

The Effect of Physician Continuity on Diabetic Outcomes in a Resident Continuity Clinic

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BACKGROUND: Conflicting data exists regarding the effect of continuity on diabetes care. Resident physicians frequently treat patients with diabetes in their continuity clinics; however, maintaining continuity in a resident clinic can be very challenging.

OBJECTIVE: To determine if resident continuity is associated with improvement in diabetic outcomes (HbA1c, LDL, blood pressure) in a resident clinic.

DESIGN AND SETTING: Retrospective analysis of data obtained from a medical record review of diabetic patients seen in a resident physician clinic.

MEASUREMENTS: We measured continuity, using the Usual Provider of Continuity Index (UPC) for residents and faculty preceptors. We measured changes in HbA1c, LDL, and blood pressure over a 3-year period. Using repeated measures analysis of variance (ANOVA), we assessed the relationship between UPC and change in these diabetic outcomes.

RESULTS: The resident UPC was 0.43, and the faculty preceptor UPC was 0.76. The overall change in HbA1c was -0.3. There was a statistically significant relationship between improvement in HbA1c and resident UPC ($p=0.02$), but not faculty preceptor UPC. There was no association between resident or faculty preceptor continuity and change in LDL or blood pressure.

CONCLUSION: This study showed a link between resident continuity and improvement in glycemic control in diabetic patients. Resident physicians have a greater opportunity to develop a personal relationship with their patients. This interpersonal continuity may be of benefit in patients with illnesses that requires a significant amount of self-management behaviors. Medical training programs should focus efforts on improving continuity in resident primary care clinics.

KEY WORDS: continuity; diabetes; residents.

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INTRODUCTION

Diabetes is one of the most prevalent chronic diseases in the United States and developed countries. The beneficial effects of tight control of glucose, LDL cholesterol, and blood pressure have been well documented¹⁻³. However, the quality of diabetes care in the US has been suboptimal,^{4,5} and intermediate outcomes are often poorly controlled. Traditionally, it has been presumed that continuity of care is beneficial for patients with chronic illness. Saultz has previously described a hierarchical model of continuity that includes informational continuity (accumulated knowledge of a person's medical and social history), longitudinal continuity (receiving care at a familiar setting), and interpersonal continuity. Interpersonal continuity refers to the ongoing, personal relationship between patient and physician that includes mutual trust and responsibility.⁶ Continuity has been shown to benefit patients with chronic illnesses such as asthma⁷ and hypertension.⁸ However, studies have shown conflicting data regarding the value of continuity in improving the quality of care and outcomes in diabetes.⁹⁻¹⁴

Continuity of care is also considered important in medical residency training programs.¹⁵ The Internal Medicine Residency Review Committee (RRC) requires residents to attend a minimum of 108 weekly continuity clinic sessions during the 36 months of their training. The time residents can be away from continuity clinic is also limited. As part of this continuity experience, residents are required to follow patients with chronic diseases on a long-term basis.¹⁶ The Accreditation Council for Graduate Medical Education (ACGME) and the Internal Medicine RRC promote preserving continuity of care in resident clinics;¹⁶ however, maintaining continuity in this setting is a challenging endeavor. Internal medicine residents only spend 1-2 half days in continuity clinic per week and are often excused from clinic during some weeks of training, including vacations and night shift work. The purpose of this study was to determine if continuity of care in a resident physician clinic is associated with an improvement in intermediate diabetic outcomes.

METHODS

Study Population and Setting

This study was an analysis of data obtained from a medical record review of diabetic patients seen in a university-based residency-training program's continuity clinic practice. This

clinic includes approximately 63 internal medicine (IM) residents (PGY 1–3), 20 medicine/pediatrics (MP) residents (PGY1–4), and 15 faculty physicians who precept residents. Forty-three percent of residents are female and 13% are of non-White ethnicity. Approximately 16% of IM residents are in a primary care track. These residents do a 3-month block of ambulatory clinic during their 2nd and 3rd years of residency. They spend approximately 1–2 months less time on the hospital inpatient or intensive care unit services. In clinic, residents see patients 1–2 half days per week, and faculty precept residents 1–4 half days per week. Residents have the same faculty preceptor throughout their residency training. Residents are excused from clinic when they have been on call the previous night, on a night shift rotation, in the intensive care unit or emergency department, or participating in a rotation away from their primary program site. Residents are in clinic the remainder of their scheduled clinic sessions, an average of 36 weeks of clinic per year. In this clinic, patients' health maintenance and follow-up appointments are scheduled with the primary resident. Non-scheduled or urgent treatment visits are seen by any available physician.

