Medicare Eligibility and Physician Utilization Among Adults With Coronary Heart Disease and Stroke

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Background: Although Medicare eligibility has been shown to generally increase health care access and utilization, few studies have investigated the association between Medicare eligibility and health care utilization among the chronically ill.

Objective: This study examines changes in health care access and utilization associated with Medicare eligibility among adults with coronary heart disease and stroke (CHDS).

Methods: Descriptive statistics and regression discontinuity analysis were used to examine health care access and utilization at age 65 when Medicare eligibility begins for 176,611 National Health Interview Survey respondents aged 55–74 surveyed between 1997 and 2010.

Results: We found that adults with CHDS reported a higher propensity to make 1+ office-based physician visits at age 65 (1.7%, $P = 0.03$) than adults with no major chronic disease (0.5%, $P = 0.07$). Adults with CHDS also reported greater reductions in cost as a barrier to care at age 65 (-3.6%, $P < 0.01$) than adults with no major chronic disease (-2.0%, $P = 0.01$). The subgroup analysis revealed that Hispanics and highly educated adults with CHDS reported the highest propensity to make 2+ office visits at age 65 (9.5%, $P = 0.04$ and 2.4%, $P < 0.01$). However, blacks with CHDS reported a decline in their propensity to make 2+ office visits at age 65 (-2.1%, $P = 0.05$).

Conclusions: Medicare eligibility improves health care access and utilization for many adults with CHDS, but it may not promote appropriate levels of physician use among some groups.

Key Words: coronary heart disease, stroke, access, utilization, Medicare

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Coronary heart disease and stroke (CHDS) are the 2 largest components of cardiovascular disease (CVD), the leading cause of disability and death in the United States. Of the 831,804 CVD-related deaths in 2007, 406,351 (49%) involved coronary heart disease and 227,215 (27%) involved stroke.[1] After an acute event, the management of either coronary heart disease or stroke requires continual monitoring and oftentimes treatment involving expensive procedures and medications. For these patients, health insurance plays a crucial role in managing their condition and improving health outcomes. Approximately 16% of adults aged 45–64 in the United States are uninsured, as compared with 2% of adults aged 65 years and older.[2] This inequality in coverage is largely attributed to Medicare eligibility rules, which give most adults access to generous insurance coverage at age 65.

Previous studies examining the impact of Medicare on health outcomes have shown that Medicare eligibility contributes to reductions in cost as a financial barrier to care and increased utilization of health care services.[3–7] Further, these studies showed that populations covered by Medicare benefit substantially from Medicare coverage, as measured by health outcomes and utilization. However, few studies report health outcomes and utilization for patients with known morbidities,[3] and we know of no such studies for CVD. Using a nationally representative dataset, this study examines the impact of Medicare eligibility on health care access and utilization among adults with CVD, which includes CHDS.

METHODS

The National Health Interview Survey (NHIS), administered by the US Census Bureau and maintained by the National Center for Health Statistics, is a population-based, cross-sectional survey of the civilian, noninstitutionalized US population. Each year approximately 40,000 households (roughly 100,000 individuals) are questioned about their medical history and sociodemographic characteristics, which impact health. We used data from the 1997 to 2010 core NHIS survey (sample-adult and person-level files) to create a dataset of adults aged 55–74.

The primary outcome variables were physician visits, access to care, and supplemental insurance coverage. In the NHIS survey, a categorical question was used to assess the frequency of use of physician services for each respondent. Respondents were asked how many times in the past year they saw a doctor or other health care professional about their health at a doctor's office, a clinic, or some other place.

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One or more office visits was chosen to proxy for basic access and use of nonemergency physician services. Two or more office visits was chosen to proxy for a schedule of care required to routinely monitor CVD risk factors (eg, weight, blood pressure, cholesterol, and blood glucose levels) to avoid future acute events.

Respondents were identified as having financial barriers to access care in the past year if medical care was delayed because of worry about the cost or if medical care was not received because of affordability problems. Respondents with 2 or more forms of health insurance were identified as having supplemental insurance coverage.

