

# Impact of Provider Continuity on Quality of Care for Persons With Diabetes Mellitus

James M. Gill, MD, MPH<sup>1</sup>

Arch G. Mainous III, PhD<sup>2</sup>

James J. Diamond, PhD<sup>3</sup>

M. James Lenhard, MD, FACE<sup>4</sup>

<sup>1</sup>Health Services Research, Christiana Care Health Services, Wilmington, Del

<sup>2</sup>Medical University of South Carolina, Charleston, SC

<sup>3</sup>Jefferson Medical College, Philadelphia, Pa

<sup>4</sup>Christiana Care Health Services, Wilmington, Del

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## ABSTRACT

**BACKGROUND** Many patients with diabetes fail to receive recommended monitoring tests. One reason might be inadequate continuity of care. This study examined the association between provider continuity and completion of monitoring tests for patients with diabetes mellitus.

**METHODS** A cross-sectional analysis was conducted on claims data from a private national health plan for 1 year (January 1, 1999, through December 31, 1999). Participants had a diagnosis of diabetes mellitus and at least 2 outpatient visits during the study year (N = 1,795). The association was measured between continuity of care with an individual provider and completion of 3 diabetes monitoring tests: a glycosylated hemoglobin test, a lipid profile, and an eye examination.

**RESULTS** Eighty-one percent of patients had a glycosylated hemoglobin test, 66% had a lipid profile, and 28% had an eye examination during the study year. After controlling for demographics, number of diabetes visits, case mix, and diabetes complications, provider continuity was not significantly associated with the receipt of a glycosylated hemoglobin test (odds ratio [OR] = 0.61, 95% confidence interval [CI], 0.32-1.16), a lipid profile (OR = 0.97, 95% CI, 0.57-1.64) or an eye examination (OR = 0.60, 95% CI, 0.30-1.19). When continuity was measured only among primary care providers, there was no significant association for receipt of a glycosylated hemoglobin test (OR = 0.73, 95% CI, 0.41-1.33), a lipid profile (OR = 0.88, 95% CI, 0.53-1.47) or an eye examination (OR = 0.70, 95% CI, 0.35-1.36).

**CONCLUSIONS** This study found no association between provider continuity and completion of diabetes monitoring tests in a national privately insured population. Whereas continuity might benefit other aspects of health care, it does not appear to benefit improved monitoring for diabetes.

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## INTRODUCTION

A hallmark of primary care is continuity of care, defined by seeing the same health care provider for a period of time.<sup>1,2</sup> It is thought that high provider continuity can have a positive impact on quality of care because of the accrued knowledge and personal relationship that develops between a patient and a provider.<sup>1-3</sup> Continuity is associated with improved preventive care<sup>4</sup> and immunizations for children,<sup>5,6</sup> improved compliance with medication prescriptions,<sup>7,8</sup> improved physician recognition of medical problems,<sup>9-11</sup> and reduced rates of hospital admissions<sup>12</sup> and emergency department visits.<sup>13-15</sup> Patients who have physician continuity are more satisfied with their care,<sup>16,17</sup> are more likely to keep follow-up appointments,<sup>14,18</sup> and communicate better with their physician.<sup>19</sup> Additionally, patients rank continuity as a high priority in their medical care.<sup>20,21</sup>

*Conflicts of interest: none reported*

### CORRESPONDING AUTHOR

James M. Gill, MD, MPH  
Christiana Care Health System  
1401 Foulk Rd  
Wilmington, DE 19803  
jgill@christianacare.org

Another potential benefit of continuity is that it might improve the quality of care for persons with chronic conditions, such as diabetes mellitus. Diabetes requires considerable medical management.<sup>22</sup> This management is likely to be easier when a patient is cared for by the same provider, because that provider would be more likely to know when tests are needed and treatment changes are indicated. Continuity might therefore have even greater benefits for persons with diabetes than it does for the general population.<sup>23</sup> In fact, one study showed that quality of care improves when patients have a regular source of care for their diabetes, although the study did not measure continuity with that provider.<sup>24</sup> A more recent study suggested that higher provider continuity might lead to better glucose control.<sup>25</sup>