Diabetes Curriculum

IM and MP residents attend two ambulatory clinic conferences dedicated to outpatient diabetes care each year. Diabetes education received during precepting encounters varies. At the time of this study, there were no reminders or supports for the implementation of diabetes care guidelines.

Data Extraction

Data were obtained from medical records of diabetic patients who were seen in a resident clinic between 1 January 2004 and 31 December 2006. Inclusion criteria for medical record selection included the following: medical records of persons age 18 or older, and medical records with an ICD-9 diagnosis code of 250.xx (diabetes mellitus and various complications) on at least two separate outpatient visits. Some very healthy patients may come to clinic once every year or so, precluding the attainment of a doctor-patient relationship within the confines of a short 3- or 4-year residency. Therefore, we focused on patients who were seen in resident clinic on more than a yearly basis, or at least four times over the 3-year period. Nine hundred fifteen medical records were identified, and 101 medical records were randomly chosen for data extraction. Information was extracted from medical records by the principal investigator or trained research assistant, and included age, gender, ethnicity, visit date, diagnoses, weight, HgA1c, LDL cholesterol, and blood pressure levels. Data also included the resident physician and faculty preceptor for each visit. The University of Kentucky Institutional Review Board granted an exemption for this study.

Continuity

Every effort is made for residents' own patients to be scheduled with them, ensuring continuity whenever possible. Residents, therefore, are expected to develop and maintain both informational and interpersonal continuity with their patients. The resident and faculty preceptor discuss the medical history, physical exam, and management plan for every patient.

Faculty preceptors must see and examine patients with residents during the first 6 months of their residency training. According to the primary care exception rule, though, faculty preceptors are not required to re-examine the resident's patients after their first 6 months of training. However, faculty preceptors do occasionally see and examine patients during encounters with more advanced residents as the situation requires. Faculty preceptors, therefore, are expected to have informational continuity regarding the patient but not necessarily interpersonal continuity. This study evaluates resident (informational and interpersonal) continuity and faculty preceptor (informational) continuity. Since there is only one site for this clinic, longitudinal continuity is maintained among residents, faculty preceptors, and patients.

We used the Usual Provider of Continuity index (UPC) to measure continuity. The UPC is the number of visits to a usual provider in a given time period divided by total number of visits.¹⁷ The UPC ranges in value from zero to one, with zero being no continuity and one being perfect continuity. For example, if a patient is seen at eight visits and four of those visits are to his or her usual provider, the UPC is 0.5. The UPC is simple to calculate and intuitive to the interpreter. To our knowledge, the UPC has never been subjected to formal validation studies, but it has been widely used in studies of continuity.¹⁸

Analysis

We assessed the relationship between provider continuity (resident and faculty preceptor UPC) and change in diabetic outcomes (HgA1c, LDL, BP) using repeated measures analysis of variance in the General Linear Model analytic (GLM) framework. The GLM approach provides the opportunity to include both continuous and categorical independent variables, unequal *n*, and to model repeated measures effects. Initial and last measured HgA1c, LDL, and systolic and diastolic blood pressures were the dependent repeated measures. Independent variables entered first as control variables were age, sex, ethnicity, and number of visits. Entered next in the analysis was the UPC index of continuity, as a continuous variable. The key indicator of whether continuity was statistically significantly associated with a change in a dependent variable (e.g., HgA1c) over the 3-year study period is indicated by the statistical interaction between continuity and the change in the dependent variable from year 1 to year 3 (time by continuity interaction). A statistically significant time by continuity interaction term indicates that the change in the dependent variable is associated with level of continuity. Interpreting the meaning or shape of the interaction requires a graphical representation of how time and level of continuity are associated.

When a statistically significant time by continuity interaction was found, we examined the shape of the interaction by dividing the distribution of UPC in two ways. First, a simple median split of resident UPC values was performed to compare low and moderate levels of continuity. A second dichotomy was created using the top quartile of resident continuity (UPC > 0.65) to create a comparison at the high end of the continuity scale. This comparison isolates a high level of continuity where residents would see their patients 65% of the time. Statistical analyses were done using SAS statistical software 9.1 (SAS Institute, Cary, NC).