Respondents were assigned to 1 of the 3 health status groups: diagnosed with CHDS, diagnosed with a major chronic disease (MCD) other than CHDS, or diagnosed with no MCD. A CHDS diagnosis was assigned if the respondent was told by a doctor or other health professional that they had coronary heart disease, a heart attack, angina pectoris, or a stroke. An MCD other than CHDS diagnosis was determined if the respondent was told by a doctor or other health professional that they had chronic pulmonary disease, diabetes, or cancer.[8] In this study, chronic pulmonary disease was defined as having chronic bronchitis, emphysema, or chronic asthma. Individuals who were not informed that they had an MCD were identified as having no MCD. Adults diagnosed with a MCD other than CHDS were excluded from the analysis.

Our decision to aggregate CHDS into 1 reporting group was based on the fact that CHDS share the same pathophysiology: CHDS are 2 distinct diseases, but they have overlapping atherosclerotic disease mechanisms and similar risk prediction algorithms.[9,10] Therefore, while the treatment for both diseases may vary substantially in their acute phase, follow-up care focuses on monitoring related risk factors like hypertension, diabetes, and elevated cholesterol levels. We therefore assumed that both diseases have the same patterns of physician monitoring; although, it may be the case that the influence of each risk factor is different for the 2 diseases in such a way that monitoring varies.[11]

Respondents who self-identified as Hispanic or Latino were identified as Hispanic regardless of race. Whites and blacks with no Hispanic or Latino ancestry were identified as white non-Hispanic (white) and black non-Hispanic (black), respectively. All other respondents were identified as "Other." In this study, we focused our subgroup analysis on the 3 largest race/ethnic categories: Hispanic, white, and black.

Income was reported as a categorical variable in the NHIS survey. A cross-sectional analysis would not be limited by this categorical measurement; however, because of inflation, these categories change over time. Thus, the income cutoffs cannot be matched from year to year. In the labor economics literature, educational attainment has been used as a substitute for income.[12] Education can be a better measure of socioeconomic status because it measures socioeconomic status before old age entitlement programs, that is, Medicare and Social Security, impact income.[5] Respondents with <12 years of education or a general education degree were identified as high school dropouts. Respondents with a high school diploma were categorized as high school graduates and respondents with any postsecondary education (for any duration) were categorized as having some college experience.

Summary statistics for physician use and access to care were tabulated for each health status group by race/ethnicity, or educational attainment. We used respondents aged 60–64 and 65–69 to generate baseline levels of pre/post-Medicare access to care and utilization, respectively. For each subgroup, adults with CHDS and adults with no MCD were compared using 2 sample *t* tests. Medicare coverage rates by age were graphed for adults with CHDS and adults with no MCD. This figure allowed us to summarize Medicare coverage rates before and after age 65 and clearly identified the resulting discontinuities.

Establishing the casual relationship between health insurance and the use of health care services is complicated by the endogeneity of health insurance. As individuals are not randomly assigned health insurance, decision factors, such as health status, may lead to self-selection bias. One way to resolve this self-selection problem is to use the exogenous variation generated by Medicare eligibility rules for identification.

Most people become eligible for Medicare coverage when they reach age 65,[13,14] creating a discrete change in coverage at that age. Regression discontinuity (RD) analysis uses discrete changes like this to identify the intended effect of an endogenous mechanism.[15,16] In our analysis, we use an indicator variable to represent Medicare eligibility: 1 if the respondent was aged 65 and older at the time of the survey or 0 otherwise. When age is included as an additional explanatory variable, the estimated coefficient on the Medicare eligibility indicator becomes an RD term, which captures the effect of Medicare coverage.

RD regressions were estimated by ordinary least squares for each health status group, then by health status and race/ethnicity or educational attainment. In each regression, we control for several individual characteristics, which include age, quadratic age, sex, race/ethnicity, educational attainment, geographic region, and survey year. Some controls for educational attainment or race/ethnicity may be excluded depending on the subgroup being analyzed. All estimation was performed with STATA 10. We used sampling weights to adjust for oversampling and the SEs were clustered by age groups to account for interclass correlation arising from the degenerative effects of aging.