Although continuity can benefit patients with diabetes, it might also have negative consequences. As with other chronic conditions, patients with diabetes are more likely than the general population to require specialty care.<sup>26,27</sup> Because most patients with diabetes are cared for by a primary care physician,<sup>28,29</sup> high continuity might come at the expense of getting appropriate specialty care if the primary care physician lacks knowledge about treating and monitoring diabetes or has difficulty managing the disease along with multiple other problems.<sup>30</sup> Several studies, in fact, have shown that primary care physicians might comply poorly with recommended guidelines for diabetes care<sup>31-33</sup> and that patients treated in specialty clinics were more likely to receive recommended care.<sup>34</sup>

This study examined the relationship between continuity and quality of care for diabetes in a large, national private health plan. Quality of care was determined by the receipt of tests as recommended by the American Diabetes Association (ADA) and other organizations: an annual glycosylated hemoglobin test, a lipid test, and a retinal eye examination. We hypothesized that after controlling for differences in demographics and case mix, higher provider continuity would be associated with a higher likelihood of receiving these tests.

## METHODS

Using a cross-sectional study design, we examined administrative claims data for persons with diabetes in a large, national private health plan. We included persons who were in the point-of-service plan and who were beneficiaries of a single large national employer. At their request, we did not disclose the names of the health plan or the employer. We secured permission to examine the data and scrambled both patient and provider identifiers before data transfer. The

local institutional review board also approved the study.

We included persons who were continuously enrolled in the health plan during the 1-year study period (January 1, 1999, through December 31, 1999). Only adults (aged 18 years and older) were included. Persons older than 64 years were excluded because of the few still employed and because many claims – largely as a result of Medicare coinsurance – were not reflected in the data.

We used the claims data definition of diabetes used by the National Committee for Quality Assurance in its Health Plan Employer Data and Information Set (HEDIS 3.0).<sup>35</sup> This definition requires a diagnosis of diabetes in at least 1 inpatient claim, 1 emergency department claim, or 2 outpatient claims during the year. We identified these claims by Current Procedural Terminology (CPT-4) codes, according to the HEDIS criteria. We defined a diagnosis of diabetes by an International Classification of Diseases (ICD-9) code of 250.xx, 357.2x, 362.0x, 366.41 or 648.0 (according to HEDIS criteria<sup>35</sup>) in any of 3 diagnosis fields. Finally, we excluded patients with fewer than 2 outpatient visits during the study year, because continuity cannot be defined for them. The final study population comprised 1,795 persons.

Our main outcomes were patients' receipt of each intervention recommended by the ADA<sup>36</sup>: a glycosylated hemoglobin test, a lipid test, and a retinal eye examination. We chose these indicators because they follow national guidelines,<sup>36</sup> they are easily captured in claims data,<sup>31</sup> and they have been previously used as quality-of-care indicators for persons with diabetes.<sup>31,37</sup>

We examined glycosylated hemoglobin tests, considering the receipt of both 1 and 2 tests during the study year. We did so because, whereas a single annual test is acceptable according to the American Medical Association (AMA), HEDIS, and ADA guidelines from 1997,<sup>35,36,38</sup> 2 or more annual tests is the minimum standard for the current ADA guidelines.<sup>22</sup> For lipid testing, we measured receipt of at least 1 full lipid profile during the study year – consistent with guidelines of both the ADA and the AMA<sup>22,36,38</sup>; but we also measured receipt of any cholesterol test during the study year, because physicians might not believe that persons with very low total cholesterol levels, very low low-density lipoprotein cholesterol levels, or very high high-density lipoprotein cholesterol levels need a full lipid profile. For eye examinations, we measured receipt of at least 1 test during the study year. For all tests, we determined completion according to CPT-4 codes as listed in the claims data. A detailed list of CPT-4 codes used to define each outcome variable is listed in Table 1.

