Continuity of Care and Recognition of Diabetes, Hypertension, and Hypercholesterolemia

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Background: Continuity of care has been shown to have a variety of health benefits, but the effect of continuity of care on recognition of common chronic diseases has been underinvestigated.

Objective: To examine the relationship between continuity of care and the recognition of 3 prevalent chronic diseases: diabetes, hypertension, and hypercholesterolemia.

Methods: We analyzed data from the third National Health and Nutrition Examination Survey, a nationally representative sample of 18,162 adult noninstitutionalized residents of the United States collected from 1988 through 1994. We examined the proportion of unrecognized disease among all individuals with diabetes, hypertension, and hypercholesterolemia according to self-reported level of continuity of care. We used logistic regression to control for possible confounders, including number of disease risk factors.

Results: Among persons with diabetes, in adjusted models, those with a usual provider of care had a lower likelihood of having unrecognized disease (odds ratio, 0.30; 95% confidence interval, 0.10-0.95) than those with no usual site or provider of care. Unrecognized hypertension had an unadjusted relationship with level of continuity of care, but continuity of care was not a significant predictor after possible confounders were adjusted for. Unrecognized hypercholesterolemia was not predicted by level of continuity of care.

Conclusions: Continuity of care has some benefits in terms of recognizing chronic disease, although benefits appear to be disease specific. More research needs to be conducted to elucidate the complex relationship between continuity and disease recognition.

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D IABETES MELLITUS, hypertension, and hypercholesterolemia are prevalent chronic conditions with substantial target organ disease and significant complications. Quality care for these conditions can reduce morbidity, mortality, and the likelihood of target organ disease. Provision of appropriate care that may decrease morbidity and mortality is contingent on early recognition of disease, often when the patients are essentially asymptomatic.

Continuity of care is a way of structuring the delivery of care that has been shown to have a variety of health benefits. Continuity has been associated with more frequent cancer screening and receipt of preventive services, decreased frequency of emergency department use and hospitalization, and better compliance with follow-up appointments.

Continuity of care may be associated with increased recognition of disease in several ways. The continuity relationship allows the patient and the physician to share knowledge over time. Recognition of changes in health status, awareness of patient desires for treatment, and opportunities for preventive intervention should accrue through this longitudinal relationship. It could be argued that conditions that are generally asymptomatic would be detected earlier because of the long-term relationship between patient and physician.

Patients with asthma have been shown to have greater communication with their health care provider when there is continuity of care. Physicians have indicated that the increased knowledge of the patient that accompanies continuity is integral to the clinical decision-making process. Pediatricians who had continuity with their patients were more likely to recognize psychosocial problems.
Recognition of disease is the first important step to management of disease and its associated morbidity and mortality, especially in the chronic diseases that can be silent for years, such as diabetes, hypertension, and hypercholesterolemia. There are few data on the role of continuity of care in the recognition of common chronic diseases. Therefore, the objective of this study was to examine the relationship of continuity of care with recognition of diabetes, hypertension, and hypercholesterolemia in a nationally representative population-based survey.

**METHODS**

This study is an analysis of the third National Health and Nutrition Examination Survey (NHANES III), a product of the National Center for Health Statistics that spans the years 1988 through 1994. The survey data include approximately 40,000 participants from a nationally representative sample of noninstitutionalized residents of the United States. The survey data were collected in 2 stages, first in 44 different communities from 1988 through 1991, then in 45 additional locations from 1991 through 1994. Eighty-six percent (33,994) of the surveyed residents were invited to examination centers for additional data collection, including physical examination and laboratory measures. Seventy-nine percent (31,311) of those surveyed completed all or some of the physical examination and laboratory data collection.

The household adult data file contains the results of the questionnaire administered to all adults in the survey population described above. Adults are defined by the National Center for Health Statistics as any noninstitutionalized civilian 17 years of age or older. During the 6 years of NHANES III data collection, 20,500 adults completed the household survey. The adult interviews were conducted in English and Spanish by highly trained field staff. The staff members were continuously retrained throughout the 6-year period to ensure that the appropriate standard was maintained.

The examination and laboratory data files contain the results of the examinations and laboratory tests performed on survey participants who followed up their household interview as requested with a visit to one of the NHANES mobile examination centers. Survey participants were examined within 1 month of completing their household interview. A less comprehensive home examination was available to those participants who were unable to leave their home.

