SPECIAL ARTICLE

# Use of Health Services by Previously Uninsured Medicare Beneficiaries

J. Michael McWilliams, M.D., Ellen Meara, Ph.D., Alan M. Zaslavsky, Ph.D., and John Z. Ayanian, M.D., M.P.P.

ABSTRACT

### BACKGROUND

Previously uninsured adults who enroll in the Medicare program at the age of 65 years may have greater morbidity, requiring more intensive and costlier care over subsequent years, than they would if they had been previously insured.

### METHODS

We used longitudinal data from the nationally representative Health and Retirement Study to assess self-reported health care use and expenditures from 1992 through 2004 among 5158 adults who were privately insured or uninsured before Medicare coverage began at the age of 65 years. We used propensity-score methods to compare health care use and expenditures for previously insured and uninsured beneficiaries who were similar across numerous characteristics at 59 to 60 years of age and adjusted for differences in supplemental and prescription-drug coverage after 65 years of age.

### RESULTS

Among 2951 adults with hypertension, diabetes, heart disease, or stroke diagnosed before 65 years of age, previously uninsured adults who acquired Medicare coverage at the age of 65 reported significantly greater increases in the numbers of doctor visits (P<0.001) and hospitalizations (P=0.001) and in total medical expenditures (P=0.02) than did previously insured adults. Significant differential increases were not evident among the 2207 adults without these conditions (P>0.12 for all comparisons). In analyses adjusted for supplemental and prescription-drug coverage, previously uninsured adults with these conditions reported more doctor visits (13% relative difference, P=0.04), more hospitalizations (20% relative difference, P=0.04), and higher total medical expenditures (51% relative difference, P=0.09) from ages 65 to 72 years than did previously insured adults.

### CONCLUSIONS

The costs of expanding health insurance coverage for uninsured adults before they reach the age of 65 years may be partially offset by subsequent reductions in health care use and spending for these adults after the age of 65, particularly if they have cardiovascular disease or diabetes before the age of 65 years.

From the Division of General Medicine and Primary Care, Department of Medicine, Brigham and Women's Hospital and Harvard Medical School (J.M.M., J.Z.A.); the Department of Health Care Policy, Harvard Medical School (J.M.M., E.M., A.M.Z., J.Z.A.); and the Department of Health Policy and Management, Harvard School of Public Health (J.Z.A.) — all in Boston; and the National Bureau of Economic Research, Cambridge, MA (E.M.). Address reprint requests to Dr. Ayanian at the Department of Health Care Policy, Harvard Medical School, 180 Longwood Ave., Boston, MA 02115, or at ayanian@ hcp.med.harvard.edu.

143

UNINSURED NEAR-ELDERLY ADULTS — those older than 50 years of age but younger than 65 — receive fewer basic clinical services,[1,2] are more likely to experience health declines,[3] and die at younger ages[4,5] than insured adults in the same age group. Uninsured near-elderly adults who also have cardiovascular disease or diabetes are particularly vulnerable to inadequate health care and are more likely to have poor outcomes.[1,4,6] The number of uninsured near-elderly adults may rise substantially as the population ages[7] and private coverage becomes less affordable.[8-11] The current generation of adults in this age group also has higher rates of obesity and hypertension than previous generations of adults of similar age,[12] suggesting a rising burden of chronic disease and a greater need for preventive care. Uninsured adults in this age group, in particular, may enter the Medicare program at the age of 65 years with greater morbidity and may require costlier care than they would if they had been insured before age 65.[5,13-15]

Extending insurance coverage to uninsured near-elderly adults may produce substantial health benefits. Legislation to enable these adults to purchase Medicare coverage before the age of 65 years was introduced in Congress in 2005,[16] and the American College of Physicians has endorsed this concept.[17] However, the effects of earlier coverage on subsequent health care needs have not been well defined.

Earlier coverage may not only improve health outcomes but also reduce health care use and Medicare expenditures after the age of 65 years.[13] These potential economic benefits have not been considered in estimating the costs of expanded coverage for uninsured near-elderly adults.[18-23]

Recognizing that Medicare eligibility confers nearly universal coverage at age 65, we used propensity-score methods to compare self-reported health care use and expenditures for cohorts of previously uninsured and insured adults with similar characteristics, particularly those with cardiovascular disease or diabetes. We also assessed the effect of obtaining Medicare coverage on the risk of high out-of-pocket medical expenditures for previously uninsured adults.