**Table 1. Definition of Variables Using Current Procedural Terminology (CPT) Codes**

Variable	CPT Code
Visits	
Inpatient	99221-99223, 99231-9233, 99238, 99251-99255, 99261-99263
Emergency department	99281-99288
Outpatient	92002-92014, 99201-99205, 99211-99215, 99217-99220, 99241, 99242-99245, 99271-99275, 99301-99303, 99311-99313, 99321-99323, 99331-99333, 99341-99355, 99381-99387, 99391-99397, 99401-99404, 99411, 99412, 99420-99429, 99499
Outcomes	
Glycosylated hemoglobin	83036
Lipid profile	80061
Eye examination	92002, 92004, 92012, 92014, 92018, 92019, 92225, 92226, 92235, or 92250

Our main independent variable was provider continuity: the extent to which a patient concentrated their outpatient visits with the same health care provider during the study year. We measured provider continuity using a previously published continuity index called the Modified Modified Continuity Index (MMCI).<sup>39</sup> The equation for this index is:

$$\text{Continuity score} = \frac{1 - (P/[V = 0.1])}{1 - (1/[V = 0.1])}$$

where  $P$  = number of outpatient providers and  $V$  = number of outpatient visits.

This continuity score ranges from nearly 0 (if each visit is to a different provider) to 1 (if all visits are to the same provider). We chose this index rather than the more commonly used Usual Provider Continuity index, because this index accounts for the total number of providers seen, rather than being a simple ratio of visits to the predominant provider.<sup>1,40,41</sup> We also examined the Continuity of Care (COC) index, because this index has been used in previous studies, and it makes even greater adjustments for the level of dispersion among providers.<sup>6,15</sup> The COC index is calculated according to the equation:

$$\text{COC} = \frac{\sum_{j=1}^s n_j^2 - n}{n(n-1)}$$

where  $n$  = total number of visits,  $n_j$  = number of visits to provider  $j$ , and  $s$  = number of providers.

Our primary definition of continuity included visits to any provider, with the exception of visits to eye specialists (because eye examinations were a main outcome variable). We also examined continuity with only

primary care providers, based on the rationale that continuity is often considered a component of primary care, not specialty care,<sup>42</sup> and that most persons have their diabetes managed by their primary care providers.<sup>28,29</sup> We defined primary care providers as general practitioners, family physicians, general internists, and general pediatricians, as indicated in the claims database. For this calculation of primary care continuity, we included persons with 2 or more visits to a primary care provider ( $N = 1,705$ ).

We included a number of control variables in our analysis. First, we included the demographic variables of age (18-34, 35-44, 45-54 or 55-64 years), sex, and residence (county of residence in a metropolitan statistical area or not).<sup>43</sup> Next we included the specialty of the predominant provider, defined as the provider whom the patient visited most.<sup>44</sup> We categorized specialty as primary care, endocrinology, other specialty, or mixed (equal number of visits made to 2 or more providers in different specialty categories). Third, we included number of annual outpatient visits for which diabetes was one of the diagnoses on the claim, because having more office visits was itself positively associated with completion of tests. (Although office visits are included in the equation for continuity, we found no significant collinearity between the 2 variables.) We also ran additional analyses using total number of outpatient visits instead of number of outpatient diabetes visits, as well as excluding office visits from the logistic models completely, but the final results did not substantially change with these alternative analyses and are not reported. Next, we included case mix, as defined by ambulatory diagnostic groups (ADGs).<sup>45</sup> Each of the 34 ADGs represents a specific medical condition or group of related medical conditions as defined by ICD-9 diagnosis codes listed in claims data. The ADG system has proved to be a strong predictor of health care utilization.<sup>31,45-49</sup> Finally, because different complications might have a different impact on the likelihood of receiving specific tests and are not always distinguishable from each other using the ADG system, we controlled for specific diabetic complications, including renal (ICD-9 code 250.4x), ophthalmologic (ICD-9 code 250.5x), neurological (ICD-9 code 250.6x), and peripheral circulatory (ICD-9 code 250.7x). Both ADGs and diabetic complications were computed as dichotomous variables.

