The Impact of Financial Barriers on Access to Care, Quality of Care and Vascular Morbidity Among Patients with Diabetes and Coronary Heart Disease

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BACKGROUND: The prevalence and consequences of financial barriers to health care among patients with multiple chronic diseases are poorly understood.

OBJECTIVE: We sought to assess the prevalence of self-reported financial barriers to health care among individuals with diabetes and coronary heart disease (CHD) and to determine their association with access to care, quality of care and clinical outcomes.

DESIGN: The 2007 Centers for Disease Control Behavioral Risk Factor Surveillance Survey.

PARTICIPANTS: Diabetic patients with CHD.

MAIN MEASURES: Financial barriers to health care were defined by a self-reported time in the past 12 months when the respondent needed to see a doctor but could not because of cost. The primary clinical outcome was vascular morbidity—a composite of stroke, retinopathy, nonhealing foot sores or bilateral foot amputations.

KEY RESULTS: Among the 11,274 diabetics with CHD, 1,541 (13.7 %) reported financial barriers to health care. Compared to individuals without financial barriers, those with financial barriers had significantly reduced rates of medical assessments within the past 2 years, hemoglobin (Hgb) A1C measurements in the past year, cholesterol measurements at any time, eye and foot examinations within the past year, diabetic education, antihypertensive treatment, aspirin use and a higher prevalence of vascular morbidity. In multivariable analyses, financial barriers to health care were independently associated with reduced odds of medical checkups (Odds Ratio [OR], 0.61; 95 % Confidence Intervals [CI], 0.55–0.67), Hgb A1C measurement (OR, 0.85; 95 % CI, 0.77–0.94), cholesterol measurement (OR, 0.76; 95 % CI, 0.67–0.86), eye (OR, 0.85; 95 % CI, 0.79–0.92) and foot (OR, 0.92; 95 % CI, 0.84–1.00) examinations, diabetic education (OR, 0.93; 95 % CI, 0.87–0.99), aspirin use (OR, 0.88; 95 % CI, 0.81–0.96) and increased odds of vascular morbidity (OR, 1.23; 95 % CI, 1.14–1.33).

CONCLUSIONS: In diabetic adults with CHD, financial barriers to health care were associated with impaired

access to medical care, inferior quality of care and greater vascular morbidity. Eliminating financial barriers and adherence to guideline-based recommendations may improve the health of individuals with multiple chronic diseases.

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INTRODUCTION

In recent years, the worsening economy, high unemployment and the continued escalation of health care costs have created or worsened financial burdens for many Americans. Since most health insurance is provided by employers, loss of employment is frequently accompanied by loss of health insurance and the inability to afford health care. Nearly 49 million Americans lack health insurance,¹ including an estimated 11.4 million with chronic diseases such as diabetes mellitus and coronary heart disease (CHD).² Among those who remain employed, increasing health care costs have led to greater cost-sharing of expenses between employer and employee, resulting in greater deductibles and copayments for services. When individuals with health insurance cannot access health care because of the financial burden imposed by these additional fees, they are considered underinsured with financial barriers to health care. In 2010, an estimated 29 million Americans were underinsured.³ With the implementation of the Patient Protection and Affordable Care Act in 2014, the numbers of uninsured and underinsured Americans will decline, but millions of Americans will still be faced with significant financial barriers to care.⁴

Multiple effects of uninsurance on health care have been reported and include impaired access to preventive services,⁵ failure to diagnose chronic disease,⁶ poor control of chronic conditions including hypertension, diabetes and hypercholesterolemia,⁶ cost-related medication underuse⁷ and increased mortality.^{8–10} However, little is known

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regarding the clinical consequences of financial barriers to care in the broader population of uninsured and underinsured Americans. Of great concern is that the burden imposed by these barriers will amplify morbidity and mortality among the sizable, high-risk population with more than one chronic illness.¹¹

We therefore sought to study the impact of financial barriers to health care on access to care, quality of care as defined by adherence to guideline-based standards for disease monitoring, screening for complications and medication compliance,^{12,13} along with vascular outcomes among individuals with diabetes and CHD, a hazardous combination associated with a significantly increased risk of death in both men and women.¹⁴⁻¹⁶

METHODS

We analyzed the 2007 Centers for Disease Control Behavioral Risk Factor Surveillance Survey (BRFSS), a telephone survey of 427,269 adults used for tracking self-reported health conditions, risk behaviors, preventive health practices and health care access in the United States. From the BRFSS population, 48,070 diabetics were identified. Of these, 11,323 reported a diagnosis of diabetes and CHD as defined by a history of coronary artery disease, angina or prior heart attack. Analyses were limited to those 11,274 participants who provided an answer to the following question: "Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?" Financial barriers to health care were defined by an affirmative response.