RESULTS

Seventy medical records met the criteria for this study. Patients had an average of 6.2 active medical problems. The majority of patients had hypertension, hyperlipidemia, or both (Table 1). There was an average of 18.3 visits per patient over the 3-year period (Table 2). The mean UPC index for residents was 0.43 (SD 0.22) with a range of 0.11 to 1.0. For faculty preceptors, the mean UPC index was 0.76 (SD 0.15) with a range of 0.4 to 1.0. The average time between the initial and final mean HgA1c values was 24 months (range 8 months to 35 months).

The relationship between resident and faculty preceptor UPC and changes in HgA1c, LDL cholesterol, and systolic and diastolic blood pressure are shown in Table 3. There was a significant relationship between the change in HgA1c and the resident UPC index (p=0.02.) There was no relationship between the change in HgA1c and the UPC for faculty preceptors. Table 4 shows the mean change in HgA1c and the percentage of patients with initial and final HgA1c <7% at different levels of resident continuity. Using the median resident UPC of 0.45 as a cutoff, there was a directional improvement in HgA1c in 61% of patients at a UPC <0.45 and in 68% of patients at a UPC ≥0.45. Using the top quartile of resident UPC (0.65) as a cutoff, there was an improvement in HgA1c in 94% of patients at a UPC ≥0.65. There was no statistically significant association between the change in LDL cholesterol and resident and faculty preceptor continuity measures. Similarly, there were no statistically significant associations with systolic or diastolic blood pressure and measures of continuity.

Age was negatively correlated with initial (r=-0.34, p=0.004) and final (r=-0.43, p<0.001) values of HgA1c, indicating that older patients in our sample had better levels of control than younger patients. However, age was not significantly associated with continuity or a change in any of the dependent variables, including a change in HgA1c (r=-0.14, ns).

DISCUSSION

Even though faculty preceptor continuity was higher, this study showed a significant relationship between a decrease in HgA1c and resident physician continuity, but no relationship between HgA1c and faculty preceptor continuity. This associ-

Table 2. Characteristics of Patient Visits

Visit characteristic	Mean (range)
Number of visits	18.3 (6-57)
Number of total providers seen	10.7
Number of residents per patient	6.2 (1-18)
Number of faculty preceptors per patient	3.9 (1-9)

ation remained significant after controlling for age, gender, ethnicity, total number of visits, and other medical problems. One possible explanation for this finding is the different roles that residents and faculty have in an academic teaching clinic. Patients usually identify their resident physician, not the faculty preceptor, as their primary care doctor.¹⁹ Faculty preceptors maintain informational continuity, but have less opportunity to develop interpersonal continuity. Residents, on the other hand, have much more of an opportunity to develop and enhance the mutual trusting relationship necessary for interpersonal continuity. Interpersonal continuity may be especially important in patients with diseases that require extensive self-management, such as diabetes. A previous study showed a significant association between HgA1c and continuity of care in patients who advanced through a stage of behavioral change in diet. The study suggested that a sustained relationship between patient and physician might improve patient self-care behaviors.¹¹ Successful diabetes care requires a partnership between a patient and physician in order to accomplish management goals. A high level of interpersonal continuity between patient and physician may enhance this partnership, and motivate patients to actively participate in their care.

This study found no significant relationship between resident or faculty preceptor measures of continuity and change in blood pressure or LDL cholesterol. Blood pressure is a dynamic measurement that can be influenced by many factors at any given time. In addition, the act of measuring blood pressure is subject to operator variation. This study evaluated blood pressures measured in usual clinical practice rather than rigorous methods of measurement, as one may see in a hypertension study. In addition, we only assessed two blood pressure values (initial and final) from patient visits over a 3-year period. Evaluating additional blood pressure values may have resulted in different findings. LDL, on the other hand, is a much more static measurement. In this study, the initial and final LDL values were both already in close range of the American Diabetes Association goal of less than 100. One would expect to see less variation in LDL measurements, particularly for patients on cholesterol-lowering medications.