**Data Analysis**

Our primary analysis was to determine the relationship between continuity and each outcome variable. Because all outcome variables were dichotomous, we used logistic regression models for each of the 5 outcome variables.<sup>50, 51</sup> For each outcome we used 2 definitions of continuity (continuity with all providers and

continuity with primary care providers) and 2 continuity equations (MMCI and COC). First we entered continuity as the only variable in the model. Then we forced all control variables into a multivariate model. Odds ratios (ORs) were calculated for all covariates along with their 95% confidence intervals (CIs); confidence intervals that did not cross 1.00 were considered statistically significant. All analyses were completed using the PC version of SAS 8.1.<sup>52</sup>

We did not do sample size calculations because all eligible patients were included. We did, however, estimate the power of our study to find a statistically significant difference. Given a previous estimate of 60% of patients having at least 2 glycosylated hemoglobin tests during the study year,<sup>24</sup> and an estimate that plus or minus 10% would be clinically significant, we determined that our study had greater than 95% power to detect a clinically significant difference for 2 or more glycosylated hemoglobin tests (with an  $\alpha$  of 0.05 using a 2-tailed test).

## RESULTS

The descriptive statistics for the study population are shown in Table 2. One half of the population was aged 55 to 64 years, 60% were male, and more than 85% lived in metropolitan areas. Most (80%) had a primary care physician as a predominant provider, whereas less than 4% saw an endocrinologist, and 6.4 percent had other specialists (with the most common "other" being cardiology) as predominant providers. A substantial proportion had a complication of diabetes diagnosed, the most common being diabetic retinopathy (12.6%).

The mean number of outpatient visits to all providers was 8.28 (SD = 6.17), whereas the mean number of visits to a primary care provider was 5.16 (SD = 3.30); the mean number of outpatient visits for diabetes (including all providers) was 4.32 (SD = 2.69). When considering outpatient visits to all providers, the mean continuity score was 0.74 (SD = 0.22) using our primary MMCI equation and was 0.51 (SD = 0.32) using the COC equation. The mean continuity score for primary care visits was 0.87 (SD = 0.21) using the MMCI equation and 0.79 (SD = 0.30) using the COC equation.

Overall, 80.6% of persons had at least 1 glycosylated hemoglobin test during the study year, whereas 51.9% had 2 or more glycosylated hemoglobin tests. To describe further those who had 3 or more tests, 463 persons (or 25.8%) had exactly 2 tests, 311 (or 17.3%) had exactly 3 tests, 112 (or 6.2%) had exactly 4 tests, and 46 (or 2.6%) had more than 4 tests. More than one half (65.7%) of persons had at least 1 full lipid profile, whereas 68.9% had any cholesterol test

**Table 2. Characteristics of Study Population**

Characteristics	Number	Percent
Age, years		
18–34	57	3.2
35–44	183	10.2
45–54	642	35.8
55–64	913	50.9
Sex		
Male	1,086	60.5
Female	709	39.5
Residence		
Metropolitan	1,537	85.6
Nonmetropolitan	258	14.4
Specialty of predominant provider		
Generalist*	1,432	79.8
Endocrinologist	66	3.7
Other	114	6.4
Mixed	146	8.1
Unknown	37	2.1
Diabetic complications		
Renal	51	2.8
Retinal	226	12.6
Neurologic	158	8.8
Peripheral vascular	66	3.7
Ambulatory diagnostic groups		
Time limited: minor	490	27.3
Time limited: minor—primary infections	604	33.7
Time limited: major	284	15.8
Time limited: major—primary infections	227	12.7
Allergies	134	7.5
Asthma	76	4.2
Likely to recur: discrete	507	28.2
Likely to recur: discrete—infections	345	19.2
Likely to recur: progressive	258	14.4
Chronic medical: stable	1,749	97.4
Chronic medical: unstable	1,160	64.6
Chronic specialty: stable—orthopedic	115	6.4
Chronic specialty: stable—ear, nose, throat	36	2.0
Chronic specialty: stable—eye	240	13.4
Chronic specialty: unstable—orthopedic	70	3.9
Chronic specialty: unstable—ear, nose, throat	13	0.7
Chronic specialty: unstable—eye	355	19.8
Dermatologic	341	19.0
Injuries/adverse effects: minor	246	13.7
Injuries/adverse effects: major	263	14.7
Psychosocial: time limited, minor	77	4.3
Psychosocial: recurrent or persistent, stable	150	8.4
Psychosocial: recurrent or persistent, unstable	63	3.5
Signs/symptoms: minor	674	37.6
Signs/symptoms: uncertain	975	54.3
Signs/symptoms: major	689	38.4
Discretionary	330	18.3
See and reassure	191	10.6
Prevention/administrative	1,086	60.5
Malignancy	128	7.1
Pregnancy	15	0.8
Dental	6	0.3
Total	1,795	100.0

