Financial Burdens and Barriers to Care Among Nonelderly Adults With Heart Disease: 2010–2015

Didem Bernard, PhD; Zhengyi Fang, MS

Background—We examined the prevalence of high burdens and barriers to care among adults with heart disease treatment.

Methods and Results—The participants were aged 18 to 64 years from the Medical Expenditure Panel Survey–Household Component (MEPS-HC) for 2010–2015. *High burden* is out-of-pocket spending on care and insurance premiums >20% of income. *Barriers to care* are forgoing and delaying care for financial reasons. Logistic regressions were used to estimate the odds of having high burdens and barriers. Adults treated for heart disease have odds ratios (ORs) of 2.18 (95% CI, 1.91–2.50) for having high burden, 2.51 (95% CI, 2.23–2.83) for forgoing care, and 3.57 (95% CI, 3.8–4.13) for delaying care compared with adults without any chronic condition. Among adults treated for heart disease compared with adults with private group coverage, ORs for having high burdens were significantly lower among those with public insurance (OR: 0.17; 95% CI, 0.10–0.26) or the uninsured (OR: 0.58; 95% CI, 0.36–0.92) and higher among those with private nongroup insurance (OR: 5.30; 95% CI, 3.26–8.61). Compared with adults with private group coverage, ORs for delaying care were 2.07 (95% CI, 1.37–3.12) for those with public insurance, 2.64; 95% CI, 1.70–4.10) for those without insurance, and 2.16 (95% CI, 1.24–3.76) for those with private nongroup insurance.

Conclusions—Public insurance provides protection against high burdens but not against forgoing or delaying care. Future research should investigate whether and to what extent barriers to care are associated with worse health outcomes and higher costs in the long term. (***J Am Heart Assoc***. 2019;8:e008831. DOI: 10.1161/JAHA.118.008831.)

Key Words: barriers to care • financial burdens • heart disease treatment

Heart disease and stroke are the leading causes of death in the United States.[1] Total direct costs of cardiovascular disease care in the United States were $318 billion (in 2015 dollars) in 2015 and were estimated to more than double to billion by 2035.[2] Addressing effective prevention, detection, and treatment of heart disease is an essential goal of public health policies and initiatives such as the Million Hearts Campaign, Healthy People 2020 (the nation's 10-year objectives for improving the health of all Americans), and the National Quality Strategy.[3–5] Million Hearts has aligned efforts across the country to prevent cardiovascular disease using a selected set of evidence-based public health and clinical strategies. Up to 500 000 cardiovascular events may have been prevented from 2012 through 2016 because of the Million Hearts initiative. The Healthy People 2020 heart disease and stroke objective is to improve cardiovascular health and quality of life through prevention, detection, and treatment of risk factors for heart attack and stroke; early identification and treatment of heart attacks and strokes; prevention of repeated cardiovascular events; and reduction of deaths from cardiovascular disease.[4]

Because nonadherence to treatment can lead to higher long-term costs due to complications and avoidable hospitalizations,[6] it is important to examine factors that lead to nonadherence. The focus of our study is health-related financial burdens and barriers to care among patients with treatment for heart disease. Whereas prior studies have focused on expenditures for the treatment of heart disease,[7–9] we measured all healthcare expenses within a family as total health-related expenses, which are a better measure of financial strain. Furthermore, we examined healthcare burden relative to income. The share of income spent on health care is a better measure of health-related burdens than healthcare expenditures because a given level of health-related expenditure is more burdensome for families with lower income. First, we examined variation in the prevalence of high burdens

Clinical Perspective

What Is New?

- Among adults treated for heart disease, the prevalence of high burden is similar among those with private group coverage (10.1%) and those with public coverage (10.8%); it is significantly greater among uninsured adults (18.4%) and highest among adults with private nongroup coverage (44.8%).
- Among adults treated for heart disease, 11.9% were unable to get care and 11.5% delayed care, and barriers to care were highest among those with public coverage and the uninsured, with 26.5% among the uninsured and 20.3% among those with public insurance forgoing care for financial reasons.

What Are the Clinical Implications?

- This study shows that a substantial proportion of patients do not have the financial means to use recommended treatments and may delay or go without treatment.

among nonelderly adults by the presence of treated chronic conditions and specifically among adults with treatment for heart disease. Second, among patients with treatment for heart disease, we examined person-level spending on treatment for heart disease versus other conditions. Third, we examined financial barriers to care, namely, the prevalence of being unable to get care or delaying care for financial reasons, among nonelderly adults by the presence of treated chronic conditions and specifically among adults treated for heart disease.

Methods

Because of the sensitive nature of the data collected for this study, requests to access the data set from qualified researchers trained in human subject confidentiality protocols may be sent to the US Agency for Healthcare Research and Quality (AHRQ) at CFACTDC@ahrq.hhs.gov. Researchers and users with approved research projects can access restricted data files that have not been publicly released for reasons of confidentiality at the AHRQ Data Center in Rockville, Maryland. This study was covered under the Chesapeake Institutional Review Board AHRQ protocol, Secondary Analysis of Confidential Data from the Medical Expenditure Panel Survey. The participants gave informed consent.

The data are from the Medical Expenditure Panel Survey–Household Component (MEPS-HC), sponsored by the AHRQ. MEPS-HC is a 2-year rotating panel of households designed to yield nationally representative estimates of healthcare expenditures for the civilian, noninstitutionalized population. Every

year, a new MEPS-HC panel is selected among a sample of households from those that participated in the prior year's National Health Interview Survey (NHIS). Data are collected through 5 rounds of interviews and include medical expenditures, insurance coverage, premiums, and other socioeconomic characteristics.[10]

Because the MEPS-HC is a household survey, the data collected are self-reported. However, MEPS also includes a medical provider component that collects data from hospitals, physicians, home healthcare providers, and pharmacies identified by MEPS-HC respondents on both the medical and financial characteristics of medical events. Its purpose is to supplement and/or replace expenditure information received from the MEPS-HC respondents about the health care that was provided to household members in the course of the survey year.

We pool the 2010–2015 MEPS-HC data to obtain a large enough sample to make reliable estimates for population subgroups. The unit of observation is a person aged 18 to 64 years (referred to as *adults* for brevity) living in nonelderly families, in which no one is aged ≥65 years. People in families with members aged ≥65 years are excluded because the older adults have different healthcare needs and insurance coverage options. The pooled MEPS-HC sample has 120 260 observations.

Financial Burdens

Following previous literature,[11–17] healthcare burdens are constructed as the share of family income spent on health-related expenditures, reflecting the fact that family members share financial resources. *Families* are defined as "health insurance eligibility units," that is, people related by blood, marriage, or adoption who would typically be eligible for coverage under a private family policy.

The numerator of the healthcare burden includes only out-of-pocket expenses for health care, whereas the numerator of the total burden also includes family out-of-pocket payments for health insurance premiums. We use after-tax income as the denominator of the burden ratio, as taxes reduce disposable income for the working-age population. Household income sources include wages, business, interest, dividends, alimony, trusts or rent, pension, individual retirement account (ie, IRA), social security, unemployment compensation, workers compensation, veterans income, cash, child support, sales, public assistance, Supplemental Security Income for disability, and other income. To construct after-tax income, we simulated state and federal income taxes (using the National Bureau of Economic Research's TAXSIM model)[18] and Social Security and Medicare taxes. We impose a $1000 floor for family income to deal with cases in which families have very low or negative incomes. Following previous

literature, a *high burden* is defined as health-related spending >20% of income.[11–17] Results are presented at the person level, enabling us to quantify the number of people who live in families with high burden.