RESULTS

Summary statistics are reported in Table 1. The pooled NHIS dataset contained 200,248 respondents aged 55–74 surveyed between 1997 and 2010. The mean age of this sample was 63. Women comprised slightly over half of the sample at 54%, and whites represented 69% of the sample. Just over 45% of respondents reported having at least some college experience. In this study, we limit our analysis to adults with CHDS and adults with no MCD. This left us with 176,611 respondents: 15,945 with CHDS and 160,666 with no MCD. Summary statistics for each subgroup were also reported.

TABLE 1. Summary Statistics

Variables	All National Health Interview Survey Respondents		Respondents With No Major Chronic Disease		Respondents With Coronary Heart Disease or Stroke	
Age	63.1 (5.7)	N = 200,248	62.8 (5.6)	N = 160,666	65.2 (5.7)	N = 15,945
Female	53.5 (49.9)	N = 107,051	53.2 (49.9)	N = 85,519	46.0 (49.8)	N = 7341
White	69.4 (46.1)	N = 138,946	67.0 (46.3)	N = 110,838	71.2 (45.3)	N = 11,358
Black	12.4 (33.0)	N = 24,880	11.9 (32.4)	N = 19,154	14.9 (35.6)	N = 2375
Hispanic	13.0 (33.7)	N = 26,076	13.6 (34.3)	N = 21,808	10.3 (30.4)	N = 1641
High school dropout	25.0 (43.3)	N = 57,372	23.7 (42.5)	N = 36,429	35.0 (47.7)	N = 5532
High school graduate	29.8 (45.7)	N = 57,372	30.3 (45.9)	N = 46,499	27.0 (44.4)	N = 4259
At least some college	45.2 (49.8)	N = 87,161	46.0 (49.8)	N = 70,636	38.0 (48.5)	N = 6007

SDs in parentheses. All values specified as percentages unless otherwise noted. Mean differences for the 2 health status groups were generally significant at the 1% confidence level.

Sample counts by health status group, race, and education are reported in the online appendix (Appendix Table 1, Supplemental Digital Content, http://links.lww.com/MLR/A262).

We assumed that both CHDS have the same patterns of physician monitoring. In support of this assumption, we compared the propensity to use physician services for CHDS at the Medicare eligibility threshold. We found no evidence to suggest that patterns of use varied between the health status groups (Appendix Table 2, Supplemental Digital Content, http://links.lww.com/MLR/A262).

Figure 1 presents Medicare coverage rates by age for each health status group. The graph shows that adults with CHDS were more likely to have Medicare coverage than adults with no MCD at every age. Before age 65, these differences could be well over 20%. The important feature of this graph is that it demonstrates the Medicare eligibility age rule that generates a discrete jump in coverage at age 65. Full Medicare coverage uptake was not observed at age 65, because some individuals choose not to enroll due to access to other forms of comprehensive insurance.[4] Additional figures describing Medicare coverage by subgroup were reported (Appendix Figs 1–6, Supplemental Digital Content, http://links.lww.com/MLR/A262).

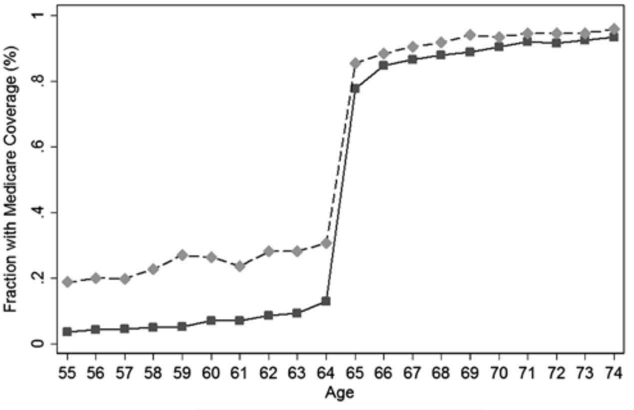

FIGURE 1. Medicare coverage rates in respondents by age and health status. Before age 65, 12.8% and 30.6% of respondents with no major chronic disease (MCD) and respondents with coronary heart disease and stroke (CHDS) were covered under Medicare at age 64, respectively. By age 65 Medicare coverage rates jump to 77.7% and 85.5%, respectively.