\* Generalist includes general practitioner, family physician, general internist, and general pediatrician.

**Table 3. Multivariate Logistic Regressions: Continuity with Any Provider**

Variable	Glycosylated Hemoglobin (≥1)		Glycosylated Hemoglobin (≥2)		Lipid Profile		Eye Examination	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Continuity*	0.61	0.32-1.16	1.06	0.64-1.76	0.97	0.57-1.64	0.60	0.30-1.19
Visits for diabetes, No.†	1.17	1.10-1.25	1.19	1.14-1.25	1.03	0.99-1.08	1.09	1.03-1.15
Specialty‡								
Generalist	0.79	0.26-2.41	0.66	0.31-1.39	1.85	0.95-3.59	1.09	0.48-2.51
Mixed	0.87	0.25-3.02	0.54	0.23-1.27	1.58	0.72-3.49	0.77	0.28-2.12
Other	0.59	0.18-1.97	0.45	0.19-1.03	2.45	1.11-5.39	0.90	0.34-2.42
Age, years§								
18-34	1.26	0.53-3.01	0.70	0.36-1.34	0.36	0.19-0.69	0.75	0.30-1.85
35-44	0.81	0.52-1.25	0.89	0.62-1.27	0.76	0.52-1.10	0.94	0.57-1.53
45-54	0.96	0.72-1.28	0.84	0.67-1.05	0.81	0.64-1.02	0.81	0.60-1.11
Sex	0.93	0.70-1.24	0.88	0.71-1.11	0.68	0.54-0.86	1.00	0.74-1.36
Diabetes complications¶								
Renal	0.57	0.25-1.26	0.72	0.37-1.41	0.78	0.40-1.52	2.04	0.89-4.67
Retinal	1.23	0.77-1.96	0.96	0.68-1.35	1.12	0.78-1.62	3.92	2.61-5.89
Neurologic	1.10	0.62-1.95	1.02	0.67-1.56	0.89	0.58-1.38	0.74	0.43-1.27
Peripheral vascular	0.91	0.43-1.94	0.68	0.38-1.24	0.82	0.45-1.50	0.69	0.32-1.50
Residence#	1.35	0.96-1.91	1.19	0.89-1.59	1.99	1.49-2.65	1.14	0.76-1.71
Ambulatory diagnostic groups**								
Time limited: major	0.56	0.39-0.81	0.68	0.49-0.93	0.73	0.53-1.01	0.89	0.58-1.36
Likely to recur: discrete	0.91	0.67-1.24	0.73	0.57-0.93	1.03	0.79-1.33	0.78	0.56-1.10
Chronic medical: stable	3.38	1.56-7.35	3.58	1.58-8.14	5.09	2.32-11.16	1.24	0.42-3.69
Chronic medical: unstable	1.13	0.84-1.52	1.25	0.99-1.59	1.32	1.03-1.69	1.28	0.92-1.79
Chronic specialty: stable—eye	1.31	0.85-2.01	1.13	0.82-1.54	1.07	0.77-1.49	10.35	7.08-15.11
Chronic specialty: unstable—eye	0.84	0.59-1.19	0.98	0.74-1.29	1.02	0.76-1.36	7.98	5.78-11.03
Prevention/administrative	1.74	1.32-2.30	1.64	1.32-2.06	1.62	1.28-2.04	1.08	0.80-1.46
Malignancy	1.01	0.60-1.69	0.93	0.62-1.40	0.60	0.39-0.89	1.53	0.90-2.59

OR = odds ratio; CI = confidence interval.