Financial Barriers to Care

MEPS collects information on whether surveyed people were unable to get care (going without care) or delayed care, and if so, why. These questions are asked separately for 3 types of services: medical care, dental care, and prescription medications. Combining financial barrier responses for these 3 services, we constructed 2 measures of financial barriers: being unable to get care and delaying care for financial reasons for medical or dental treatment or prescription medicines. If respondents reported (1) that they could not afford care; (2) that insurance would not approve, cover or pay; or (3) that the doctor refused the family's insurance plan, they are coded as having financial barriers to care. The question, "How much of a problem was not receiving care or being delayed in receiving treatment?" was removed from the survey questionnaire in 2015. However, our analysis of pre-2015 data showed that, on average, 80% of those who are unable to get care and delay care for financial reasons report it as a big problem.

Medical Conditions

Medical conditions in MEPS-HC were collected from households verbatim and coded by professional coders using the *International Classification of Diseases, Ninth Revision* (*ICD-9*). Chronic conditions are defined using the fully specified *ICD-9, Clinical Modification* (*ICD-9-CM*) diagnosis codes and based on application of the AHRQ Healthcare Utilization Project Chronic Condition Indicator (CCI)[19] and Clinical Classification Software (CCS)[20] tools to the MEPS medical condition files, which include conditions associated with medical events, disability days, and/or days reported as bothersome because of a health issue during the year. The CCI categorizes all *ICD-9-CM* diagnosis codes as *chronic* or *not chronic*, with chronic conditions defined as those lasting ≥12 months that also place limitations on self-care, independent living, and social interactions or result in the need for ongoing intervention with medical products, services, and special equipment. The CCI algorithm originated with work by a physician panel that reviewed diagnosis codes appearing in Health Care Utilization Project data.[21] This study cannot include 2016 data because chronic condition indicators for 2016 were not available at the time of writing. Because of the change from *ICD-9-CM* to *ICD-10-CM* codes in 2016, the CCI and CCS tools are being revised.

Our analysis is based on "treated prevalence," that is, people who reported medical treatment for any chronic condition at any time during a year. We classified people into 3 mutually exclusive categories: *heart disease* (people with ≥1 medical event associated with CCS code 23), *other chronic condition* (people with no medical events associated with heart disease but who have ≥1 medical event associated with other chronic conditions), or *no chronic condition* (people with no medical events associated with any chronic conditions). The pooled MEPS-HC sample includes 5332 people with heart disease, 48 884 people with other chronic conditions, and 66 044 people with no chronic conditions.

Health Insurance

Each person is classified as having *private group* (employment-related) insurance, *private nongroup* (individual) insurance, *public insurance*, or *no coverage*. People with no private or public coverage at any time during the year are classified as *uninsured*. We distinguish between 2 types of private insurance because nongroup insurance is generally more expensive and provides less generous benefits than group insurance.[22] Marketplace coverage in 2014 and 2015 is coded as private nongroup coverage because the share of expenditures paid out-of-pocket among those with marketplace coverage is more similar to private nongroup coverage than private group coverage. Insurance categories are mutually exclusive. People with multiple types of coverage during the year are assigned the coverage with the longest duration based on monthly insurance indicators. People without major medical coverage for hospital and physician services who have only supplemental coverage are classified as uninsured.

Health Insurance Premiums

Data on out-of-pocket premiums are collected from household respondents for private group coverage, private nongroup coverage, and supplemental coverage for dental or vision care. All premium amounts are prorated to account for the duration of coverage during the year.

Expenditures

Expenditures are classified into 4 service categories: hospital stays, ambulatory visits (office-based provider and outpatient), prescription medications, and *all other* services (emergency room, home health visits, dental visits, and other). All expenditure amounts are adjusted using the Consumer Price Index for all urban consumers and are reported in 2015 US dollars.

Methods

We present descriptive statistics and odds ratios (ORs) of having high total burden and financial barriers. The

regressions were performed using the SAS *surveylogistic* procedure. For the sample of nonelderly adults, model 1 controls for medical condition category, age, sex, and race/ethnicity. For the sample of nonelderly adults with heart disease, model 1 controls for insurance status, age, sex, and race/ethnicity. For both samples, model 2 includes insurance status, marital status, employment, poverty, education, region, and urbanicity, as well as the variables included in model 1. Model 1 is presented because controlling for sociodemographic variables that are highly correlated with race/ethnicity such as poverty, education, and insurance can understate the differences in total burden and barriers to care by race/ethnicity. All estimates are weighted to represent the US civilian noninstitutionalized population. Standard errors are corrected to account for the complex design of MEPS, with Taylor series linearization of the variance.

Results

Burdens by Presence of Chronic Conditions

Table 1 presents components of the burden measures and the percentages of participants with high healthcare and total burdens for nonelderly adults with heart disease, those with other chronic conditions, and those without any chronic conditions. Mean family income among adults with heart disease was lower compared with adults with other chronic conditions ($50 297 versus $57 551; *P*<0.01). Mean out-of-pocket expenditures on healthcare services and premiums were significantly higher among adults with heart disease compared with adults without chronic conditions ($4124 versus $2558; *P*<0.01). Consequently, adults with heart disease were more likely to be living in families with high total burdens compared with those with other chronic conditions (12.5% versus 9.3%; *P*<0.1) and those with no chronic conditions (12.5% versus 4.6%; *P*<0.01).

Burden by Insurance Status Among Adults With Heart Disease

The average annual population of people with treatment for heart disease was 9.1 million from 2010 to 2015. Among nonelderly adults with treatment for heart disease, 5.4 million had private group coverage, 400 000 had private nongroup coverage, 2.4 million had public coverage, and 800 000 were uninsured. Table 1 shows that, compared with those with private group coverage, the prevalence of high total burden was higher among those with private nongroup coverage (10.1% versus 44.8%; *P*<0.01) and among the uninsured (10.1% versus 18.4%; *P*<0.01) but similar among those with public coverage (10.8%).

Regression Analysis Results for Burden by Presence of Chronic Conditions

In model 1, which controls for age, sex, and race/ethnicity, the OR for having high total burden was 2.36 (95% CI, 2.08–2.69)

Table 1. Income, Healthcare Expenditures and Percentage With High Out-of-Pocket Burden Among Nonelderly Adults by Medical Condition and Insurance Status, 2010–2015

	n	Population (× 1000)	Mean Family Income, $ (SE)	Mean Out-of-Pocket Expenditures, $ (SE)		Percent of People With High Burden, % (SE)	
				Healthcare Services	Healthcare Services and Premiums	High Healthcare Burden*	High Total Burden[†]
Presence of chronic conditions							
Adults with heart disease	5332	9053	50, 297 (1101)	2005 (75)	4124 (117)	7.0 (0.4)	12.5 (0.6)
Adults with other chronic conditions	48 884	87 597	57 551[‡] (657)	1607[‡] (27)	3991 (59)	4.6[‡] (0.2)	9.3[‡] (0.2)
Adults with no chronic conditions	66 044	93 743	50 065 (595)	750[‡] (18)	2558[‡] (46)	1.5[‡] (0.1)	4.6[‡] (0.1)
Insurance status among adults with heart disease							
Private group insurance	2664	5449	67 104 (1325)	2362 (98)	5243 (143)	3.9 (0.4)	10.1 (0.8)
Private nongroup insurance	185	403	55 036[§] (4927)	3230[§] (338)	9716[‡] (752)	13.9[‡] (3.6)	44.8[‡] (4.3)
Public insurance	1909	2405	18 080[‡] (778)	989[‡] (80)	1201[‡] (94)	9.3[‡] (0.9)	10.8 (1.0)
No coverage[||]	574	796	30 202[‡] (2031)	2014 (203)	2474[‡] (246)	17.8[‡] (2.4)	18.4[‡] (2.4)