**OUTCOME VARIABLES**

Our outcome variable, in general, is the proportion of unrecognized disease among all those judged to have the disease. This proportion is considered for diabetes, hypertension, and hypercholesterolemia.

For diabetes mellitus, individuals were counted as having unrecognized disease (1) if they answered no to the question, “Has a doctor ever told you that you have high cholesterol?” and (2) if they had a measured fasting total cholesterol level greater than 200 mg/dL (>5.17 mmol/L). The total individuals with disease were the sum of the individuals with unrecognized disease and those who answered yes that a physician had told them on 2 or more occasions that they had high blood pressure. These standards are consistent with the guidelines of the Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of Hypertension.

For hypercholesterolemia, individuals were counted as having unrecognized disease (1) if they answered no to the question, “Has a doctor ever told you that you have high cholesterol?” and (2) if they had a measured fasting total cholesterol level greater than 200 mg/dL (>5.17 mmol/L). The total individuals with disease were the sum of the individuals with unrecognized disease and those who answered yes that a physician had told them that they had high cholesterol levels. These standards are consistent with the guidelines of the National Cholesterol Education Program.

**PREDICTOR VARIABLE**

Our predictor variable is level of continuity. Continuity of care was operationalized based on the answers to 2 questions. Individuals were asked, “Is there a particular clinic, health center, doctor’s office, or other place that you usually go to if you are sick, need advice about your health, or for routine care?” If they answered yes they were asked, “Is there one particular doctor or health professional you usually see?” The answers allowed us to create an ordered variable of continuity ranging from (1) no usual source of care to, (2) usual place but no usual provider, to (3) usual place and provider.

**CONTROL VARIABLES**

We controlled for factors that might affect screening and detection of disease in the office setting: age, general health status, sex, race, income, education, health insurance, and outpatient visits in the past 12 months.

Because we thought that the presence of disease risk factors might have an impact on recognition of disease, we also controlled for the number of risk factors for each of the 3 diseases. For diabetes, we identified the following risk factors: age older than 45 years; body mass index (weight in kilograms divided by the height in meters squared) greater than 25; diabetes in a first-degree relative; race/ethnicity; a history of hypertension; a high-density lipoprotein cholesterol level lower than 35 mg/dL (<0.9 mmol/L); or a triglyceride level higher than 250 mg/dL (>2.82 mmol/L). For hypertension, we identified the following cardiovascular disease risk factors: a history of smoking; a history of hypercholesterolemia; a history of diabetes, age older than 60 years; a family history of heart attack; previous heart attack; a history of heart failure; and a history of stroke. For hypercholesterolemia, we identified the following cardiovascular risk factors: a history of smoking; a history of hypertension; a family history of heart attack; men older than 45 years and women older than 55 years; body mass index greater than 30; and a history of heart attack or heart failure.

The data were weighted and the analysis was conducted using specialized software for analyzing clustered data (SUDAAN; RTI International, Research Triangle Park, NC) in an effort to account for the complex sampling design used in the NHANES III. This analysis allowed us to make more accurate parameter and SE estimates and to make population estimates for the noninstitutionalized adult US population. \( \chi^2 \) Analy-
ses were performed for recognition of diabetes, hypertension, and hypercholesterolemia according to level of continuity. We performed logistic regression analyses for each of the 3 diseases, with unrecognized disease as an outcome and with level of continuity as the predictor variable, using the risk factors and other control variables identified above.

RESULTS

In the study population, 22.1% (SE, 0.84%) of the subjects had no usual site of care, 11.7% (SE, 0.75%) had a usual site of care but no usual provider, and 66.2% (SE, 1.25%) had a usual provider of care. The demographics of this study population with respect to level of continuity are shown in Table 1. Sex, age, race, insurance status, education, health status, number of outpatient visits, and income were all associated with level of continuity of care, as expected.

The unadjusted relationships between proportion of unrecognized disease and level of continuity of care are shown in Table 2. A greater level of continuity was associated with a lower likelihood of having unrecognized diabetes and hypertension, but not hypercholesterolemia.

When possible confounding factors were controlled for, the logistic regression for continuity of care as a predictor of unrecognized diabetes showed that those individuals with a usual provider of care had 70% less unrecognized disease than those with no usual site or provider of care (odds ratio [OR], 0.30; 95% confidence interval [CI], 0.10-0.95). However, a usual site without a usual provider of care was not significantly different from not having a usual site or provider. Frequency of visits also predicted unrecognized disease. Individuals who had not seen a physician in the last year were nearly 4 times as likely to have unrecognized disease as those who had seen a physician 4 times or more in the past year (OR, 3.80; 95% CI, 1.46-9.93). The number of diabetes risk factors was not a significant predictor of unrecognized diabetes after the other variables were controlled for.