\* Compares continuity score of 1.00 with continuity score of 0.00.

† Number of outpatient visits during study year for which diabetes was listed as any of 3 diagnoses.

‡ Reference group is endocrinologist.

§ Reference group is 55-64 years.

|| Reference group is male.

¶ For each diabetic complication, comparison is presence vs absence of complication.

# Reference group is nonmetropolitan.

\*\* For each ambulatory diagnostic group (ADG), comparison is presence vs absence of ADG; only ADGs significant at  $P < .05$  for 1 or more outcomes are included in this table.

during the study year (because these rates are similar, further results are reported only for full lipid profiles). Finally, 28% of persons had a retinal eye examination during the study year.

When continuity with all providers was calculated using the MMCI equation, high continuity was associated with a lower likelihood of having an eye examination in bivariate analysis (OR = 0.60, 95% CI, 0.38-0.95). There was, however, no significant association between continuity and having a single glycosylated hemoglobin test (OR = 0.95, 95% CI, 0.56-1.62), multiple glycosylated hemoglobin tests (OR = 1.50, 95% CI, 0.99-2.29), or a lipid profile (OR = 1.18, 95% CI, 0.76-1.83). In multivariate analysis, there was no significant association for eye examinations ( $P > .1$ ) or any other outcome variable (Table 3). When the COC equation was used instead of the MMCI, the

results were similar; therefore, the results using the COC equation are not shown in the table but are available from the authors on request.

When continuity was computed using only visits to primary care physicians, there was no significant association between continuity and any outcome variable. Using the MMCI equation, in bivariate analysis the primary care continuity was not associated with the likelihood of having a single glycosylated hemoglobin test (OR = 0.74, 95% CI, 0.41-1.35), multiple glycosylated hemoglobin tests (OR = 0.71, 95% CI, 0.47-1.08), a lipid profile (OR = 1.28, 95% CI, 0.80-1.03) or an eye examination (OR = 0.68, 95% CI, 0.42-1.10). There remained no significant association in multivariate analysis (Table 4). When the COC equation was used instead of the MMCI, the results were similar (results not shown).