Data are from the authors' calculations using the Medical Expenditure Panel Survey–Household Component (MEPS-HC), 2010–2015. All monetary amounts were converted to 2015 dollars using Consumer Price Index for all urban consumers.
*High healthcare burden is defined as spending ≥20% of disposable family income on healthcare services.
[†]High total burden is defined as spending ≥20% of disposable family income on healthcare services and health insurance premiums.
[‡]Difference from the reference category "adults with heart disease or adults with heart disease and private group insurance" is significant at the 1% level.
[§]Difference from the reference category "adults with heart disease or adults with heart disease and private group insurance" is significant at the 5% level.
[||]Premiums for nonelderly adults with no coverage reflect health insurance coverage for supplemental insurance or insurance coverage for other family members.

Table 2. ORs of Having High Total Burden Among Nonelderly Adults and Nonelderly Adults With Heart Disease, 2010–2015

	All Adults, OR (95% CI)		Adults With Heart Disease, OR (95% CI)	
	Model 1	Model 2	Model 1	Model 2
	(1)	(2)	(3)	(4)
Chronic condition vs no condition				
Heart disease	2.36 (2.08–2.69)	2.18 (1.91–2.50)	. . .	. . .
Other chronic condition	1.85 (1.72–1.99)	1.98 (1.83–2.15)	. . .	. . .
Insurance vs private group				
Private nongroup	. . .	3.67 (3.16–4.26)	6.94 (4.83–9.97)	5.30 (3.26–8.61)
Public	. . .	0.17 (0.14–0.19)	1.07 (0.83–1.39)	0.17 (0.10–0.26)
Uninsured	. . .	0.38 (0.34–0.43)	2.16 (1.50–3.13)	0.58 (0.36–0.92)
Age group vs 18–39 y				
Age 40–54 y	1.12 (1.03–1.23)	1.52 (1.38–1.68)	1.41 (0.99–2.00)	1.61 (1.10–2.34)
Age 55–64 y	1.60 (1.47–1.74)	2.16 (1.96–2.39)	1.88 (1.33–2.66)	2.32 (1.55–3.49)
Sex vs male				
Female	1.14 (1.08–1.19)	0.98 (0.93–1.04)	1.16 (0.94–1.43)	0.96 (0.76–1.21)
Race/ethnicity vs white/other				
Black	0.78 (0.71–0.85)	0.60 (0.54–0.66)	0.88 (0.70–1.12)	0.69 (0.53–0.89)
Hispanic	0.72 (0.66–0.78)	0.61 (0.55–0.68)	0.95 (0.71–1.29)	0.81 (0.56–1.16)
Marital status vs married				
Never married	. . .	1.06 (0.96–1.17)	. . .	0.95 (0.64–1.40)
Widowed/divorced/separated	. . .	0.77 (0.70–0.85)	. . .	0.69 (0.50–0.97)
Employment status vs full-time work				
Not working	. . .	2.58 (2.35–2.84)	. . .	2.48 (1.77–3.47)
Part-time worker	. . .	1.25 (1.13–1.38)	. . .	1.38 (0.94–2.04)
Poverty status vs high income				
Poor	. . .	20.89 (17.73–24.62)	. . .	30.72 (16.91–55.80)
Low income/near poor	. . .	8.24 (7.01–9.70)	. . .	12.09 (7.22–20.24)
Middle income	. . .	3.89 (3.38–4.78)	. . .	6.20 (4.06–9.49)
Education vs more than high school				
Less than high school	. . .	0.84 (0.76–0.94)	. . .	0.95 (0.66–1.35)
High school	. . .	0.98 (0.88–1.09)	. . .	0.79 (0.59–1.07)
Region vs Northeast				
Midwest	. . .	0.98 (0.86–1.11)	. . .	1.25 (0.85–1.85)
South	. . .	1.05 (0.92–1.19)	. . .	1.18 (0.85–1.64)
West	. . .	1.02 (0.90–1.16)	. . .	1.18 (0.77–1.81)
Urbanicity				
Non-MSA vs MSA	. . .	0.91 (0.82–1.03)	. . .	1.19 (0.85–1.66)
No. of observations	120 260	120 260	5332	5332

High total burden is defined as spending ≥20% of disposable family income on healthcare services and health insurance premiums. Data are from the authors' calculations using the Medical Expenditure Panel Survey–Household Component (MEPS-HC), 2010–2015. MSA indicates metropolitan statistical area; OR, odds ratio.

among adults treated for heart disease compared with adults without any chronic conditions (Table 2, column 1). In model 2, which controls for all sociodemographic characteristics, the OR for having high total burden was 2.18 (95% CI, 1.91–2.50) among adults with heart disease compared with adults without any chronic condition (Table 2, column 2).

Regression Analysis for Burdens by Insurance Status Among Adults With Heart Disease

In model 1, compared with adults with private group coverage, ORs for having high total burden were 6.94 (95% CI, 4.83–9.97) among adults with private nongroup coverage and 2.16 (95% CI, 1.50–3.13) among the uninsured; ORs were not significantly different among those with public coverage (Table 2, column 3). In model 2, compared with adults with private group coverage, the OR for having high total burden was 5.30 (95% CI, 3.26–8.61) among adults with private nongroup coverage. In contrast, the odds of having high total burden among those with private group coverage were 5.88 times greater than among those with public coverage (OR: 0.17; 95% CI, 0.10–0.26) and 1.72 times greater than among the uninsured (OR: 0.58; 95% CI, 0.36–0.92; Table 2, column 4).

Among adults with heart disease, the odds of having high total burden were greater for older adults, for white compared with black adults, for married adults compared with those who were widowed or divorced, and for those who were unemployed or part-time workers compared with full-time workers. The OR for having high total burden was 30.72 (95% CI, 16.91–55.80) among poor participants compared with adults with high income.

Out-of-Pocket Expenditures Among Adults With Heart Disease

Table 3 presents person-level out-of-pocket expenditures among adults with heart disease by service type. Mean total out-of-pocket expenditures were $1378 overall, $1479 among the uninsured, and $829 among those with public coverage. Compared with those with private group coverage, out-of-pocket expenditures were higher for those with private nongroup coverage ($1531 versus $2376; P<0.05), lower for those with public coverage ($1531 versus $829; P<0.01), and similar for uninsured participants ($1531 versus $1479). Prescription drugs ($536) and ambulatory care ($421) accounted for the largest share of out-of-pocket expenses. Treatment for heart disease accounted for 21% of all healthcare expenditures.