The data extracted included age, sex, ethnicity, marital status, education, health insurance status (at the time of the survey), employment, annual income, hypertension, hypercholesterolemia, stroke, diabetic retinopathy, nonhealing foot sores, smoking status, body mass index, physical activity, medical checkup, cholesterol, glucose and hemoglobin A1c (HgbA1c) testing, eye and foot examinations, diabetic education and use of medications, including insulin, diabetic oral medications, antihypertensive agents and aspirin, as reported by patients during a structured interview. The primary clinical endpoint of interest was vascular morbidity, which included both macrovascular and microvascular disease and was defined by self-reported stroke, retinopathy, nonhealing (for >4 weeks) foot sores or bilateral foot amputations. Because this study involved only secondary analysis of de-identified data available in the public domain, it was exempt from ethics review.

Statistical Analysis

Data were summarized by descriptive statistics. Univariate analyses were performed to examine demographic and clinical (health care utilization, medication use and vascular

outcomes) characteristics of patients with and without financial barriers to health care. The chi-squared test (or Fisher's exact test, when applicable) was used to compare differences in categorical variables and student's *t*-test was used for continuous variables. The association of financial barriers to care with access to care (medical checkup in the last 2 years), quality of care (guideline-recommended glucose testing, HgbA1C testing, cholesterol testing, diabetic education, eye examination, foot examination, antihypertensive therapy and aspirin use) and vascular morbidity was assessed using multivariable logistic regression models and expressed as adjusted odds ratios with 95 % confidence intervals. Variables included in the models were those that differed in univariate comparisons of subjects with and without each outcome with a $P < 0.1$. For the quality of care outcomes, medical checkup in the last 2 years was included in the models to determine if adherence to quality metrics was dependent upon access to care.

To address the effect of missing values, a two-step multiple imputation process¹⁷ was utilized prior to repeating the multivariable regression analyses. Missing data was first imputed to produce a monotone missing data pattern. Logistic regression was then used to impute the remaining missing categorical data. Ten fully imputed data sets were used for further analysis. Variables that were significant based on those ten imputed data sets were further examined for independent effects in multiple regression models to test whether financial barriers to health care were independently associated with indicators of access to care, quality of care and vascular morbidity. All variables in final models had a relative efficiency of 0.95 or more. The Hosmer and Lemeshow goodness-of-fit test for all models based on ten imputed data sets suggested the fitted model predicted the data very well. Each logistic regression model was highly significant ($P < 0.05$) as indicated by the likelihood ratio tests of the global null hypothesis. PROC MI and PROC MIANALYZE in SAS 9.2 were utilized. Because the multivariable regression models using imputed data yielded more conservative results than those that without imputed data, only the results with imputed data are presented. A two-tailed $P < 0.05$ was considered statistically significant.

RESULTS

Among the 11,274 diabetics with CHD, 1,541 (13.7 %) reported financial barriers to health care in the past 12 months, whereas 9,733 (86.3 %) denied financial barriers. Baseline demographic and clinical characteristics of patients with and without financial barriers are presented in Table 1. Patients with financial barriers were younger (60 vs. 68 years, $P < 0.001$) and more often female ($P < 0.001$) and Hispanic ($P < 0.001$) than those without financial barriers. Those with financial barriers were less likely to

Table 1. Demographic Data and Medical History

	Financial Barriers		P value
	No (n=9,733)	Yes (n=1,541)	
Demographics			
Age, mean (SD), y	68 (11)	60 (12)	< 0.001
No. (%)			
Age≥65 y	6,227 (64.0)	479 (31.1)	< 0.001
Male	4,857 (49.9)	633 (41.1)	< 0.001
Hispanic	614 (6.4)	176 (11.5)	< 0.001
Employed	1,493 (15.4)	273 (17.8)	0.02
College Education	4,290 (44.2)	588 (38.2)	< 0.001
Annual Income≥\$50,000	1,710 (20.8)	109 (8.2)	< 0.001
Health Insurance	9,393 (96.7)	1,188 (77.3)	< 0.001
Married	4,698 (48.4)	671 (43.6)	< 0.001
Medical History			
Hypertension	7,728 (79.6)	1,225 (79.8)	0.89
Hypercholesterolemia	6,848 (73.1)	1,106 (77.5)	0.001
Active Smoker	1,411 (23.0)	427 (44.3)	< 0.001
Moderate Physical Activity	6,188 (65.9)	935 (63.0)	0.03
Vigorous Physical Activity	1,722 (18.4)	294 (19.9)	0.16
Body Mass Index			< 0.001
Normal	1,439 (15.4)	236 (16.1)	
Overweight	3,239 (34.6)	395 (26.9)	
Obese	4,677 (50.0)	838 (57.0)	
Cardiac History			
Myocardial Infarction	6,627 (68.8)	1,094 (72.1)	0.01
Angina/Coronary Disease	6,605 (70.8)	1,003 (68.3)	0.05