**Table 4. Multivariate Logistic Regressions: Continuity with a Primary Care Provider**

Variable	Glycosylated Hemoglobin (≥1)		Glycosylated Hemoglobin (≥2)		Lipid Profile		Eye Examination	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Continuity*	0.73	0.41-1.33	1.14	0.70-1.86	0.88	0.53-1.47	0.70	0.35-1.36
Visits for diabetes, No.†	1.19	1.11-1.27	1.20	1.14-1.26	1.03	0.99-1.08	1.10	1.04-1.16
Specialty‡								
Generalist	0.55	0.20-1.52	0.43	0.22-0.84	1.20	0.67-2.17	0.66	0.32-1.36
Mixed	0.40	0.14-1.16	0.33	0.16-0.69	0.78	0.40-1.52	0.41	0.18-0.95
Other	0.45	0.15-1.36	0.29	0.13-0.63	1.41	0.69-2.88	0.57	0.24-1.30
Age, years§								
18 - 34	1.41	0.62-3.24	0.80	0.43-1.50	0.35	0.19-0.64	1.10	0.50-2.44
35 - 44	0.93	0.60-1.43	0.94	0.66-1.33	0.78	0.54-1.11	0.94	0.59-1.51
45 - 54	0.97	0.74-1.28	0.85	0.68-1.06	0.81	0.64-1.02	0.81	0.59-1.09
Sex	0.90	0.68-1.19	0.86	0.69-1.08	0.66	0.52-0.83	0.95	0.71-1.27
Diabetes complications¶								
Renal	0.61	0.28-1.30	0.69	0.36-1.31	0.81	0.43-1.52	1.79	0.82-3.91
Retinal	1.12	0.73-1.74	0.93	0.67-1.29	1.01	0.71-1.44	3.78	2.56-5.58
Neurologic	1.03	0.60-1.76	0.97	0.64-1.45	0.79	0.52-1.19	0.77	0.46-1.28
Peripheral vascular	1.03	0.49-2.17	0.65	0.36-1.16	0.85	0.47-1.54	0.73	0.35-1.53
Residence#	1.34	0.96-1.88	1.17	0.88-1.56	1.95	1.47-2.60	1.16	0.78-1.73
Ambulatory diagnostic groups**								
Time limited: major	0.56	0.39-0.79	0.70	0.51-0.95	0.75	0.55-1.02	0.91	0.61-1.38
Likely to recur: discrete	0.86	0.63-1.16	0.72	0.57-0.92	0.99	0.77-1.28	0.75	0.54-1.04
Chronic medical: stable	3.45	1.73-6.88	3.37	1.63-6.98	4.07	2.05-8.06	1.50	0.59-3.79
Chronic medical: unstable	1.14	0.85-1.51	1.32	1.05-1.66	1.39	1.09-1.77	1.29	0.93-1.78
Chronic specialty: stable—eye	1.37	0.90-2.08	1.09	0.80-1.48	1.08	0.79-1.49	10.23	7.09-14.77
Chronic specialty: unstable—eye	0.83	0.60-1.17	0.96	0.73-1.26	1.00	0.75-1.33	7.40	5.41-10.13
Prevention/administrative	1.75	1.34-2.29	1.64	1.32-2.05	1.59	1.27-2.00	1.11	0.83-1.49
Malignancy	0.93	0.56-1.53	0.91	0.61-1.35	0.57	0.38-0.85	1.49	0.89-2.51

OR = odds ratio; CI = confidence interval.

\* Compares continuity score of 1.00 with continuity score of 0.00.

† Number of outpatient visits during study year for which diabetes was listed as any of 3 diagnoses.

‡ Reference group is endocrinologist.

§ Reference group is 55-64 years.

|| Reference group is male.

¶ For each diabetic complication, comparison is presence vs absence of complication.

# Reference group is nonmetropolitan.

\*\* For each ambulatory diagnostic group (ADG), comparison is presence vs absence of ADG; only ADGs significant at  $P < .05$  for 1 or more outcomes are included in this table.

## DISCUSSION

This study found no significant association between continuity of care and the likelihood of receiving standard monitoring tests for diabetes mellitus. This finding was true whether continuity was measured from all outpatient visits or from visits to primary care providers only. This finding was also true after considering multiple potential confounders, including demographics, provider specialty, number of diabetes visits, and case mix.

At first glance, these results might seem surprising. Given the known benefits of continuity,<sup>1-3,6-10,12-15</sup> one might think that continuity would also benefit diabetes management. In fact, 2 previous studies might be interpreted to show such a benefit. One study of health maintenance organization patients in Minnesota found

that patients who had a regular source of care for their diabetes were more likely to have had appropriate tests and were less likely to have very high glycosylated hemoglobin levels. Although the study examined the role of having a regular source of care, it did not measure the level of continuity that patients had with that provider.<sup>24</sup>

A more recent study found that for patients with diabetes in 5 clinics in southern Texas, high provider continuity was associated with better glucose control.<sup>25</sup> Because all patients received glycosylated hemoglobin tests as part of the study, they were not able to examine the relationship between continuity and receipt of glycosylated hemoglobin tests. Nor did they examine testing for hyperlipidemia or retinopathy. Most importantly, all participants had an established relationship with a primary care clinic, and continuity was meas-

ured only within the context of visits to that clinic. The study, therefore, could not account for discontinuity attributable to visits to physicians other than those in their primary care clinic or resulting from patients changing to another clinic (which could have been the case for those patients who were lost to follow-up). Consequently, although the study by Parchman et al provides important data about how continuity within a clinic is associated with glycemic control, it did not address the question of whether continuity is associated with adequacy of monitoring.