Regression Analysis for Financial Barriers to Care by Presence of Chronic Conditions

In both models 1 and 2, the odds of being unable to get care among adults with heart disease is 2.51 times (95% CI, 2.23–2.83) those of adults without any chronic condition (Table 4). Similarly, in models 1 and 2, the odds of delaying care among adults with heart disease were 3.58 and 3.57 times those of adults without any chronic conditions (OR: 3.57; 95% CI, 3.08–4.13; Table 4).

Financial Barriers to Care by Insurance Status Among Adults With Heart Disease

Table 5 shows that in descriptive analysis, among adults with heart disease, 11.9% were unable to get care and 11.5% delayed care for financial reasons. The uninsured group was significantly more likely than participants with private group coverage to go without care (26.5% versus 11.9%; P<0.01). Similarly, those with public insurance were significantly more likely than those with private group coverage to go without care (20.3% versus 11.9%; P<0.01). The results were similar for delaying care.

Regression Analysis for Financial Barriers to Care by Insurance Status Among Adults With Heart Disease

In model 1, compared with adults with private group coverage, ORs for being unable to get care were 3.84 (95% CI, 2.98–4.95) among those with public insurance and 5.87 (95% CI, 4.19–8.22) for the uninsured group (Table 6, column 1). In model 2, compared with adults with private group coverage, ORs for being unable to get care were 2.14 (95% CI, 1.42–3.22) among those with public insurance and 3.91 (95% CI, 2.60–5.90) for the uninsured group (Table 6, column 2).

Similar to forgone care, the differences between insurance groups for delaying care were attenuated in model 2 once we controlled for sociodemographic variables compared with model 1 (Table 6, columns 3 and 4). Focusing on model 2, compared with adults with private group coverage, the ORs for delaying care were 2.16 (95% CI, 1.24–3.76) among adults with private nongroup coverage, 2.07 (95% CI, 1.37–3.12) among those with public insurance, and 2.64 (95% CI, 1.70–4.10) among uninsured participants (Table 6, column 4).

We also estimated how the dual-eligible population specifically fares in terms of financial barriers to access to care. Dual-eligible beneficiaries refers to those qualifying for both Medicare and Medicaid benefits. In the nonelderly population, this group is more likely to be disabled and poor but to have the advantage of Medicare coverage as well as Medicaid. When we compared dual-eligible participants with others with public coverage, we found that the probability of financial barriers to care was not significantly different. The probability of going without care is 18.0% for the dual-eligible group and 20.0% among others with public coverage. Dual-eligible participants have twice the total expenditures (a proxy for healthcare utilization level; $30 743 versus $16 547; P<0.01) but similar out-of-pocket expenditures as others with public coverage ($889 versus $855). Consequently, we found that dual-eligible participants with heart disease have significantly higher healthcare utilization but similar out-of-pocket expenditures and financial barriers as others with public insurance (results not shown).

Table 3. Mean Out-of-Pocket Expenditures by Service Type Among Nonelderly Adults With Heart Disease by Insurance Status, 2010–2015

Service Type	Total	Private Group (SE)	Private Nongroup (SE)	Public (SE)	Uninsured (SE)
All services					
All health care, $	1378	1531	2376*	829[†]	1479
	(51)	(63)	(331)	(69)	(136)
Heart disease treatment, $	293	319	493	157[†]	424
	(21)	(26)	(112)	(39)	(73)
Heart disease treatment, %	21	21	21	19	29
Prescription drug					
All health care, $	536	552	656	458	599
	(21)	(25)	(118)	(43)	(70)
Heart disease treatment, $	81	90	90	52	98
	(5)	(7)	(32)	(7)	(15)
Heart disease treatment, %	15	16	14	11	16
Ambulatory care					
All health care, $	421	483	1.069[†]	156[†]	464
	(25)	(30)	(217)	(32)	(88)
Heart disease treatment, $	102	110	189[†]	50[†]	164
	(11)	(10)	(48)	(28)	(57)
Heart disease treatment, %	24	23	18	32	35
Hospital care					
All health care, $	139	171	202	65[†]	114
	(18)	(25)	(104)	(25)	(32)
Heart disease treatment, $	69	84	167	21[†]	56
	(11)	(15)	(104)	(16)	(13)
Heart disease treatment, %	49	49	83	33	49
Other services[‡]					
All health care, $	282	325	449	150[†]	303
	(15)	(20)	(76)	(28)	(34)
Heart disease treatment, $	41	35	46	33[†]	106
	(8)	(7)	(17)	(24)	(27)
Heart disease treatment, %	15	11	10	22	35

Data are from the authors' calculations using the Medical Expenditure Panel Survey–Household Component (MEPS-HC), 2010–2015. All monetary amounts were converted to 2015 dollars using Consumer Price Index for all urban consumers.

*Difference from the reference category "adults with heart disease and private group insurance" is significant at the 5% level.

[†]Difference from the reference category "adults with heart disease and private group insurance" is significant at the 1% level.

[‡]Other services include emergency room, home health visits, dental visits, and other medical expenditures.

Regression Analysis for Financial Barriers to Care Among Those With High Financial Burden

In theory, a patient who needs care either chooses to get care and thus may incur high financial burden or chooses not to get care for financial reasons. However, it is also possible that a patient who chooses to get care and incurs high financial burden may still delay care or be unable to get needed care because of cost. The results for financial barriers to care by level of burden are presented in Table 7. We found that the odds of being unable to get care were not significantly different among adults with high total burden compared with those with low total burden in both models 1 and 2 (ORs: 1.35 and 1.04, respectively; Table 7). The OR for delaying care was 1.74 (95% CI, 1.25–2.43)

Table 4. ORs for Being Unable to Get Care and Delaying Care for Financial Reasons Among Nonelderly Adults, 2010–2015

	Unable to Get Care, OR (95% CI)		Delayed Care, OR (95% CI)	
	Model 1	Model 2	Model 1	Model 2
Chronic condition vs no condition				
Heart disease	2.51 (2.23–2.83)	2.51 (2.23–2.83)	3.58 (3.10–4.13)	3.57 (3.08–4.13)
Other chronic condition	1.82 (1.69–1.95)	2.22 (2.06–2.39)	2.39 (2.19–2.61)	2.76 (2.52–3.02)
Age group vs 18–39 y				
Age 40–54 y	1.13 (1.05–1.22)	1.27 (1.17–1.37)	1.13 (1.04–1.22)	1.21 (1.10–1.32)
Age 55–64 y	1.08 (0.97–1.19)	1.19 (1.06–1.33)	1.16 (1.05–1.29)	1.22 (1.08–1.37)
Sex vs male				
Female	1.25 (1.18–1.33)	1.17 (1.10–1.25)	1.38 (1.29–1.47)	1.28 (1.20–1.37)
Race/ethnicity vs white/other				
Black	1.21 (1.08–1.34)	0.76 (0.68–0.85)	1.14 (1.02–1.26)	0.80 (0.72–0.89)
Hispanic	1.05 (0.93–1.19)	0.60 (0.52–0.69)	0.82 (0.72–0.94)	0.55 (0.47–0.64)
Insurance vs private group				
Private nongroup	. . .	1.64 (1.36–1.99)	. . .	1.80 (1.50–2.14)
Public	. . .	2.38 (2.09–2.71)	. . .	2.08 (1.81–2.38)
Uninsured	. . .	4.33 (3.86–4.86)	. . .	3.34 (2.98–3.75)
Marital status vs married				
Never married	. . .	1.27 (1.16–1.39)	. . .	1.19 (1.07–1.33)
Widowed/divorced/separated	. . .	1.72 (1.58–1.88)	. . .	1.66 (1.51–1.81)
Employment status vs full-time work				
Not working	. . .	1.10 (1.01–1.20)	. . .	1.08 (0.96–1.20)
Part-time worker	. . .	1.10 (1.01–1.19)	. . .	1.05 (0.95–1.17)
Poverty status vs high income				
Poor	. . .	2.81 (2.39–3.31)	. . .	2.08 (1.79–2.41)
Low income/near poor	. . .	2.93 (2.56–3.35)	. . .	2.27 (1.97–2.61)
Middle income	. . .	2.14 (1.87–2.44)	. . .	1.83 (1.62–2.07)
Education vs more than high school				
Less than high school	. . .	0.85 (0.77–0.93)	. . .	0.74 (0.66–0.83)
High school	. . .	0.99 (0.91–1.07)	. . .	0.89 (0.81–0.98)
Region vs Northeast				
Midwest	. . .	1.16 (0.98–1.39)	. . .	1.09 (0.94–1.26)
South	. . .	1.29 (1.09–1.51)	. . .	1.24 (1.08–1.41)
West	. . .	1.23 (1.04–1.46)	. . .	1.16 (1.01–1.33)
Urbanicity vs MSA				
Non-MSA	. . .	0.96 (0.82–1.13)	. . .	0.94 (0.80–1.10)
No. of observations	120 260	120 260	120 260	120 260