be college educated (38 % vs. 44 %, $P<0.001$) and more often employed (18 % vs. 15 %, $P=0.018$). Only 8 % of patients with financial barriers reported annual income of at least \$50,000 compared to 21 % of those without financial barriers to care ($P<0.001$). Seventy-seven percent of those with financial barriers had health insurance as opposed to 97 % of those who reported no financial barriers ($P<0.001$).

Hypertension was reported in 80 % of both groups ($P=0.89$). Individuals with financial barriers had higher rates of hypercholesterolemia (78 % vs. 73 %, $P=0.001$), smoking (44 % vs. 23 %, $P<0.001$) and obesity (57 % vs. 50 %, $P<0.001$) and were less likely to engage in moderate physical activity (63 % vs. 66 %, $P=0.03$) than those without financial barriers. Patients with financial barriers more frequently reported a history of myocardial infarction, whereas those without financial barriers more frequently reported angina or coronary artery disease.

Indicators of access to care and quality of care are presented in Table 2. Patients with financial barriers to health care were less likely to have had a medical checkup within the last 2 years (85 % vs. 96 %, $P<0.001$), less regular monitoring of their HgbA1c levels (77 % vs. 84 %, $P<0.001$) and a tendency toward less frequent blood glucose monitoring. They also were less likely to have had a cholesterol screening (95 % vs. 98 %, $P<0.001$), eye examination (59 % vs. 75 %, $P<0.001$), foot examination (68 % vs. 77 %, $P=0.022$) and diabetic education classes (52 % vs. 55 %, $P=0.049$). Diabetics with financial barriers reported higher rates of insulin use (52 % vs. 55 %, $P=0.002$) and lower rates of diabetic oral medication use (66 % vs. 71 %, $P<0.001$). Antihypertensive medication use (among individuals with hypertension) (91 % vs.

Table 2. Access to Care, Disease Monitoring and Medication Use

	Financial Barriers		P value
	No (n=9,733)	Yes (n=1,541)	
	No. (%)		
Out-patient Care			
Last checkup			< 0.001
Within the past 2 years	9,145 (95.5)	1,291 (85.4)	
At least 2 years ago	367 (3.8)	195 (12.9)	
Never	61 (0.6)	26 (1.7)	
Blood glucose checked			0.06
Daily	4,535 (70.2)	731 (69.2)	
Weekly	1,092 (16.9)	162 (15.3)	
At least monthly	392 (6.1)	70 (6.6)	
Never	437 (6.8)	93 (8.8)	
HgbA1c checked in the past 12 months			< 0.001
Yes	4,929 (83.8)	759 (77.0)	
No	409 (7.0)	143 (14.5)	
Does not know what HgbA1c is	541 (9.2)	84 (8.5)	
Cholesterol ever checked	9,459 (98.2)	1,447 (95.4)	< 0.001
Eye exam within the past year	4,850 (75.4)	629 (59.2)	< 0.001
Annual foot exam with provider	4,802 (76.5)	701 (68.3)	< 0.001
Diabetic education class taken	3,598 (55.1)	557 (51.9)	0.049
Medications			
Insulin	2,296 (35.1)	433 (40.0)	0.002
Diabetic oral medication	4,633 (70.9)	714 (66.1)	0.001
Antihypertensive medication(s)	7,366 (95.7)	1,105 (90.9)	< 0.001
Aspirin	2,283 (77.1)	383 (69.8)	< 0.001

96 %, $P<0.001$) and aspirin use (70 % vs. 77 %, $P<0.001$) were significantly lower in individuals with financial barriers to health care.

Compared to diabetics without financial barriers, those with financial barriers reported greater overall vascular morbidity (68 % vs. 55 %, $P<0.001$), with significantly higher rates of stroke (24 % vs. 20 %, $P<0.001$), diabetic retinopathy (39 % vs. 28 %, $P<0.001$) and nonhealing foot sores (27 % vs. 14 %, $P<0.001$) (Table 3). Bilateral foot amputations did not differ between groups.