Using data from the third National Health and Nutrition Examination Survey (NHANES), Manious et al. examined the relationship between continuity and diabetes control. This study also found an association between continuity and glycemic control, but no association between continuity and lipid or blood pressure control. The authors suggested that physicians may prioritize glycemic control over lipid and blood pressure control.¹² We would add that glycemic control requires more effort from the patient in terms of his or her own self-management. Checking finger stick blood glucoses multiple times a day, injecting insulin, and following a diabetic diet are daily routines for many diabetic patients. Again, the

Table 1. Characteristics of the Studied Population (N=70)

Patient characteristic	Mean (range) or N (%)
Age, years	61.8 (27-88)
Female	51%
Ethnicity, % non-White	45%
Number of active medical problems	6.2 (1-13)
Hypertension	85.7%
Hyperlipidemia	68.6%
Hypertension and hyperlipidemia	60%
Depression	31.4%
Coronary artery disease	16.6%
Chronic kidney disease	17.2%
Peripheral neuropathy	12.8%

Table 3. Initial and Final Mean HgA1c, LDL, Systolic, and Diastolic Blood Pressure Values at Greater than or Less than 50% Continuity

	Resident				Faculty preceptor			
	UPC<0.5*		UPC>0.5†		UPC<0.5*		UPC>0.5†	
Outcome	Initial	Final	Initial	Final	Initial	Final	Initial	Final
HgA1c	8.5	8.5	8.2	7.7‡	8.4	8.3	8.4	7.9
LDL§	117.3	86.9	121.9	99.9	113.2	96.3	119.8	89.8
Systolic BP	140.9	135.1	134.8	136.0	140.4	139.0	135.7	132.6
Diastolic BP	79.5	76.7	77.6	76.9	80.0	78.1	77.3	75.3

BP blood pressure

*UPC<0.5 describes continuity of less than 50%

†UPC>0.5 describes continuity of greater than 50%

‡p=0.02 (HgA1c final less than initial for resident UPC>0.5)

§p<0.001 (overall LDL final less than initial)

complexity of maintaining glycemic control may be more heavily influenced by the doctor patient relationship.

Our data show that improving HgA1c is possible in a resident physician clinic. Although causation cannot be implied, this study does suggest that a resident continuity level (UPC) of 0.65 or higher is associated with a clinically meaningful improvement in HgA1c (decrease of 10%). Few studies have actually looked at the association between continuity in resident physician clinics and diabetes outcomes. One study showed an association between continuity and improvement in a quality of care score for diabetics. This quality score included predominantly process indicators, and the continuity score was based on patient recall.⁹ Another study, done in Malaysia, found no association between provider continuity and glucose control, but only recruited patients if their regular provider had worked in the clinic for the previous 28 months.¹² In a 3-year residency, this would exclude patients seen by all but 3rd-year residents.

In interpreting these data, several limitations should be noted. This study focused on a university-based resident continuity clinic. Because this is a unique type of physician practice, the results cannot be generalized to other non-resident practices. Medical records were randomly selected

for data extraction, but we did not stratify the sampling for a random resident distribution. In addition, we did not collect data on individual resident characteristics, such as interest in primary care versus subspecialty care. It is possible that some residents may be more fully engaged in chronic disease management, and thus, more actively pursue follow-up with their diabetic patients. Our data do not allow identification of subgroups of diabetic patients who may have greater benefit from increased continuity or a critical value for which continuity leads to improvement in diabetic outcomes. Continuity is one of many influences on health outcomes in diabetes. Other explanations for observed effects, such as patients' personality characteristics or values, may also exist and affect self-management behaviors. There was also no control in the study for patients who receive additional care from endocrinologists.

Despite the limitations of our study, the findings suggest that resident physician continuity is linked with improvement in glycemic control. The development of interpersonal continuity may be more influential in chronic diseases requiring a great deal of patient self-management. The unique relationship between a resident physician and his or her patient may play a role in this improvement. Increasing resident physician continuity would not only enhance the resident's educational experience in caring for patients with chronic diseases, but may also improve the quality of care diabetic patients receive in resident continuity clinics. Therefore, medical training programs should focus efforts on improving continuity in resident primary care clinics. Further studies examining resident physician continuity and health outcomes in other chronic diseases (asthma, chronic obstructive pulmonary disease, congestive heart failure) would be useful. Studies evaluating patients' beliefs about their relationship with their resident physician and the effect that relationship may have on their self-care behaviors would be equally illuminating.

Table 4. Effect Size of the Relationship between Change in HgA1c and Resident Continuity

Resident UPC	Mean HgA1c change	Initial HgA1c <7 (%)	Final HgA1c <7 (%)
UPC <0.45* below median (N=35)	-0.03	20%	22%
UPC ≥0.45 median and above (N=35)	-0.54	31%	45%
UPC ≥0.65† top quartile (N=16)	-1.08	25%	50%

Values represent change in HgA1c over time and percentage of patients with initial or final HgA1c <7. HgA1c <7 is target goal for patients with diabetes

*Median resident UPC was 0.45

†Top quartile of resident continuity was a UPC ≥0.65

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