Data are from authors' calculations using the Medical Expenditure Panel Survey–Household Component (MEPS-HC), 2010–2015. MSA indicates metropolitan statistical area; OR, odds ratio.

among adults with high total burden, whereas in model 2, the odds of delaying care were not significantly different among adults with high total burden compared with adults with low total burden (Table 7). We found that those with high financial burden were more likely than those with low burden to delay getting care, although this relationship was attenuated by other sociodemographic characteristics.

Table 5. Financial Barriers to Care Among Nonelderly Adults With Treatment for Heart Disease by Insurance Status, 2010–2015

	Total	Private Group	Private Nongroup	Public	Uninsured
Unable to get care for financial reasons, % (SE)	11.9	6.3	9.2	20.3*	26.5*
	(0.6)	(0.6)	(2.7)	(1.3)	(2.6)
Delayed care for financial reasons, % (SE)	11.5	6.7	17.2*	18.7*	19.8*
	(0.7)	(0.6)	(3.9)	(1.3)	(2.5)

Data are from authors' calculations using the Medical Expenditure Panel Survey–Household Component (MEPS-HC), 2010–2015.
*Difference from the reference category "adults with heart disease and private group insurance" is significant at the 1% level.

Burdens and Barriers to Care Among Adults With Heart Disease Who Have Other Comorbid Chronic Conditions

Patients treated for heart disease who have at least one other chronic condition are more likely to have high burden and financial barriers to care compared to patients who had only heart disease. We found that the OR for having high total burden was 1.79 (95% CI, 1.09–2.93) among adults with heart disease and other chronic conditions compared with adults who had only heart disease (Table S1). We also found that the ORs for being unable to get care and delaying care were 1.70 (95% CI, 1.03–2.81) and 2.11 (95% CI, 1.31–3.38), respectively, among adults with heart disease and other chronic conditions compared with adults who had only heart disease (Table S2). In our sample, 87.5% of adults with heart disease treatment also had treatment for at least one other chronic condition. Among patients treated for heart disease who had at least one other chronic condition, 47.6% had hyperlipidemia, 24.7% had diabetes mellitus, 33.7% had mental disorders, and 57.6% had hypertension.

Discussion

Our findings that those with private nongroup insurance have the highest prevalence of high burden, whereas those with public insurance and those without insurance have the highest prevalence of financial barriers to care, are consistent with prior studies on health-related financial burdens among adults in general and among people with chronic conditions such as cancer, diabetes mellitus, and hypertension.[11–17] A related line of research has examined the prevalence of problems paying medical bills, medical debt, and related fiscal strain among the nonelderly adult population.[23–26] Estimates of the prevalence of medical debt in these studies ranged from 16% to 26% in 2015, partly because of differences in the survey questions about problems paying medical bills and medical debt. Consistent with our findings, these studies have shown that problems paying medical bills and having medical debt are greater among people with chronic conditions and are associated with being uninsured, having poor health status, and having lower income. Furthermore, people who have problems paying medical bills are more likely to report being unable to pay for basic necessities like food, heat, or housing and having difficulty accessing needed health care.

In terms of study limitations, note that our goal was to examine the prevalence of high burdens among people with heart disease. It is beyond the scope of this study to disentangle the multiple potential causal relationships among health conditions, income (which can be reduced because of illness), insurance coverage, and healthcare expenditures. Precisely because a chronic condition such as heart disease may lead to reduced employment, lower income, and loss of access to employment-related health insurance, we presented models that control only for age, sex, and race/ethnicity. To the extent that having chronic conditions leads to lower income, estimates from the fully specified models (model 2) underestimate the effect of chronic conditions on the prevalence of financial burdens and barriers. Moreover, we cannot examine the variation in burdens by treatment type, given sample-size limitations.

We found that although public insurance provides protection against high burdens, those with public insurance are more likely to go without or delay care. This finding highlights the importance of tracking multiple measures of burdens and access barriers. Although we examined only financial burdens and barriers, our findings are of relevance to the broader debate on access to care. For people with chronic conditions such as heart disease, healthcare expenditures tend to be persistent over time, so high burdens place a financial strain on patients that might not be sustainable in the long term. Several recent studies have suggested that delay of care and nonadherence with treatment are associated with worse health outcomes and higher expenditures. In a recent study, Pezzin et al examined the extent to which barriers to health care are associated with hospitalizations for *ambulatory-care–sensitive* conditions and related costs.[27] Ambulatory-care–sensitive conditions are based on the Prevention Quality Indicators, established by the AHRQ in 2011, which assume that inpatient hospitalizations for certain conditions are potentially preventable and may indicate reduced access to and lower quality of ambulatory care.[28,29] Endorsed by the

Table 6. ORs for Being Unable to Get Care and Delaying Care for Financial Reasons Among Nonelderly Adults With Heart Disease, 2010–2015