## METHODS

### STUDY POPULATION

We analyzed data from the Health and Retirement Study, a nationally representative, longitudinal survey.[24,25] In 1992, noninstitutionalized adults and eligible spouses 51 to 61 years of age in the continental United States were enrolled in the study. Initial interviews conducted in 7705 households yielded 9760 participants (a response rate of 82%). Biennial follow-up survey data were available through 2004.

Our study cohort included participants who were 65 years of age or older by 2004. We excluded participants who reported receiving publicly funded coverage before age 65 because they were likely to have major disabilities or severe medical conditions, such as end-stage renal disease. Because this study used publicly available de-identified data, the Human Subjects Committee of Harvard Medical School deemed it exempt from review.

### STUDY VARIABLES

In each biennial survey, participants answered detailed questions about sources of health insurance and, if they were insured, whether they had lacked coverage at any time since the preceding survey.[26] On the basis of prespecified definitions, participants were classified as previously insured if they reported having continuous private coverage in the 5 to 6 years immediately before the age of 65 years; they were otherwise classified as previously uninsured. In addition, we assessed self-reported demographic, socioeconomic, and health characteristics at ages 59 to 60 years. After age 65, participants were classified as having supplemental insurance if they ever reported having employer-sponsored insurance, Medicaid, Medigap, Medicare managed care, or traditional Medicare with additional coverage. Participants who reported at least intermittent partial coverage for prescribed medications after the age of 65 years were classified as having prescription-drug coverage.

In each survey from 1992 through 2004, participants reported the number of times in the preceding 2 years that they visited a doctor or were admitted to a hospital. From 1996 through 2004, participants reported out-of-pocket costs in the preceding 2 years for a range of health services. From 1996 through 2002, they were also asked to estimate their total medical costs, either as exact amounts or through a series of unfolding questions to identify ranges, from which continuous values were imputed with the use of methods detailed elsewhere.[27] Reported expenditures were inflated to constant 2004 dollars with use of the gross domestic product deflator.[28]

## STATISTICAL ANALYSIS

We assessed self-reported doctor visits, hospitalizations, and out-of-pocket and total medical expenditures from up to four biennial surveys before and up to four biennial surveys after participants reached 65 years of age. Because many adults reported no hospitalizations, we created a dichotomous biennial indicator of any hospitalizations. We excluded a small number (<0.1%) of biennial observations that were extreme outliers (≥50 hospitalizations, ≥300 doctor visits, or total expenditures ≥$2 million).

Among 8374 participants who were alive in 2004, 70.5% responded to all seven surveys from 1992 through 2004, and the remaining 29.5% responded to an average of 4.1 surveys. Item non-response rates were less than 3% for all study variables. To obtain less biased and more efficient estimates, we used multiple imputation methods to impute missing data.[29]

We used a propensity-score[30] weighting technique to balance the distributions of numerous characteristics between comparison groups at ages 59 to 60 years (Table 1). We used logistic regression to model the odds of being uninsured before age 65 as a function of these characteristics. Predicted probabilities of being uninsured (propensity scores) were used to derive individual weights equal to the probability of belonging to the opposite group, making the weighted distribution of characteristics of insured and uninsured participants identical. Weighted analyses therefore adjusted for potential confounding due to measured predictors of both insurance coverage and use of services.

To compare groups of previously uninsured adults and insured adults, we used generalized linear models for mean doctor visits, hospital stays, and total medical expenditures as a function of age and insurance status before the age of 65 years. We used a log link to improve model fit and selected a proportional-to-mean variance function using the Park test.[31] According to a prespecified analytic plan, separate models were fitted for observations recorded before and after participants reached 65 years of age, and no significant departures from proportional trends between the groups were noted (P>0.50 for age–insurance interactions). Therefore, propensity-score–weighted estimates of relative use of health services (relative use=use$_{\text{uninsured}}$÷use$_{\text{insured}}$) and relative expenditures (relative expenditures=expenditures$_{\text{uninsured}}$÷expenditures$_{\text{insured}}$), as derived

from model coefficients, describe adjusted relative differences averaged over all years before or after participants reached the age of 65 years.

To estimate differential increases associated with acquiring Medicare coverage, we fitted models allowing biennial health care use and expenditures to vary by previous insurance status, an indicator of Medicare eligibility after the age of 65 years, and an interaction between these two variables. Differential increases were thus estimated as ratios of relative use of health services (ratio of relative use=relative use$_{\text{after 65}}$÷relative use$_{\text{before 65}}$) and relative expenditures (ratio of relative expenditures=relative expenditures$_{\text{after 65}}$÷relative expenditures$_{\text{before 65}}$), comparing relative use or expenditures after age 65 with relative use or expenditures before age 65. Under the null hypotheses, these ratios would equal 1.00. All reported results were adjusted for propensity-score and survey-sampling weights. Generalized estimating equations were used to account for weighting, geographic clustering, and repeated measures.