Baseline utilization and RD estimates are presented in Table 2. Overall, adults with CHDS had a higher propensity to make 1+ office-based visits before Medicare eligibility (94.9%) relative to adults with no MCD (84.0%). Adults with CHDS also had a higher propensity to make 2+ office-based visits (88.2%) than adults with no MCD (66.4%). Blacks with CHDS had the highest propensity to make 2+ office visits (90.4%), and Hispanics with no MCD had the lowest propensity to make 2+ office visits (55.7%).

In general, the RD estimates show an increase in the propensity to make 1+ and 2+ office-based visits. At age 65, adults with CHDS increased their propensity to make 1+ office visits by 1.7% ($P = 0.03$) relative to their younger counterparts. This increase is in addition to the higher likelihood of adults with CHDS making 1+ office visits before age 65. Among adults with no MCD, only high school dropouts reported statistically significant increase in their propensity to make 2+ office visits at age 65 (2.4%, $P = 0.01$). Hispanics with CHDS and adults with some college experience with CHDS also reported an increased propensity to make 2+ office visits at age 65 (9.5%, $P = 0.04$ and 2.4%, $P < 0.01$). Blacks with CHDS decreased their propensity to make 2+ office visits at age 65 (−2.1%, $P = 0.05$).

Baseline access to care and supplemental insurance coverage and RD estimates are shown in Table 3. Overall, 8.6% of adults with no MCD reported barriers to care, whereas adults with CHDS report much higher rates at 15.5%. Blacks, low educated adults, and Hispanics with CHDS reported the highest barriers to access care at 21.9%, 18.9%, and 17.8%, respectively. 7.2% of adults with no MCD reported having supplemental coverage, whereas adults with CHDS report much higher rates at 20.2%. Blacks and high school dropouts reported the highest rates of supplemental coverage at 21.3% and 23.7%, respectively. Hispanics reported the lowest rate of supplemental coverage at 12.0%.

At age 65, adults with CHDS reported a greater reduction in reporting barriers to care at age 65 for adults with

TABLE 2. Regression Discontinuity Estimates[†] at Age 65 for Office-based Physician Visits With *P* Values and Sample Size

	Dependent Variable: Office-based Visits (1+)				Dependent Variable: Office-based Visits (2+)			
	No Major Chronic Disease		CHD and Stroke		No Major Chronic Disease		CHD and Stroke	
	Mean Before Age 65[‡]	RD At 65	Mean Before Age 65	RD At 65	Mean Before Age 65	RD At 65	Mean Before Age 65	RD At 65
Overall sample	84.0 (0.3)	0.5 (0.07) N = 55,635	94.9 (0.4)	1.7* (0.03) N = 15,576	66.4 (0.4)	0.9 (0.31) N = 55,635	88.2 (0.6)	1.4 (0.09) N = 15,576
By ethnicity								
Whites	85.6 (0.4)	0.2 (0.08) N = 39,543	95.3 (0.5)	1.3* (0.02) N = 11,125	67.7 (0.5)	1.0 (0.42) N = 39,543	88.6 (0.7)	1.1 (0.16) N = 11,125
Blacks	81.2 (1.1)	1.9 (0.10) N = 7133	95.7 (0.9)	0.7 (0.29) N = 2307	66.1 (1.3)	1.6 (0.37) N = 7133	90.4 (1.7)	−2.1* (0.05) N = 2307
Hispanics	74.2 (1.4)	3.0 (0.26) N = 6503	88.3 (2.3)	8.2 (0.06) N = 1592	55.7 (1.6)	2.2 (0.35) N = 6503	79.4 (2.9)	9.5* (0.04) N = 1592
By education								
High school dropout	76.0 (0.9)	3.4* (0.05) N = 12,371	93.7 (0.9)	1.9 (0.25) N = 5453	60.5 (1.0)	2.4** (0.01) N = 12,371	86.9 (1.2)	1.8 (0.34) N = 5453
High school graduate	83.4 (0.6)	−0.7 (0.23) N = 16,322	94.8 (0.8)	2.6** (0.01) N = 4196	64.1 (0.9)	1.4 (0.15) N = 16,322	88.9 (1.1)	0.1 (0.94) N = 4196
At least some college	87.4 (0.4)	−0.1 (0.89) N = 26,942	96.0 (0.6)	1.0** (0.01) N = 5927	69.8 (0.6)	−0.1 (0.95) N = 26,942	88.9 (1.0)	2.4** ($P < 0.01$) N = 5927