	Unable to Get Care, OR (95% CI)		Delayed Care, OR (95% CI)	
	Model 1	Model 2	Model 1	Model 2
	(1)	(2)	(3)	(4)
Insurance vs private group				
Private nongroup	1.46 (0.75–2.85)	1.15 (0.58–2.27)	2.78 (1.61–4.79)	2.16 (1.24–3.76)
Public	3.84 (2.98–4.95)	2.14 (1.42–3.22)	3.29 (2.53–4.26)	2.07 (1.37–3.12)
Uninsured	5.87 (4.19–8.22)	3.91 (2.60–5.90)	3.76 (2.55–5.53)	2.64 (1.70–4.10)
Age group vs 18–39 y				
Age 40–54 y	1.53 (1.11–2.09)	1.49 (1.08–2.05)	1.47 (1.05–2.05)	1.46 (1.03–2.08)
Age 55–64 y	1.56 (1.16–2.11)	1.50 (1.08–2.09)	1.58 (1.09–2.30)	1.52 (1.03–2.26)
Sex vs male				
Female	1.28 (1.03–1.59)	1.53 (0.91–1.46)	1.20 (0.98–1.48)	1.04 (0.82–1.31)
Race/ethnicity vs white/other				
Black	0.90 (073–1.11)	0.83 (0.67–1.03)	0.86 (0.67–1.11)	0.81 (0.63–1.04)
Hispanic	0.71 (0.54–0.95)	0.67 (0.50–0.90)	0.72 (0.50–1.02)	0.73 (0.51–1.05)
Marital status vs married				
Never married	. . .	1.13 (0.80–1.60)	. . .	1.12 (0.79–1.60)
Widowed/divorced/separated	. . .	1.60 (1.15–2.21)	. . .	1.52 (1.12–2.07)
Employment status vs full-time work				
Not working	. . .	1.14 (0.84–1.57)	. . .	1.29 (0.94–1.77)
Part-time worker	. . .	1.07 (0.73–1.55)	. . .	1.36 (0.87–2.15)
Poverty status vs high income				
Poor	. . .	2.38 (1.52–3.71)	. . .	1.95 (1.19–3.19)
Low income/near poor	. . .	2.56 (1.73–3.80)	. . .	2.08 (1.34–3.22)
Middle income	. . .	2.49 (1.75–3.56)	. . .	2.22 (1.53–3.22)
Education vs more than high school				
Less than high school	. . .	1.06 (0.78–1.44)	. . .	0.77 (0.56–1.05)
High school	. . .	0.98 (0.76–1.27)	. . .	0.88 (0.68–1.14)
Region vs Northeast				
Midwest	. . .	1.21 (0.84–1.75)	. . .	0.90 (0.62–1.29)
South	. . .	1.09 (0.79–1.52)	. . .	0.97 (0.70–1.33)
West	. . .	1.33 (0.90–1.96)	. . .	0.93 (0.65–1.35)
Urbanicity vs MSA				
Non-MSA	. . .	1.00 (0.77–1.29)	. . .	1.11 (0.78–1.57)
No. of observations	5332	5332	5332	5332

Data are from authors' calculations using the Medical Expenditure Panel Survey–Household Component (MEPS-HC), 2010–2015. MSA indicates metropolitan statistical area; OR, odds ratio.

Institute of Medicine,[30] lists of these conditions have been used as indicators in the United States, Canada, England, Brazil, and other countries.[31–36] Pezzin et al found that people who reported having delayed or not sought needed medical care because of financial difficulties were statistically

significantly more likely to have an ambulatory-care–sensitive hospitalization than those who did not experience such financial barriers (OR: 1.17; 95% CI, 1.02–1.34) and incurred excess ambulatory-care–sensitive hospitalization costs of $2082 relative to those reporting no such financial barriers.

Table 7. ORs for Being Unable to Get Care and Delaying Care for Financial Reasons Among Nonelderly Adults With Heart Disease by Presence of High Total Burden, 2010–2015

	Unable to Get Care, OR (95% CI)		Delayed Care, OR (95% CI)	
	Model 1	Model 2	Model 1	Model 2
Burden vs low total burden				
High total burden	1.35 (0.99–1.84)	1.04 (0.75–1.46)	1.74 (1.25–2.43)	1.37 (0.98–1.92)
Age group vs 18–39 y				
Age 40–54 y	1.47 (1.08–2.00)	1.49 (1.07–2.05)	1.44 (1.03–2.02)	1.44 (1.02–2.05)
Age 55–64 y	1.47 (1.10–1.97)	1.49 (1.07–2.08)	1.54 (1.07–2.23)	1.48 (1.00–2.21)
Sex vs male				
Female	1.27 (1.02–1.57)	1.15 (0.91–1.46)	1.21 (0.99–1.48)	1.04 (0.82–1.3)
Race/ethnicity vs white/other				
Black	1.23 (1.01–1.50)	0.83 (0.67–1.03)	1.12 (0.89–1.41)	0.82 (0.64–1.05)
Hispanic	1.01 (0.76–1.35)	0.67 (0.50–0.90)	0.93 (0.66–1.32)	0.73 (0.51–1.05)
Insurance vs private group				
Private nongroup	...	1.14 (0.58–2.23)	...	1.96 (1.14–3.39)
Public	...	2.16 (1.43–3.26)	...	2.22 (1.49–3.31)
Uninsured	...		...	2.69 (1.73–4.17)
Marital status vs married				
Never married	...	1.13 (0.80–1.60)	...	1.13 (0.79–1.60)
Widowed/divorced/separated	...	1.60 (1.15–2.22)	...	1.55 (1.13–2.11)
Employment status vs full-time work				
Not working	...	1.14 (0.83–1.56)	...	1.24 (0.90–1.70)
Part-time worker	...	1.06 (0.73–1.55)	...	1.35 (0.85–2.14)
Poverty status vs high income				
Poor	...	2.35 (1.48–3.72)	...	1.74 (1.08–2.82)
Low income/near poor	...	2.54 (1.69–3.81)	...	1.93 (1.26–2.98)
Middle income	...	2.48 (1.72–3.57)	...	2.10 (1.45–3.05)
Education vs more than high school				
Less than high school	...	1.06 (0.78–1.44)	...	0.77 (0.57–1.06)
High school	...	0.98 (0.76–1.27)	...	0.89 (0.69–1.16)
Region vs Northeast				
Midwest	...	1.21 (0.84–1.75)	...	0.89 (0.62–1.28)
South	...	1.09 (0.79–1.52)	...	0.96 (0.70–1.32)
West	...	1.33 (0.90–1.96)	...	0.93 (0.64–1.34)
Urbanicity vs MSA				
Non-MSA	...	1.00 (0.77–1.29)	...	1.11 (0.78–1.57)
No. of observations	5332	5332	5332	5332

Data are from authors' calculations using the Medical Expenditure Panel Survey–Household Component (MEPS-HC), 2010–2015. High total burden is defined as spending ≥20% of disposable family income on healthcare services and health insurance premiums. MSA indicates metropolitan statistical area; OR, odds ratio.

Another study found that delaying time to treatment initiation beyond 60 days was associated with decreased overall survival and increased recurrence among patients with head and neck squamous cell carcinoma.[37] A recent systematic review and meta-analysis of medication nonadherence and its association with adverse health outcomes in aging populations concluded that medication nonadherence may be significantly associated with all-cause hospitalization and

mortality in older people.[38] However, the evidence is less clear on whether preventive care and specific heart disease treatments save costs and improve health in the long term.[39–41] Future research should investigate whether and to what extent going without or delaying care for heart disease is associated with worse health outcomes and higher health-care costs in the long term.

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Disclosures

None.

References

1. Murphy SL, Kochanek KD, Xu JQ, Arias E. *Mortality in the United States, 2014. NCHS Data Brief, No 229*. Hyattsville, MD: National Center for Health Statistics; 2015.

2. Khavjou O, Phelps A, Leib A. Projections of Cardiovascular Disease Prevalence and Costs: 2015–2035. *Technical Report*. Prepared for American Heart Association by RTI International. RTI Project Number 0214680.003.001.001. November 2016. Available at: https://healthmetrics.heart.org/wp-content/uploads/2017/10/Projections-of-Cardiovascular-Disease.pdf.