Because uninsured adults with cardiovascular disease or diabetes may be at a particularly high risk for costly preventable complications,[4] in prespecified subgroup analyses we stratified our cohort into those with and those without diagnosed hypertension, diabetes, heart disease, or stroke before the age of 65 years. To illustrate health care use by insurance status, age, and presence of these conditions, propensity-score–adjusted group means were plotted for each 2-year age interval.

Because previously uninsured adults are less likely than previously insured adults to have supplemental insurance or prescription-drug coverage after the age of 65 years, we adjusted analyses after age 65 by adding indicators of these benefits to analytic models to assess relative use of health services between groups with more equivalent access to care. In these comparisons of previously insured and previously uninsured Medicare beneficiaries who had similar characteristics at 59 to 60 years of age and similar coverage after age 65, differences in health care use and expenditures after age 65 represent the principal findings of our study.

In descriptive analyses, we evaluated the hypothesis that declining health before the age of 65 years mediated greater need for services after age 65 among previously uninsured adults.[3] We assessed changes in health before age 65 as a function of insurance status, using logistic

145

**Table 1. Characteristics of the Study Cohort at 59 to 60 Years of Age by Insurance Status before Medicare Eligibility at Age 65.***

| Characteristic | Unadjusted Comparison | | P Value | Adjusted Comparison† | |
|---|---|---|---|---|---|
| | Insured (N=3773) | Uninsured (N=1385) | | Insured (N=3773) | Uninsured (N=1385) |
| Mean age — yr | 59.7±0.01 | 59.6±0.03 | 0.37 | 59.6±0.02 | 59.6±0.03 |
| Female sex — % | 53.6 | 56.7 | 0.09 | 55.3 | 55.3 |
| Race or ethnic group — % | | | <0.001 | | |
| Non-Hispanic white | 89.3 | 72.2 | | 80.7 | 80.7 |
| Non-Hispanic black | 5.9 | 12.3 | | 9.7 | 9.7 |
| Hispanic | 3.2 | 11.9 | | 6.8 | 6.8 |
| Other | 1.6 | 3.6 | | 2.8 | 2.8 |
| Married — % | 81.2 | 69.6 | <0.001 | 74.7 | 74.7 |
| Military veteran — % | 27.8 | 20.2 | <0.001 | 23.2 | 23.2 |
| Census division — % | | | <0.001 | | |
| New England | 6.6 | 4.1 | | 4.9 | 4.9 |
| Middle Atlantic | 16.8 | 15.4 | | 16.7 | 16.7 |
| East north central | 17.5 | 13.6 | | 15.1 | 15.1 |
| West north central | 10.8 | 6.8 | | 8.4 | 8.4 |
| South Atlantic | 16.6 | 21.1 | | 19.5 | 19.5 |
| East south central | 5.5 | 5.1 | | 5.2 | 5.2 |
| West south central | 7.2 | 13.9 | | 10.9 | 10.9 |
| Mountain | 4.5 | 4.7 | | 4.8 | 4.8 |
| Pacific | 14.5 | 15.3 | | 14.5 | 14.5 |
| Mean household size — no. of members | 2.53±0.03 | 2.69±0.05 | 0.004 | 2.58±0.04 | 2.58±0.04 |
| Education — % | | | <0.001 | | |
| Not a high-school graduate | 14.6 | 34.9 | | 25.5 | 25.5 |
| High-school graduate or GED | 41.0 | 37.6 | | 41.1 | 41.1 |
| Some college | 21.3 | 15.2 | | 18.0 | 18.0 |
| College graduate | 23.1 | 12.3 | | 15.4 | 15.4 |
| Employment — % | | | <0.001 | | |
| Full-time | 55.3 | 51.3 | | 55.8 | 55.8 |
| Part-time | 9.1 | 12.8 | | 11.4 | 11.4 |
| Unemployed | 1.0 | 3.6 | | 2.2 | 2.2 |
| Semiretired | 7.8 | 3.8 | | 4.6 | 4.6 |
| Retired | 17.7 | 12.0 | | 13.6 | 13.6 |
| Disabled | 0.6 | 1.9 | | 1.0 | 1.0 |
| Not in labor force | 8.5 | 14.6 | | 11.4 | 11.4 |
| Annual household income — % | | | <0.001 | | |
| ≤10th percentile | 2.7 | 11.9 | | 6.2 | 6.2 |
| 10th to 25th percentile | 7.0 | 21.6 | | 15.3 | 15.3 |
| 25th to 50th percentile | 24.3 | 28.9 | | 30.5 | 30.5 |
| 50th to 75th percentile | 30.9 | 20.5 | | 25.5 | 25.5 |
| >75th percentile | 35.1 | 17.1 | | 22.5 | 22.5 |