On multivariable analysis (Table 4), financial barriers to health care were independently associated with a nearly 40 % reduction in the odds of a medical checkup within the

Table 3. Vascular Morbidity

	Financial Barriers		P value
	No (n=9,733)	Yes (n=1,541)	
	No. (%)		
Vascular Morbidity	3,685 (55.0)	769 (68.2)	< 0.001
Stroke	1,939 (20.1)	364 (24.0)	< 0.001
Diabetic eye changes/retinopathy	1,785 (27.6)	419 (39.2)	< 0.001
Foot sore taking >1 month to heal	894 (13.7)	289 (26.9)	< 0.001
Bilateral foot amputation	42 (0.7)	9 (0.9)	0.52

past 2 years (Odds Ratio [OR], 0.61; 95 % Confidence Interval [CI], 0.55–0.67). In addition, after adjustment for access to care, financial barriers remained independently associated with reduced likelihood of a Hgb A1C measurement within the last 12 months (OR, 0.85; 95 % CI, 0.77–0.94), any cholesterol screening (OR, 0.76; 95 % CI, 0.67–0.86), an annual foot exam (OR, 0.92; 95 % CI, 0.84–1.00), an annual eye exam (OR, 0.85; 95 % CI, 0.79–0.92), a diabetic education

Table 4. Multivariable Analysis of Indicators of Access and Quality

	Odds Ratio	95 % Confidence Interval	P value
Medical checkup within past 2 years*			
Financial barriers to care	0.61	0.55–0.67	< 0.001
Health Insurance	1.40	1.23–1.58	< 0.001
Age (per year)	1.01	1.00–1.02	0.049
Employed	0.84	0.76–0.94	0.002
Active Smoker	0.89	0.80–1.00	0.04
Any cholesterol measurement within 12 months†			
Financial barriers to care	0.76	0.67–0.86	< 0.001
Health Insurance	1.51	1.31–1.74	< 0.001
Obese (vs. Normal)	1.17	1.03–1.34	0.02
Active Smoker	0.79	0.70–0.91	< 0.001
Checkup within past 2 years	1.98	1.76–2.24	< 0.001
Hgb A1C measurement within 12 months‡			
Financial barriers to care	0.85	0.77–0.94	0.002
Health Insurance	1.55	1.35–1.77	< 0.001
Obese (vs. Normal)	1.13	1.01–1.26	0.03
College Education	1.09	1.01–1.18	0.03
Active Smoker	0.92	0.84–1.00	0.04
Checkup within past 2 years	1.46	1.29–1.65	< 0.001
Foot exam within 12 months§			
Financial barriers to care	0.92	0.84–1.00	0.049
Health Insurance	1.24	1.13–1.37	< 0.001
Male Gender	1.13	1.06–1.19	< 0.001
Hispanic	0.74	0.67–0.81	< 0.001
Obese (vs. Normal)	1.15	1.07–1.23	< 0.001
Employed	0.91	0.84–0.98	0.009
Active Smoker	0.90	0.83–0.96	0.003
Checkup within past 2 years	1.52	1.38–1.68	< 0.001
Eye exam within 12 months			
Financial barriers to care	0.85	0.79–0.92	< 0.001
Health Insurance	1.31	1.19–1.44	< 0.001
Age (per year)	1.02	1.01–1.02	< 0.001
College Education	1.12	1.06–1.18	< 0.001
Employed	0.92	0.85–0.99	0.02
Annual Income ≥ \$50,000	1.11	1.03–1.19	0.006
Active Smoker	0.87	0.81–0.93	< 0.001
Checkup within past 2 years	1.34	1.23–1.47	< 0.001
Diabetic Education¶			
Financial barriers to care	0.93	0.87–0.99	0.03
Health Insurance	1.11	1.01–1.23	0.03
Age (per year)	0.98	0.97–0.98	< 0.001
Obese (vs. Normal)	1.16	1.08–1.24	< 0.001
College Education	1.27	1.20–1.34	< 0.001
Employed	0.92	0.87–0.98	0.01
Active Smoker	0.87	0.82–0.93	< 0.001
Checkup within past 2 years	1.12	1.02–1.23	0.02
Aspirin use#			
Financial barriers to care	0.88	0.81–0.96	0.005
Male Gender	1.23	1.16–1.30	< 0.001
Hispanic	0.79	0.70–0.90	0.001
Overweight (vs. Normal)	1.10	1.02–1.20	0.02
Employed	1.11	1.00–1.22	0.04
Annual Income ≥ \$50,000	1.20	1.10–1.30	< 0.001
Active Smoker	0.92	0.86–0.98	0.01
Hypertension	1.17	1.09–1.26	< 0.001
Hypercholesterolemia	1.16	1.09–1.23	< 0.001
Checkup within past 2 years	0.98	0.84–1.13	0.74