3. Million Hearts®: Meaningful Progress 2012–2016–A Final Report. 2017. Available at: https://millionhearts.hhs.gov/files/MH-meaningful-progress.pdf. Accessed November 24, 2019.

4. Healthy people 2020: heart disease and stroke objective. Office of Disease Prevention and Health Promotion. Available at: https://www.healthypeople.gov/2020/topics-objectives/topic/heart-disease-and-stroke. Accessed November 5, 2019.

5. About the National Quality Strategy. 2017. Agency for Healthcare Research and Quality, Rockville, MD. Available at: https://www.ahrq.gov/workingforquality/about/index.html. Accessed November 24, 2019.

6. Encinosa W, Bernard D, Dor A. Does prescription drug adherence reduce hospitalizations and costs? The case of diabetes. In: Dor A, ed. *Pharmaceutical Markets and Insurance Worldwide. Advances in Health Economics and Health Services Research. Volume 22*. London: Emerald Group Publishing; 2010:151–174.

7. Mensah GA, Brown DW. An overview of cardiovascular disease burden in the United States. *Health Aff*. 2007;26:38–48.

8. Nichols GA, Bell TJ, Pedula K, O'Keefe-Rosetti M. Medical care costs among patients with established cardiovascular disease. *Am J Manag Care*. 2010;16:e86–e93.

9. Khera R, Hong JC, Saxena A, Arrieta A, Virani SS, Blankstein R, de Lemos JA, Krumholz HM, Nasir K. Burden of catastrophic health expenditures for acute myocardial infarction and stroke among uninsured in the United States. *Circulation*. 2018;137:408–410.

10. Cohen S. *Sample Design of the 1997 Medical Expenditure Panel Survey Household Component, Methodology Report 11, AHRQ Pub. No. 01-0001*. Rockville, MD: Agency for Healthcare Research and Quality; 2000.

11. Bernard D, Banthin J, Encinosa W. Health care expenditure burdens among adults with diabetes in 2001. *Med Care*. 2006;44:210–215.

12. Selden T, Banthin J. Health care expenditure burdens among elderly adults: 1987 and 1996. *Med Care*. 2003;41(supplement):III-13–III-23.

13. Banthin JS, Bernard DM. Changes in financial burdens for health care: national estimates for the population younger than 65 years, 1996 to 2003. *JAMA*. 2006;296:2712–2719.

14. Banthin J, Cunningham P, Bernard D. Financial burden of health care, 2001–2004. *Health Aff*. 2008;27:188–195.

15. Bernard D, Farr S, Fang Z. National estimates of out-of-pocket health care expenditure burdens among nonelderly adults with cancer: 2001–2008. *J Clin Oncol*. 2011;29:2821–2826.

16. Bernard D, Johansson P, Fang Z. Out-of-pocket health care expenditure burdens among nonelderly adults with hypertension: 2007–2009. *Am J Manag Care*. 2014;20:406–413.

17. Bernard D, Selden T, Yeh S. Financial burdens and barriers to care among nonelderly adults: the role of functional limitations and chronic conditions. *Disabil Health J*. 2016;9:256–264.

18. Feenberg D, Coutts E. An introduction to the TAXSIM model. *J Policy Anal Manage*. 1993;12:189–194. Available at: http://users.nber.org/~taxsim/. Accessed November 5, 2019.

19. HCUP CCS. Healthcare Cost and Utilization Project (HCUP). March 2017. Agency for Healthcare Research and Quality, Rockville, MD. Available at: www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp. Accessed November 25, 2019.

20. Chronic condition indicator for ICD-9-CM. Rockville, MD: Agency for Healthcare Research and Quality. Available at: http://www.hcup-us.ahrq.gov/toolssoftware/chronic/chronic.jsp. Accessed November 5, 2019.

21. Hwang W, Weller W, Ireys H, Anderson G. Out-of-pocket medical spending for care of chronic conditions. *Health Aff*. 2001;20:267–268.

22. Bernard D, Banthin J, Encinosa W. Wealth, income and the affordability of health insurance. *Health Aff*. 2009;28:887–896.

23. Cohen RA, Zammitti E. Problems paying medical bills among persons under age 64: early release of estimates from the National Health Interview Survey, 2011-June 2017. o. Available at: https://www.cdc.gov/nchs/data/nhis/earlyrelease/probs_paying_medical_bills_jan_2011_jun_2017.pdf. Accessed November 5, 2019.

24. Karpman M, Caswell KJ. *Past Due Medical Debt Among Nonelderly Adults, 2012–2015*. Washington, DC: Urban Institute; 2017. Available at: https://www.urban.org/research/publication/past-due-medical-debt-among-nonelderly-adults-2012-15. Accessed November 5, 2019.

25. Hamel L, Norton M, Pollitz K, Levitt L, Claxton G, Brodie M. The burden of medical debt: results for the Kaiser Family Foundation/New York Times Medical Bills Survey. 2016. Available at: https://www.kff.org/wp-content/uploads/2016/01/8806-the-burden-of-medical-debt-results-from-the-kaiser-family-foundation-new-york-times-medical-bills-survey.pdf. Accessed November 5, 2019.

26. Gunja MZ, Collins SR, Doty MM, Beutel S. Insurance coverage, access to care, and medical debt since the ACA: a look at California, Florida, New York, and Texas. 2017. Available at: https://www.commonwealthfund.org/sites/default/files/documents/___media_files_publications_issue_brief_2017_mar_1935_gunja_coverage_access_four_largest_states_ib.pdf. Accessed November 5, 2019.

27. Pezzin LE, Bogner HR, Kurichi JE, Kwong PL, Streim JE, Dawei X, Na L, Hennessy S. Preventable hospitalizations, barriers to care, and disability. *Medicine (Baltimore)*. 2018;97:e0691.

28. Prevention quality indicator overview. 2011. Available at: http://www.qualityindicators.ahrq.gov/Modules/pqi_overview.aspx. Accessed November 5, 2019.

29. Purdy S, Griffin T, Salisbury C, Sharp D. Ambulatory care sensitive conditions: terminology and disease coding need to be more specific to aid policy makers and clinicians. *Public Health*. 2009;123:169–173.

30. Institute of Medicine. Best care at lower cost. 2012. Available at: http://nationalacademies.org/hmd/~/media/Files/Report%20Files/2012/Best-Care/BestCareReportBrief.pdf. Accessed November 5, 2019.

31. Brown AD, Goldacre MJ, Hicks N, Rourke JT, McMurtry RY, Brown JD, Anderson GM. Hospitalization for ambulatory care sensitive conditions: a method for comparative access and quality studies using routinely collected statistics. *Can J Public Health*. 2001;92:155–159.

32. Caminal J, Starfield B, Sanchez E, Casanova C, Morales M. The role of primary care in preventing ambulatory care sensitive conditions. *Eur J Public Health*. 2004;14:246–251.

33. James Macinko J, de Oliveira VB, Turci MA, Guanais FC, Bonolo PF, Lima-Costa MF. The influence of primary care and hospital supply on ambulatory care–sensitive hospitalizations among adults in Brazil, 1999–2007. *Am J Public Health*. 2011;101:1963–1970.

34. Roos LL, Walld R, Uhanova J, Bond R. Physician visits, hospitalizations, and socioeconomic status: ambulatory care sensitive conditions in a Canadian setting. *Health Serv Res*. 2005;40:1167–1185.