**Table 1. (Continued.)**

| Characteristic | Unadjusted Comparison | | P Value | Adjusted Comparison† | |
|---|---|---|---|---|---|
| | Insured (N=3773) | Uninsured (N=1385) | | Insured (N=3773) | Uninsured (N=1385) |
| Total household wealth — % | | | <0.001 | | |
| ≤10th percentile | 3.0 | 12.0 | | 6.8 | 6.8 |
| 10th to 25th percentile | 7.9 | 20.2 | | 15.0 | 15.0 |
| 25th to 50th percentile | 22.5 | 27.3 | | 27.9 | 27.9 |
| 50th to 75th percentile | 31.5 | 21.2 | | 25.7 | 25.7 |
| >75th percentile | 35.1 | 19.3 | | 24.6 | 24.6 |
| Mean general health status (1=excellent, 5=poor) | 2.30±0.02 | 2.65±0.04 | <0.001 | 2.49±0.03 | 2.49±0.04 |
| Mean recent change in health (1=much better, 5=much worse) | 2.95±0.01 | 3.00±0.02 | 0.09 | 2.96±0.01 | 2.96±0.02 |
| Receiving SSI or SSDI benefits — % | 0.4 | 0.5 | 0.70 | 0.4 | 0.4 |
| Current smoker — % | 19.2 | 29.8 | <0.001 | 26.3 | 26.3 |
| Heavy alcohol consumption (≥3 drinks per day) — % | 4.5 | 5.3 | 0.31 | 4.7 | 4.7 |
| Body-mass index | 26.7±0.1 | 27.0±0.2 | 0.05 | 26.9±0.1 | 26.9±0.2 |
| Light exercise ≥3 times per week — % | 60.1 | 58.7 | 0.50 | 58.8 | 58.8 |
| Vigorous activity ≥3 times per week — % | 19.8 | 21.6 | 0.31 | 20.6 | 20.6 |
| Difficulties with activities of daily living‡ | | | | | |
| Mean no. of difficulties | 0.04±0.00 | 0.09±0.01 | <0.001 | 0.06±0.01 | 0.06±0.01 |
| At least one difficulty — % | 3.0 | 6.5 | <0.001 | 4.6 | 4.6 |
| Functional limitations§ | | | | | |
| Mean no. of limitations | 1.26±0.04 | 1.74±0.08 | <0.001 | 1.52±0.06 | 1.52±0.07 |
| At least one limitation — % | 48.7 | 56.6 | <0.001 | 53.7 | 53.7 |
| Mean score for depressive symptoms¶ | 0.78±0.03 | 1.22±0.06 | <0.001 | 1.00±0.04 | 1.00±0.05 |
| Diagnosed chronic conditions — % | | | | | |
| Hypertension | 46.3 | 42.5 | 0.04 | 43.9 | 43.9 |
| Diabetes | 12.3 | 14.2 | 0.12 | 13.3 | 13.3 |
| Heart disease | 16.8 | 15.6 | 0.37 | 15.8 | 15.8 |
| Stroke | 3.2 | 4.3 | 0.08 | 3.7 | 3.7 |
| Arthritis | 52.0 | 51.8 | 0.89 | 52.2 | 52.2 |
| Cancer (except skin cancer) | 10.9 | 8.4 | 0.03 | 8.9 | 8.9 |
| Chronic lung disease (except asthma) | 6.6 | 8.1 | 0.15 | 7.4 | 7.4 |
| Psychiatric, emotional, or nervous condition | 8.1 | 11.6 | 0.003 | 9.6 | 9.6 |