In contrast to the unadjusted relationship, the regression analysis showed that level of continuity of care was not a significant predictor of unrecognized hypertension after the control variables were adjusted for. Frequency of visits again predicted unrecognized disease, with individuals who had not seen a physician in the last year being more than twice as likely to have unrecognized disease as those who had seen a physician 4 times or more in the past year (OR, 2.66; 95% CI, 1.42-4.98). The number of cardiovascular risk factors was not a significant predictor of unrecognized hypertension.

In the logistic regression examining predictors of unrecognized hypercholesterolemia, the level of continuity of care was not an important predictor. Race was a significant predictor, with non-Hispanic blacks having 31% more unrecognized disease than non-Hispanic whites (OR, 1.31; 95% CI, 1.10-1.56). The number of visits in the past year and the number of cardiovascular risk factors were not important predictors of unrecognized hypercholesterolemia. However, a self-perceived health status of “good” (OR, 0.60; 95% CI, 0.47-0.77) or “fair” (OR, 0.55; 95% CI 0.37-0.83) was associated with less unrecognized disease than a status of “excellent.”

Table 1. Population Proportions for Sociodemographic Characteristics and Continuity of Care

<table>
<thead>
<tr>
<th>Continuity of Care</th>
<th>None (P)</th>
<th>Usual Place (P)</th>
<th>Usual Place and Person (P)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>64.34 (1.19)</td>
<td>49.89 (1.69)</td>
<td>41.79 (0.65)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Age, y</td>
<td>67.05 (1.36)</td>
<td>61.09 (1.78)</td>
<td>41.11 (1.03)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>17-39</td>
<td>24.43 (1.28)</td>
<td>27.42 (1.28)</td>
<td>31.46 (0.84)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>≥60</td>
<td>8.52 (0.78)</td>
<td>11.49 (1.08)</td>
<td>27.42 (1.26)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Race</td>
<td>68.36 (2.73)</td>
<td>60.88 (3.61)</td>
<td>80.76 (1.86)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>White non-Hispanic</td>
<td>12.03 (1.28)</td>
<td>15.14 (1.65)</td>
<td>10.24 (1.21)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Black non-Hispanic</td>
<td>32.81 (2.44)</td>
<td>23.97 (1.38)</td>
<td>9.00 (1.14)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Other</td>
<td>72.25 (1.67)</td>
<td>82.47 (2.28)</td>
<td>82.95 (0.54)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>High school graduate or higher</td>
<td>71.27 (1.76)</td>
<td>67.62 (2.57)</td>
<td>74.76 (3.35)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Health status</td>
<td>21.84 (1.43)</td>
<td>20.33 (1.74)</td>
<td>19.90 (0.94)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Excellent</td>
<td>32.06 (1.43)</td>
<td>28.87 (1.98)</td>
<td>31.03 (0.79)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Very good</td>
<td>32.99 (1.05)</td>
<td>33.99 (2.23)</td>
<td>32.69 (0.74)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Good</td>
<td>11.55 (1.07)</td>
<td>13.52 (1.48)</td>
<td>12.93 (0.69)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Poor</td>
<td>1.56 (0.27)</td>
<td>3.26 (0.55)</td>
<td>3.45 (0.27)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Outpatient visits</td>
<td>56.41 (2.46)</td>
<td>40.74 (2.33)</td>
<td>34.44 (0.98)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>0</td>
<td>25.41 (2.05)</td>
<td>28.94 (1.96)</td>
<td>29.94 (0.80)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>1</td>
<td>11.31 (1.62)</td>
<td>19.09 (1.84)</td>
<td>19.58 (0.76)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>≥4</td>
<td>6.88 (0.92)</td>
<td>11.23 (1.76)</td>
<td>16.06 (0.71)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Income &lt;$20 000 per year</td>
<td>40.09 (1.80)</td>
<td>39.31 (2.93)</td>
<td>30.82 (1.62)</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

*Numbers in parentheses are SEs.*
In this study, we found that patients who had a usual provider of care were less likely to have unrecognized diabetes, despite the presence of possible confounders. It should be noted that patients who had a usual site of care but no usual provider were not significantly different from those with no usual site or provider in relation to the likelihood of having unrecognized diabetes. The level of continuity of care was not an important predictor for either unrecognized hypertension or hypercholesterolemia after possible confounders were controlled for.