*Statistically significant at the 5% confidence level.
**Statistically significant at the 1% confidence level.
[†] All estimates were weighted to adjust for oversampling and the SEs were clustered by age.
[‡] Mean for respondents aged 60–64.
CHD indicates coronary heart disease; RD, regression discontinuity.

CHDS (−3.6%, P<0.01), relative to adults with no MCD (−2.0%, P = 0.01). Although Hispanics reported the largest increase in propensity to make visits, blacks reported the greatest decline in barriers to care at age 65 (7.3%, P = 0.03). For Hispanics and blacks with CHDS, these declines in barriers to care were respect to relatively high financial difficulties in obtaining care before age 65. The RD estimates show a substantial increase in supplemental insurance coverage across all groups at age 65.

We estimated 3 alternative specifications (Appendix Tables 3 and 4, Supplemental Digital Content, http://links.lww.com/MLR/A262). First, we test to robustness of the finding that blacks and Hispanics with CHDS decreased or increased their propensity to make 2+ physician visits at age 65, by examining interactions between race/ethnicity and education. We verify our results are robust to interactions between race and educational attainment.

Second, the robustness of the results to the included controls was investigated by limiting the right hand-side variables to the RD term, quadratic age, and survey years. By excluding most individual characteristics from the model, we verified that no single variable drives the results. Next, the robustness of the results to the age bandwidth selected was investigated by restricting our window of analysis to adults aged 60–69. Doing so allowed us to verify the consistency of the estimates over different age windows. In this specification, we were able to verify the sign and magnitude of the results for blacks with CHDS, but we were unable to find statistical significance. This may be due to the fact that under a shorter age window, subgroup samples were too small to make meaningful inferences.

DISCUSSION

Although previous studies have examined the impact of Medicare eligibility on the use of health care services,[3,4] relatively few studies have investigated this association among the chronically ill. This study is the first to estimate the impact of Medicare eligibility at age 65 on health care access and utilization for the 2 largest components of CVD, coronary heart disease, and stroke. The results of this study contribute to our understanding of the appropriate use of physician services among adults with CHDS and the extent to which Medicare eligibility impacts disparities in health care access and utilization.

Our main results show that before age 65, adults with CHDS had a higher propensity of Medicare coverage than adults with no MCD. These results are consistent with early Medicare eligibility guidelines, which allow persons diagnosed with chronic heart failure, myocardial infarctions, ischemic heart disease, arrhythmias, congenital heart defects, angina pectoris, and valve defects to apply for supplemental security income or social security disability benefits.[13] Being diagnosed with one of the named conditions does not

TABLE 3. Regression Discontinuity Estimates† at Age 65 for Access to Care and Supplemental Health Insurance With *P* values and Sample Size