* Plus–minus values are means ±SE. All estimates have been adjusted for the complex design of the survey. Chi-square tests were used to compare distributions of categorical variables and t-tests were used for continuous variables. GED denotes general equivalency diploma, SSI Supplemental Security Income, and SSDI Social Security Disability Income. Race or ethnic group was self-reported. Body-mass index is the weight in kilograms divided by the square of the height in meters.
† In adjusted comparisons, responses were weighted according to the estimated propensity of participants to be uninsured before 65 years of age.
‡ Activities of daily living included walking across a room, dressing, bathing, eating, and getting in and out of bed.
§ Functional limitations were defined as reporting any difficulty with the following activities: walking one block; walking several blocks; sitting for 2 hours; getting up from a chair; climbing one flight of stairs; climbing several flights of stairs; stooping, kneeling, or crouching; lifting 10 lb (4.5 kg); picking up a dime; extending one's arms above shoulder level; and pushing or pulling large objects.
¶ Adapted from the Center for Epidemiologic Studies — Depression (CES-D) scale for depressive symptoms. Respondents were asked if for all or most of the time during the previous week they felt depressed, sad, lonely, that everything was an effort, that their sleep was restless, that they could not get going, happy, that they enjoyed life. The depression score (range, 0 to 8) was calculated as the sum of affirmative responses to the first six questions and negative responses to the last two questions. Lower scores therefore indicate better mental health.

regression to model the propensity-score–adjusted odds of reporting a decrease in overall health, new functional limitation, or new difficulty with an activity of daily living. We then compared health care use after the age of 65 years for those who did and those who did not experience a preceding health decline.

Finally, we used a differences-in-differences logistic regression model to compare the adjusted odds of previously uninsured and insured adults incurring out-of-pocket expenses in the top decile of biennial spending before (>$5,500) and after (>$7,200) the age of 65 years.

All analyses were performed using SAS statistical software, version 9.1. We report two-sided P values without adjustment for multiple testing.

## RESULTS

Of the 9760 participants interviewed in 1992, we excluded 564 (5.8%) who died before the age of 65 years, 1903 (19.5%) who had not reached age 65 by 2004, 2125 (21.8%) who had publicly funded insurance before age 65, and 10 (0.1%) with survey weights of zero. Of the remaining 5158 participants who were 53 to 61 years of age in 1992, 3773 (73.1%) reported having continuous private coverage, and 1385 (26.9%) reported being uninsured before age 65 in at least one of the surveys and for more than half of the surveyed years, on average. Among the study cohort, 2951 (57.2%) adults reported diagnoses of hypertension, diabetes, heart disease, or stroke before age 65, including 2185 (57.9%) of all insured adults and 766 (55.3%) of all uninsured adults.

Uninsured adults differed significantly from insured adults in many demographic, socioeconomic, and health characteristics at the ages of 59 to 60 years (Table 1). With adjustment by propensity-score weighting, these characteristics were equally distributed between insurance groups. After age 65, previously uninsured adults were less likely than previously insured adults to have supplemental insurance (69.7% vs. 83.8%, P<0.001) or prescription-drug coverage (70.5% vs. 86.6%, P<0.001) in adjusted comparisons. Uninsured adults were significantly more likely than insured adults to report health declines before the age of 65 years (adjusted odds ratio, 1.31; 95% confidence interval [CI], 1.11 to 1.56; P=0.002). Experiencing a health decline was associated with

23.4% more doctor visits (P<0.001) and 37.0% more hospitalizations (P<0.001) after age 65.

Uninsured adults reported significantly fewer doctor visits and hospital stays than insured adults before age 65 and slightly, but not significantly, more visits and admissions after age 65 (Table 2). Relative increases in doctor visits (ratio of relative use, 1.22; 95% CI, 1.09 to 1.38; P=0.002) and hospitalizations (ratio of relative use, 1.36; 95% CI, 1.00 to 1.86; P=0.049) were significantly greater for previously uninsured adults than for previously insured adults. After adjustment for supplemental and prescription-drug coverage after 65 years of age, previously uninsured adults reported significantly more doctor visits and tended to report more hospital stays after age 65 than previously insured adults. Previously uninsured adults also tended to report greater biennial odds of hospitalization (adjusted odds ratio, 1.13; 95% CI, 0.98 to 1.30; P=0.098) after age 65 than previously insured adults.

Increases in self-reported total medical expenditures were significantly greater for previously uninsured adults than for previously insured adults (ratio of relative expenditures, 1.87; 95% CI, 1.18 to 2.95; P=0.009). Previously uninsured adults reported total medical expenditures after the age of 65 years that were significantly greater than those reported by previously insured adults (Table 2). Uninsured adults were more likely than insured adults to incur out-of-pocket medical costs in the cohort's top decile before age 65 (adjusted odds ratio, 1.52; 95% CI, 1.18 to 1.96; P=0.001) but not after age 65 (adjusted odds ratio, 1.05; 95% CI, 0.84 to 1.32; P=0.66) and reported a significant differential decrease in the odds of incurring such high out-of-pocket expenditures (adjusted odds ratio, 0.69; 95% CI, 0.51 to 0.94; P=0.02).