Table 4. (continued)

	Odds Ratio	95 % Confidence Interval	P value
Antihypertensive Use**			
Financial barriers to care	0.91	0.81–1.03	0.14
Health Insurance	1.48	1.26–1.73	< 0.001
Age (per year)	1.02	1.01–1.03	< 0.001
Obese (vs. Normal)	1.37	1.17–1.60	0.001
Hypercholesterolemia	1.16	1.01–1.33	0.04
Checkup within past 2 years	1.74	1.50–2.02	< 0.001

*Model included the following variables: health insurance, age, gender, body mass index, employed, active smoker

†Model included the following variables: health insurance, age, body mass index, employed, annual income ≥ \$50,000, active smoker, medical checkup within past 2 years

‡Model included the following variables: health insurance, body mass index, college education, annual income ≥ \$50,000, active smoker, medical checkup within past 2 years

§Model included the following variables: health insurance, age, gender, Hispanic, body mass index, college education, employed, annual income ≥ \$50,000, active smoker, medical checkup within past 2 years

||Model included the following variables: health insurance, age, gender, Hispanic, body mass index, college education, employed, annual income ≥ \$50,000, active smoker, medical checkup within past 2 years

¶Model included the following variables: health insurance, age, gender, Hispanic, body mass index, college education, employed, annual income ≥ \$50,000, active smoker, medical checkup within past 2 years

#Model included the following variables: health insurance, gender, Hispanic, body mass index, college education, employed, annual income ≥ \$50,000, active smoker, hypertension, hypercholesterolemia, medical checkup within past 2 years

**Model included the following variables: health insurance, age, body mass index, employed, annual income ≥ \$50,000, active smoker, hypercholesterolemia, medical checkup within past 2 years

class (OR, 0.93; 95 % CI, 0.87–0.99) and aspirin use (OR, 0.88; 95 % CI, 0.81–0.96). In each model, a medical checkup within the past 2 years was associated with significantly increased odds of adherence to these quality indicators.

Financial barriers to health care were associated with a 23 % increase in the odds of vascular morbidity (OR, 1.23; 95 % CI, 1.14–1.33) (Table 5). Hispanic ethnicity (OR, 1.14; 95 % CI, 1.03–1.26) and hypercholesterolemia (OR,

Table 5. Multivariable Analysis of Vascular Morbidity

	Odds Ratio	95 % Confidence Interval	P value
Financial barriers to care	1.23	1.14–1.33	< 0.001
Age (per year)	0.99	0.98–1.00	< 0.001
Hispanic	1.14	1.03–1.26	0.009
Obese (vs. Normal)	0.93	0.86–0.99	0.03
College Education	0.90	0.85–0.94	< 0.001
Employed	0.79	0.72–0.85	< 0.001
Annual Income ≥ \$50,000	0.88	0.83–0.94	< 0.001
Hypercholesterolemia	1.08	1.02–1.13	0.007
Aspirin Use	0.84	0.79–0.89	< 0.001

Model included the following variables: health insurance, age, gender, Hispanic, body mass index, college education, employed, annual income ≥ \$50,000, active smoker, hypercholesterolemia, HgbA1c testing within past 12 months, aspirin use, antihypertensive use

1.08; 95 % CI, 1.02–1.13) were also associated with increased odds of vascular morbidity. Variables associated with reduced odds of vascular morbidity included younger age (OR, 0.99; 95 % CI, 0.98–1.00), obesity (OR, 0.93; 95 % CI, 0.86–0.99), college education (OR, 0.90; 95 % CI, 0.85–0.94), employment (OR, 0.79; 95 % CI, 0.72–0.85), annual income $\geq$ \$50,000 (OR, 0.88; 95 % CI, 0.83–0.94) and aspirin use (OR, 0.84; 95 % CI, 0.79–0.89).