	Dependent Variable: Financial Barriers to Care				Dependent Variable: Supplemental Insurance			
	No Major Chronic Disease		CHD and Stroke		No Major Chronic Disease		CHD and Stroke	
	Mean Before Age 65‡	RD At 65	Mean Before Age 65	RD At 65	Mean Before Age 65	RD At 65	Mean Before Age 65	RD At 65
Overall sample	8.6 (0.3)	−2.0** (0.01) N=56,428	15.5 (0.7)	−3.6** ($P<0.01$) N=15,796	7.2 (0.3)	46.3** ($P<0.01$) N=56,428	20.2 (0.8)	38.2** ($P<0.01$) N=15,796
By ethnicity								
Whites	8.0 (0.3)	−2.0* (0.02) N=40,060	14.2 (0.7)	−3.0** (0.01) N=11,272	7.3 (0.3)	52.0** ($P<0.01$) N=40,060	20.9 (0.9)	40.3** ($P<0.01$) N=11,272
Blacks	11.0 (0.8)	−1.6** (0.01) N=7274	21.9 (2.1)	−7.3* (0.03) N=2346	8.0 (0.8)	31.0** ($P<0.01$) N=7274	21.3 (2.2)	29.8** ($P<0.01$) N=2346
Hispanics	12.1 (1.0)	−4.7* (0.02) N=6600	17.8 (2.3)	−4.7* (0.03) N=1617	5.5 (0.7)	20.6** ($P<0.01$) N=6600	12.0 (1.8)	27.3** ($P<0.01$) N=1617
By education								
High school dropout	13.5 (0.7)	−4.8* (0.02) N=12,551	18.9 (1.3)	−3.6** ($P<0.01$) N=5532	7.7 (0.6)	35.6** ($P<0.01$) N=12,551	23.7 (1.5)	29.3** ($P<0.01$) N=5532
High school graduate	7.9 (0.5)	−2.2** (0.01) N=16,573	13.4 (1.2)	−3.1** ($P<0.01$) N=4258	7.0 (0.5)	49.8** ($P<0.01$) N=16,573	19.8 (1.5)	41.0** ($P<0.01$) N=4258
At least some college	7.2 (0.3)	−0.8 (0.29) N=27,304	14.4 (1.0)	−4.3** (0.01) N=6006	7.1 (0.4)	48.4** ($P<0.01$) N=27,304	18.2 (1.2)	43.2** ($P<0.01$) N=6006

*Statistically significant at the 5% confidence level.
**Statistically significant at the 1% confidence level.
†All estimates were weighted to adjust for oversampling and the SEs were clustered by age.
‡Mean for respondents aged 60–64.
CHD indicates coronary heart disease; RD, regression discontinuity.

guarantee acceptance into the supplemental security income or social security disability programs; however, individuals with advanced conditions are more likely to gain entry, which is consistent with the data presented.

A discrete jump in insurance coverage, as a result of Medicare eligibility rules, allowed us to use RD methods to estimate the impact of Medicare coverage on health care access and use. We found that Medicare eligibility increased the propensity for adults to make one or more office-based visits, decreased barriers to care, and increased the propensity for adults to have supplemental insurance coverage relative to adults just under age 65. Minorities with CHDS reported the greatest declines in barriers to care; although these declines were relative to high baseline levels of financial difficulties.

Conversely, some socioeconomically disadvantaged adults with CHDS seemed to seek frequent care from physicians at a lower rate than comparable patients who had not reached age 65. For blacks with CHDS, reaching Medicare eligibility led to statistically significant declines in their propensity to make 2+ office visits. In contrast, Hispanics with CHDS report the largest rise in their propensity to make 2+ office visits. These results differed significantly from the results for white and highly educated adults. There are a number of possible explanations for both findings.

First, economic models of the demand for health insurance tell us that households, which anticipate credit constraints in the future are expected to become more risk averse.[17] These credit constraints are often the result of income and health status shocks, both of which increase demand for insurance. For those who are poor or suffering from a chronic disease, expensive care can drive up insurance premiums to unaffordable levels, leaving many of these individuals underinsured.

