities, race/ethnicity, preferred language, number of primary care visits in 2005, number of medical classes taken for condition, Medicare status (yes, no), geocoded education and income, and physician age, gender, race/ethnicity, languages spoken, number of patients in panel, and number of diabetes patients in panel. The interaction effect was determined by a global patient-physician interaction term added to the models. Treatment intensification models are also adjusted for patient medication adherence. PCP is adjusted for as a random effect.

Discussion

This study found a modest association between gender concordance and CVD risk factor levels: female patients of female PCPs were more likely to have HbA1c control in the four patient-PCP gender dyads. Although differences were small, this study also suggests that female patients of female PCPs have better LDL-C and SBP control and may be more likely to receive a treatment intensification for all three CVD risk factors than female patients of male PCPs. This finding adds to the literature on patient-provider gender concordance by providing modest support to the hypothesis that gender concordance may positively affect CVD treatment and outcomes.

This study also adds to the evidence that female patients have lower levels of LDL-C and blood pressure control than male patients.[14–17] However, this study finds a small positive association of female patient gender with HbA1c control, with women being more likely to be at or below HbA1c < 8% target levels than men. This finding is in contrast with previous studies suggesting no gender difference[17] in HbA1c < 8% and disparities for women in HbA1c control when the cutoff point is HbA1c < 7%.[15] This study uses a much larger sample size than previous studies of HbA1c control, which may have increased the likelihood of detecting statistically significant differences in levels of control.

Our study found that female patients were somewhat less likely to receive treatment intensification for high blood pressure levels than male patients, which is consistent with other studies showing women are less likely to receive appropriate CVD therapies than men.[14] This disparity in timely intensification of treatment in response to elevated SBP levels may help explain the large difference in SBP control rates between men vs. women in this study and in other settings.

We found that female physicians in this study were somewhat more likely than their male counterparts to intensify hyperlipidemia and hypertension therapy for their patients. This finding is similar to that of another recent study suggesting that female physicians may provide higher-quality care for diabetes patients than male physicians[10] but is in contrast to previous studies suggesting that male physicians may be stronger on technical aspects of care.[6,9] A number of studies suggest that female PCPs place more emphasis on prevention than do male physicians.[2–8] Female physicians' greater rates of treatment intensification compared with male physicians may reflect this emphasis on prevention, as the management of CVD risk factors to below target levels has been shown to decrease mortality and morbidity from CVD in both men and women.[27]

Although it is possible that differences in physician communication styles by gender[1] may lead to differences in communication about medication adherence with patients by male and female physicians, no gender or gender concordance effects on medication adherence were detected in these analyses.

These current findings have a number of implications. This study and others[2,21] suggest that female physicians are more

Table 3. Adjusted Proportions[a] of Patients above Target for CVD Risk Factors Receiving Treatment Intensification by Patient and Primary Care Physician Gender

	Female patients		*Male patients*		p *values*		
	Female MDs	*Male MDs*	*Female MDs*	*Male MDs*	*MD gender*	*Patient gender*	*Interaction*
Intensification for HbA1c ≥8%	76%	75%	73%	74%	NS	NS	NS
Intensification for LDL ≥100	45%	43%	46%	45%	$p < 0.05$	NS	NS
Intensification for SBP ≥130	58%	55%	63%	59%	$p < 0.0001$	$p < 0.0001$	NS

[a]Adjusted percentages from models adjusted for patient age, gender, baseline laboratory values, number of comorbidities, race/ethnicity, preferred language, number of primary care visits in 2005, number of medical classes taken for condition, Medicare status (yes, no), geocoded education and income, and physician age, gender, race/ethnicity, languages spoken, number of patients in panel, and number of diabetes patients in panel. The interaction effect was determined by a global patient-physician interaction term added to the models. Treatment intensification models are also adjusted for patient medication adherence. PCP is adjusted for as a random effect.

Table 4. Adjusted Proportions[a] of Patients with ≥80% Medication Adherence by Patient and Primary Care Physician Gender

	Female patients		*Male patients*		p *values*		
	Female MDs	*Male MDs*	*Female MDs*	*Male MDs*	*MD gender*	*Patient gender*	*Interaction*
Hyperglycemia medications	81%	82%	82%	82%	NS	NS	NS
Hyperlipidemia medications	80%	80%	81%	81%	NS	NS	NS
Hypertension medications	81%	81%	81%	81%	NS	NS	NS

[a]Adjusted percentages from models adjusted for patient age, gender, baseline laboratory values, number of comorbidities, race/ethnicity, preferred language, number of primary care visits in 2005, number of medical classes taken for condition, Medicare status (yes, no), geocoded education and income, and physician age, gender, race/ethnicity, languages spoken, number of patients in panel, and number of diabetes patients in panel. The interaction effect was determined by a global patient-physician interaction term added to the models. Treatment intensification models are also adjusted for patient medication adherence. PCP is adjusted for as a random effect.

likely than male physicians to treat female patients in many primary care settings. Our findings that female patients of female patients have somewhat improved treatment intensification rates and intermediate outcomes over female patients of male physicians suggest that better understanding of the female patient-female provider relationship may be a path toward ameliorating disparities in CVD treatment and outcomes in women.

This study shows that female PCPs are significantly (although modestly) more likely to intensify hypertension treatment than their male counterparts. We cannot explain this difference, but it is possible that female physicians' increased emphasis on prevention activities may lead to a greater emphasis on CVD prevention in high-risk patients. Policies that encourage an increased emphasis on prevention for both male and female physicians and focus on the particular importance of CVD prevention in female patients may result in improved focus on management of CVD risk factors in women with diabetes.

There are a number of limitations to this study. We were unable to measure whether the diabetes patients in our study chose a physician of the same or different gender or were assigned to a physician. We also could not assess patients' underlying healthcare values and beliefs. Previous work on the effects of gender and gender concordance on healthcare suggests these underlying elements may influence such effects.[21] Similarly, we were unable to directly measure and adjust for physician attitudes and beliefs about their approaches to treating male vs. female (or concordant vs. discordant) patients. This study only examines the cross-sectional effect of physician gender and gender concordance on CVD risk factor control and treatment; potential effects of the length and continuity of the PCP-patient relationship on CVD risk factor control and treatment could not be examined in this analysis. Patients and providers were from a single, large, integrated healthcare delivery system with a strong physician culture[21] that emphasizes quality improvement; it is possible that rates of risk factor control and treatment intensification may vary more by patient and physician gender and gender concordance in other settings.[21] Finally, we were only able to measure medication-level physician response to above target CVD risk factor levels; it is possible that physicians are responding to high-risk factor values with lifestyle advice and counseling in ways that we cannot detect in this study.

Conclusions

Patient and physician gender and gender concordance modestly affect CVD treatment and risk factor control in diabetes. Further understanding of these differences could help improve CVD outcomes and reduce health disparities for women with diabetes.

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Disclosure Statement

The authors have no conflicts of interest to report.

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