DISCUSSION

Several important findings emerge from this nationally representative cross-sectional study of diabetic adults with CHD. First, financial barriers to health care were relatively common, being reported by nearly one in seven respondents, 77 % of whom possessed health insurance. Second, the presence of financial barriers to health care was independently associated with impaired access to medical care as indicated by a nearly 40 % reduction in the likelihood of a medical checkup in the preceding 2 years. Third, after adjusting for access to medical care, financial barriers remained associated with inferior quality of care, manifested by an 8–24 % reduction in the odds of recommended disease monitoring, screening examinations, diabetic education and regular aspirin use. Finally, financial barriers were independently predictive of significantly greater vascular morbidity. To our knowledge, this is the first study to address the impact of financial barriers at multiple points along the continuum of care—from access to care to disease monitoring to screening for complications to medication compliance to outcomes in a high-risk population with multimorbidity. Given the growing numbers of Americans with financial barriers to care¹⁸ and the increasing prevalence of diabetes,¹⁹ these findings not only have important implications for public health, but should also inform the ongoing debate on health care reform.

Financial barriers to health care affect a broad and growing population that includes both individuals with no health insurance and those with health insurance who experience financial hardship in paying for various components of health care. Different definitions of financial barriers exist and explain the wide range of reported rates of financial barriers. If a liberal definition is used (problems paying medical bills in the last 12 months or currently have medical bills that are being paid over time), nearly one-third of individuals in the United States are in a family experiencing financial burdens.²⁰ The current study, using a more restrictive definition (the self-reported inability to see a physician because of cost), resulted in a financial barrier rate of approximately 14 %. This is similar to the 18 % rate of financial barriers found in a recent study of over 2,400 patients with acute myocardial infarction²¹ where financial barriers were defined as avoidance of health care services because of cost. That study documented that

69 % of patients with financial barriers possessed health insurance, which is similar to the 77 % rate in the current study. It is possible that some of these individuals may have had gaps in their insurance coverage during the year prior to the survey; nevertheless, our findings indicate that mandating health insurance will not guarantee that patients will then be able to afford, access or receive the health care they need.

We chose to study diabetics with CHD, a high-risk population whose morbidity and mortality are reduced by adherence to evidence-based standards of care^{12,13} generally implemented and monitored in the ambulatory setting. Sicker patients such as these generally require more visits to generalist and specialist physicians, more tests and more medications—each commonly requiring separate deductibles, co-payments and other out-of-pocket expenses. Thus, it is not surprising that financial barriers to health care prevented these complex patients from being able to access care. The failure to access care was accompanied by suboptimal adherence to disease monitoring and treatment recommendations, and ultimately, poorer health outcomes. Our study does not allow us to determine the specific mechanisms responsible for these deficiencies. However, these results suggest that although access is critically important for receiving proper care, other deficiencies exist whereby even those individuals with financial barriers who access the health care system receive suboptimal care. This may reflect the fact that healthcare providers in systems utilized by those with financial barriers are unfamiliar with guidelines for disease monitoring, screening and treatment. Alternatively, language, socioeconomic factors or other cultural barriers may prevent the implementation of care that was recommended.^{22,23}

By mandating health insurance, the Patient Protection and Affordable Care Act will lower cost barriers for previously uninsured Americans, but it is unlikely to reverse the trend of increasing cost-sharing and financial liability for patients.⁴ Individuals with an income of less than 400 % of the federal poverty limit will be eligible for some protection through cost-sharing subsidies to limit deductibles, co-payments and other out-of-pocket expenses.³ However, those who use health services frequently will still be liable for considerable costs. Thus, adequately addressing the disparities in access to care may require more profound changes in health care such as universal access. For example, in Canada, universal access has reduced most disparities in access to health care.²⁴

Limitations

Several limitations of this study exist. First, as with all studies of retrospective data, there is potential error in data entry and by omission. We minimized the impact of missing values on our results by utilization of multiple imputation techniques.^{17,25} Second, as all variables collected in this

database were self-reported, the data reliability may be affected by recall bias and by a subject's knowledge of their own medical information. Third, patients with financial barriers to care may have reported lower rates of certain comorbidities as a consequence of not being diagnosed during regular physician visits. Fourth, we are unable to determine which specific cost factor (co-payment, transportation, childcare, etc.) created the financial barrier to seeing a physician. Finally, as BRFSS is a cross-sectional survey, the impact of suboptimal access and quality on mortality cannot be determined.

CONCLUSIONS

In conclusion, this observational analysis demonstrated a consistent association between the presence of financial barriers to health care and impaired access to medical care, less adherence to guideline-recommended diabetes management and inferior vascular outcomes in diabetic adults with CHD.

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Conflict of Interest: The authors declare that they do not have a conflict of interest.

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