The findings regarding diabetes provide some reinforcing evidence of the importance of the personal longitudinal relationship between patient and physician. The current findings are similar to those from another study that demonstrated that in relation to the likelihood of future hospitalization, having continuity with a specific provider yielded a lower likelihood of hospitalization, while having continuity with a site but no specific provider was not different from having little continuity with either a site or a provider. These findings suggest that specific benefits may accrue from the information transferred in the interpersonal interactions between patient and physician that are not contained in the medical record accessed by other providers at the same site.

The nature of the diseases and the status of knowledge and screening at the time of the NHANES survey should be considered when continuity as it relates to disease recognition is examined. Diabetes may well be a disease that benefits most from a sustained relationship between physician and patient. Diabetes in its early stages is relatively asymptomatic and is not a disease for which routine screening is performed. Therefore, of the 3 diseases that were considered in our study, diabetes is the one that might most rely on the knowledge of the patient’s history and the recognition of subtle changes in health status that might arise from a longitudinal relationship.

Hypertension is unlike diabetes in that adults often undergo blood pressure measurement as part of a routine examination of vital signs on visiting a physician. It could be argued that, for this reason, continuity is not as necessary for recognition of hypertension as for diabetes.

Hypercholesterolemia has been identified as an important risk factor for cardiovascular disease, and routine screening recommendations are now in place. However, screening recommendations were less well defined at the time of this survey. For example, the US Preventive Services Task Force in 1989 recommended that “periodic measurement of total serum cholesterol is most important for middle-aged men, and it may also be clinically prudent in young men, women, and the elderly.” Because the recommendation to clinicians was not as strong then as it is now, we might expect to see different screening behaviors in the late 1980s and early 1990s than we might see today.

We had hypothesized that the number of risk factors might be an important control variable in predicting unrecognized disease with respect to continuity. A long-term relationship with a patient might lead to a greater knowledge of his or her potential risk factors for disease and therefore lead to greater recognition of disease. However, the number of risk factors did not appear to be an important predictor, as we had hypothesized, and might not be the mechanism underlying the effect of continuity with a usual provider.

Some limitations of the study should be noted. The NHANES is a cross-sectional survey and allows only for the current status of the participants’ level of continuity. The data are also self-reported, with the only indication of level of continuity being the participant’s own estimation on whether he or she has a usual site or provider of care. This measure of continuity is relatively simplistic and does not rigorously count visits to different sites or providers. However, it does assess some of the aspects of the interpersonal relationship that is important in continuity. Past research assessing patient self-reports of having an identified regular provider has shown relationships both to patient satisfaction among general populations of patients and to glycemic control among patients with diabetes. Also, some risk factors for the 3 diseases we studied, such as poor diet, sedentary lifestyle, other atherosclerotic disease, and a history of impaired glucose tolerance or gestational diabetes, could not be accurately addressed using the NHANES data.

Although continuity demonstrated some benefits in this study, any effects of continuity on the early detection of disease could be influenced by a variety of factors other than the disease itself, including the frequency of visits allowing physicians more opportunities to detect disease early, the relationship between physician and patient, and physician competence. Future research focusing on the nature of the continuity relationship and issues surrounding the patient-physician relationship may provide valuable insights. Regardless, continuity of care, particularly with a provider, should be encouraged not just for individuals with recognized chronic diseases but for all adults.

**Table 2. Proportion of Unrecognized Disease by Level of Continuity of Care**

<table>
<thead>
<tr>
<th>Continuity of Care</th>
<th>None</th>
<th>Usual Place</th>
<th>Usual Place and Person</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>34.70 (7.44)</td>
<td>15.10 (4.97)</td>
<td>11.35 (1.27)</td>
<td>.03</td>
</tr>
<tr>
<td>Hypertension</td>
<td>16.89 (2.95)</td>
<td>7.51 (2.24)</td>
<td>6.34 (0.75)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>42.43 (2.97)</td>
<td>48.42 (3.22)</td>
<td>44.97 (0.98)</td>
<td>.41</td>
</tr>
</tbody>
</table>

*Numbers in parentheses are SE.
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REFERENCES