Compared with the general population, blacks are disproportionally poor and affected by CVD. Further, for blacks with CHDS, underinsurance is evidenced by the sharp increase in supplemental insurance coverage disparities between subgroups. Their lack of supplemental insurance coverage makes them responsible for both the Medicare part B deductible, 20% of the cost for each physician medical visit, and approved medication.[4,8] Thus, the various forms of cost sharing in Medicare may still lead socioeconomically disadvantaged persons to curtail utilization on the margin.

Another explanation may be attributed to whites and highly educated patient's ability to better utilize Medicare. Disparities in health care utilization between racial and educational groups have been studied extensively,[3,4,18–22] with several studies examining utilization within fully insured populations.[23–28] Even insured populations, racial, and socioeconomic differences in the use of CVD hospital procedures are still seen.[23,24,29] Disparities in outcomes seem to be minimized in the VA system of equal health care access.[26,27] Less is known about disparities in preventative care in similar environments.[23,24] Understanding these disparities is crucial to minimizing future acute events.[23,24,29]

Higher treatment rates for Medicare Hispanic patients relative to blacks have been identified in inpatient care.[30,31] In particular, Cromwell et al[30] found that white patients admitted for ischemic heart disease had the highest rates of invasive procedures, blacks had the lowest, and Hispanics were in between. Furthermore, the jump in utilization at age 65 for Hispanics may be attributable to the large disparity in health insurance coverage between nonelderly Hispanics and non-Hispanics.[32] Additional analysis generally confirms these trends (Appendix Tables 5 and 6, Supplemental Digital Content, http://links.lww.com/MLR/A262).

Our study contributes to the literature by demonstrating the role that Medicare plays in improving health care access for adults with CHDS and the potential weakness in the program for blacks. Insurance status and financial concerns about accessing care have been found to play a crucial role in the timing of care for heart attack patients.[33] Therefore, declining use of routine services at age 65 highlights a need for policies, which ensure that adults with CHDS receive routine monitoring of CVD risk factors. Expansions of Medicaid under the new federal health care reform law may create 1 vital source of supplemental insurance coverage. For the most disadvantaged Medicare beneficiaries who also qualify for Medicaid, also referred to as dual eligibles, researchers have found that dual eligible blacks used more office-based physician services than whites.[34] Apart from insurance, some racial groups may still not be able to get good quality care if they lack access to transportation to make it to their appointment, access to a land line or cell phone to schedule an appointment, or a support system to help them make it to their appointments. Future research should focus on examining how supplemental insurance and these additional constraints impact health care access and use.

There are several limitations to the interpretation of these results. First, respondents to the NHIS survey are sampled every year, such that our inferences regarding the effects of Medicare eligibility are drawn from annual cohorts of persons at each age, rather than from repeated observations of the same individuals as they age. Second, our estimates for physician use focus on office visits, which may lead to underestimation of utilization if patients substitute emergency room visits for office visits. We examine the use of emergency care and find similar patterns of utilization (Appendix Table 7, Supplemental Digital Content, http://links.lww.com/MLR/A262). However, as health care utilization measures are recorded as categorical variables, we are unable to create global measures of utilization. In addition, our models assume the only major event that occurs at age 65 is Medicare eligibility, but other events, for example, retirement, may also occur. We include employment status as an additional control and find our results are robust to its inclusion (Appendix Table 8, Supplemental Digital Content, http://links.lww.com/MLR/A262). These retirements may bias our results, but it is more likely that substantial discontinuities exist for every year after age 62 (the earliest possible retirement age for Social Security). Last, we cannot rule out the possibility that the decline in 2+ office visits per year for blacks with CHDS reflects better management of disease symptoms with medications or access to better physicians due to Medicare coverage. However, 9 of the 12 years of data in our sample are years before the implementation of Medicare Part D in 2006, therefore this is less likely an issue.

In summary, given that reaching Medicare eligibility is associated with reductions in the frequent use of physician services for blacks with CHDS, future studies should investigate the underlying causes of this decline. The decline in multiple annual visits could be the result of improved care under Medicare, but it might also reflect shortcomings in the Medicare program for socioeconomically disadvantaged patients with CVD.

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