35. Agabiti N, Pirani M, Schifano P, Cesaroni G, Davoli M, Bisanti L, Caranci N, Costa G, Forastiere F, Marinacci C, Russo A, Spadea T, Perucci CA; Italian Study Group on Inequalities in Health Care. Income level and chronic ambulatory care sensitive conditions in adults: a multicity population based study in Italy. *BMC Public Health*. 2009;9:457.

36. Magan P, Otero A, Alberquilla A, Ribera JM. Geographic variations in avoidable hospitalizations in the elderly, in a health system with universal coverage. *BMC Health Serv Res*. 2008;8:42.

37. Liao DZ, Schlecht NF, Rosenblatt G, Kinkhabwala CM, Leonard JA, Ference RS, Prystowsky MB, Ow TJ, Schiff BA, Smith RV, Mehta V. Association of delayed time to treatment initiation with overall survival and recurrence among patients with head and neck squamous cell carcinoma in an underserved urban population. *JAMA Otolaryngol Head Neck Surg*. 2019;145:1001–1009.

38. Walsh CA, Cahir C, Tecklenborg S, Byrne C, Culbertson MA, Bennett KE. The association between medication non-adherence and adverse health outcomes in ageing populations: a systematic review and meta-analysis. *Br J Clin Pharmacol*. 2019;85:2464–2478.

39. Miller G, Cohen JT, Roehrig C. Cost-effectiveness of cardiovascular disease spending. *J Am Coll Cardiol*. 2012;60:2123–2124.

40. Cardiovascular disease and risk management. *Diabetes Care*. 2015;38:S49–S57.

41. Stewart J, Manmathan G, Wilkinson P. Primary prevention of cardiovascular disease: a review of contemporary guidance and literature. *JRSM Cardiovasc Dis*. 2017;6:2048004016687211.

ORIGINAL RESEARCH

SUPPLEMENTAL MATERIAL

Table S1. The odds ratio of having high total burdens[1] among non-elderly adults with heart disease by presence of multiple chronic conditions, 2010-2015

	Adults with heart disease	
	Model 1 (95% CI)	Model 2 (95% CI)
Multiple chronic condition vs heart disease only		
Multiple chronic condition	2.08 (1.34-3.23)	1.79 (1.09-2.93)
Insurance vs private group		
Private non-group	7.30 (5.04-10.59)	5.51 (3.39-8.96)
Public	1.02 (0.79-1.33)	0.16 (0.10-0.26)
Uninsured	2.20 (1.53-3.18)	0.59 (0.37-0.94)
Age group vs 18-39		
Age 40-54	1.19 (0.82-1.72)	1.40 (0.94-2.09)
Age 55-64	1.51 (1.03-2.20)	1.98 (1.28-3.05)
Female vs male	1.15 (0.93-1.42)	0.96 (0.76-1.22)
Race/ethnicity vs white/other		
Black	0.88 (0.70-1.11)	0.68 (0.53-0.89)
Hispanic	0.97 (0.72-1.31)	0.81 (0.57-1.17)
Marital status vs married		
Never married		0.95 (0.65-1.40)
Widowed/divorced/separated		0.68 (0.49-0.95)
Employment status vs full time work		
Not working		2.35 (1.69-3.29)
Part time worker		1.36 (0.92- 2.01)
Poverty status vs high income		
Poor		31.04 (17.06-56.48)
Low income/near poor		12.35 (7.35-20.75)
Middle income		6.26 (4.08-9.61)
Education vs > High school		
Less than high school		0.93 (0.66-1.33)
High school		0.78 (0.58-1.05)
Region vs Northeast		
Midwest		1.24 (0.84-1.83)
South		1.19 (0.85-1.66)

West		1.19 (0.78-1.83)
Non-MSA vs MSA		1.17 (0.84-1.64)
Number of observations	5,332	5,332

Source: Authors' calculations using the Medical Expenditure Panel Survey-Household Component, 2010-2015.

[1] High total burden is defined as spending 20% or more of disposable family income on health care services and health insurance premiums.

CI= confidence interval

Table S2. The odds ratio of being unable to get care and delaying care due to financial reasons among non-elderly adults with heart disease by presence of multiple chronic conditions, 2010-2015

	Was unable to get care (95% CI)		Delayed care (95% CI)	
	Model 1	Model 2	Model 1	Model 2
Multiple chronic condition vs heart disease only				
Multiple chronic condition	1.78 (1.05-3.00)	1.70 (1.03-2.81)	2.17 (1.37-3.45)	2.11 (1.31-3.38)
Insurance vs private group				
Private non-group	1.49 (0.76-2.94)	1.18 (0.59-2.36)	2.89 (1.68-4.95)	2.24 (1.28-3.89)
Public	3.69 (2.87-4.76)	2.13 (1.41-3.21)	3.13 (2.41-4.06)	2.06 (1.36-3.11)
Uninsured	5.98 (4.27-8.37)	4.04 (2.67-6.10)	3.84 (2.61- 5.65)	2.75 (1.77-4.28)
Age group vs 18-39				
Age 40-54	1.34 (0.95-1.91)	1.33 (0.92-1.93)	1.24 (0.89-1.73)	1.26 (0.89-1.79)
Age 55-64	1.34 (0.94-1.89)	1.32 (0.90-1.93)	1.29 (0.89-1.87)	1.27 (0.87-1.88)
Female vs male	1.28 (1.03-1.58)	1.15 (0.91-1.45)	1.19 (0.97-1.47)	1.04 (0.82-1.31)
Race/ethnicity vs white/other				
Black	0.91 (0.74-1.12)	0.84 (0.67-1.04)	0.87 (0.68-1.12)	0.82 (0.64-1.05)
Hispanic	0.73 (0.55-0.97)	0.68 (0.51-0.91)	0.74 (0.52-1.04)	0.74 (0.51-1.06)
Marital status vs married				
Never married		1.13 (0.80-1.61)		1.12 (0.79-1.60)
Widowed/divorced/separated		1.57 (1.13-2.17)		1.49 (1.09-2.03)
Employment status vs full time work				
Not working		1.09 (0.79-1.49)		1.20 (0.87-1.68)
Part time worker		1.05 (0.72-1.53)		1.34 (0.84-2.13)
Poverty status vs high income				
Poor		2.40 (1.53-3.76)		1.96 (1.19-3.23)
Low income/near poor		2.61 (1.76-3.90)		2.13 (1.36-3.32)
Middle income		2.52 (1.77-3.61)		2.25 (1.54-3.27)
Education vs > High school				
Less than high school		1.05 (0.77-1.43)		0.76 (0.56-1.04)
High school		0.98 (0.75-1.26)		0.87 (0.67-1.13)
Region vs Northeast				

Midwest		1.18 (0.82-1.71)		0.87 (0.60-1.26)
South		1.08 (0.78-1.50)		0.96 (0.69-1.32)
West		1.33 (0.90-1.97)		0.93 (0.65-1.35)
Non-MSA vs MSA		0.99 (0.77-1.28)		1.10 (0.78-1.55)
Number of observations	5,332	5,332	5,332	5,332

Source: Authors' calculations using the Medical Expenditure Panel Survey-Household Component, 2010-2015.

[1] High total burden is defined as spending 20% or more of disposable family income on health care services and health insurance premiums.

CI= confidence interval