Our study found that when all providers and visits are accounted for, continuity is not associated with receipt of tests for monitoring diabetes mellitus. One reason for this finding might be that persons with diabetes are sicker than the general population and often require specialty care.<sup>26,27</sup> More visits to specialists usually means lower continuity; however, it also means more opportunities to have tests ordered. Even when one considers only visits to primary care providers, low continuity indicates more visits to different providers. These providers might order tests because they are unfamiliar with the patient and are unsure of whether the test is due, which could explain why having high continuity does not necessarily lead to a higher likelihood of receiving diabetes monitoring tests.

It is important to note that while continuity did not have a positive impact on quality of care, neither did it have a negative impact. It is sometimes argued that persons with chronic diseases should see specialists (and therefore have less continuity with a primary care physician), because primary care physicians do not always provide optimal quality of care.<sup>31,33,34,53</sup> This study does not support that hypothesis; high continuity with a primary care physician was not associated with lower quality, and having an endocrinologist as one's predominant provider was not consistently associated with better quality. These findings are supported by a recent study suggesting that after adjusting for case mix and other confounding variables, quality of care for diabetes is no better when patients are cared for by endocrinologists compared with generalists.<sup>54</sup> These negative findings are important, because shifting care to specialists can not only increase costs but can sometimes reduce quality, especially for conditions that are outside the specialists' expertise.<sup>55</sup>

Several potential limitations should be considered in interpreting the results of this study. First, claims data are not always accurate in capturing diagnoses and procedures.<sup>56-61</sup> Our study design helps alleviate this issue by examining quality indicators that are represented accurately in claims data,<sup>31</sup> by using a case-mix measure that is robust to diagnostic coding errors,<sup>45,46</sup>

and by examining beneficiaries of the same health plan for whom the accuracy of claims data would be comparable.

Second, because continuity was not randomly allocated, patients at different levels of continuity could have differed in important ways. For example, patients with more diabetic complications might have tests ordered more often and might also have lower continuity because of a need to see multiple specialists. Although we controlled for the number of diabetes visits and for diabetic complications and other comorbidities, unmeasured differences could still exist, such as differences in adherence to ordered tests. The only way to eliminate such bias would be to allocate patients randomly to different levels of continuity, which would be difficult (and possibly unethical) to do.

Finally, there are limitations to how the results of the study can be generalized. We examined only one aspect of quality of care for diabetes (ie, the likelihood of having specific tests performed). Other quality indicators, such as level of metabolic control, might be positively associated with continuity<sup>25</sup>; but these outcomes are beyond the scope of our study, because they are not available in claims data. Also our study population comprised only members of one health plan (albeit one of the largest health plans in the nation), beneficiaries of one employer, and adults aged less than 65 years. Although this population is important to examine, the results of our study cannot necessarily be generalized to other populations.

Despite these limitations, the results of this study yield important implications that can be used to help guide health care policy decisions. It is often assumed that continuity should lead to improved quality of care. Patients are often strongly encouraged or sometimes even coerced (as in the case of gatekeeping in managed care) to see their regular physician whenever possible. Patients often prefer to see their regular physician,<sup>19</sup> but sometimes they might not and even resent restrictions on seeing other physicians.<sup>62</sup> This study shows that for persons with diabetes, continuity should not be forced on patients based on the assumption that it will improve quality of care – at least when quality is measured by the receipt of appropriate tests. Continuity might have other substantial benefits, such as fewer emergency department visits and hospitalizations,<sup>12,13</sup> and the results of this study should not be taken to mean that physicians should not try to provide continuity for their patients. What the study findings do suggest is that increasing the rate of monitoring for persons with diabetes does not appear to be one of the benefits of continuity.

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