Among adults with cardiovascular disease or diabetes, acquiring Medicare coverage was associated with significantly greater increases in self-reported doctor visits (Fig. 1) and hospitalizations (Fig. 2) for previously uninsured adults relative to previously insured adults. Significant differential increases were not evident among adults without these conditions. Similarly, acquiring Medicare coverage was associated with significantly greater increases in self-reported total medical expenditures for previously uninsured adults relative to previously insured adults with these conditions

148

**Table 2.** Adjusted Self-Reported Health Care Use and Expenditures before and after the Start of Medicare Eligibility for Previously Uninsured Adults Relative to Continuously Insured Adults.*

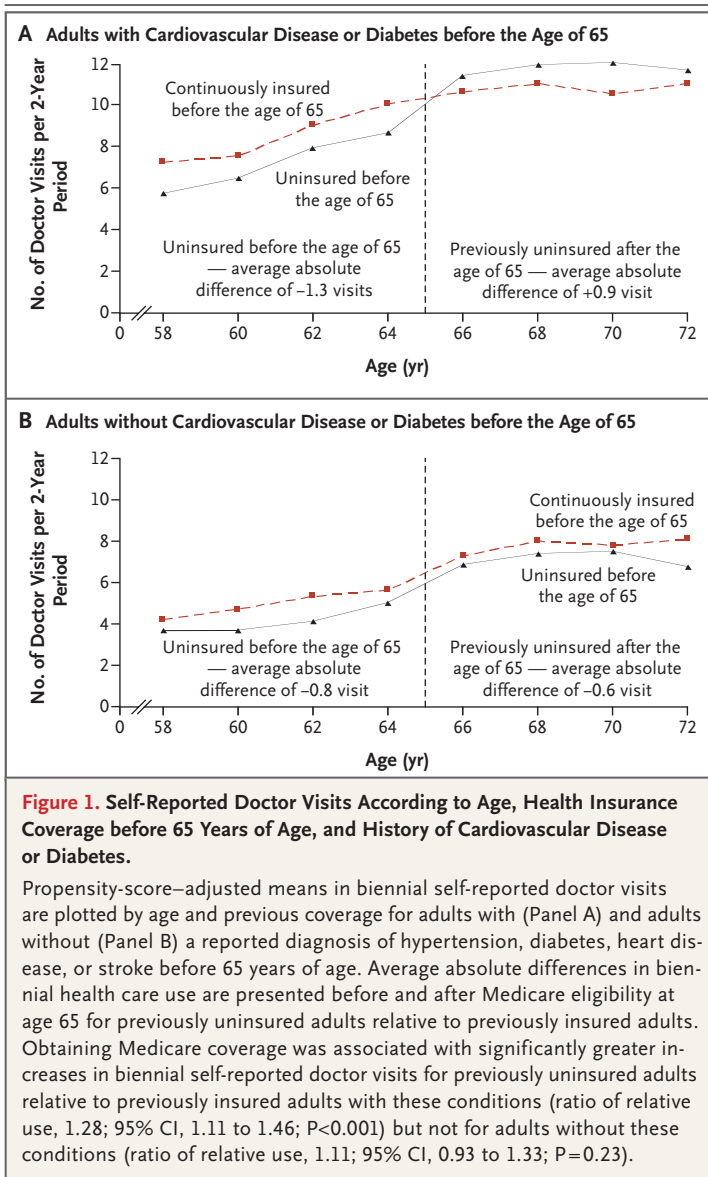| Factor | Entire Study Cohort (N=5158) | | Adults with Hypertension, Diabetes, Heart Disease, or Stroke before 65 Years of Age (N=2951) | | Adults without Hypertension, Diabetes, Heart Disease, or Stroke before 65 Years of Age (N=2207) | |
|---|---|---|---|---|---|---|
| | RU or RE (95% CI) | P Value | RU or RE (95% CI) | P Value | RU or RE (95% CI) | P Value |
| **Doctor visits** | | | | | | |
| Before 65 years of age | 0.85 (0.77–0.93) | 0.001 | 0.85 (0.75–0.97) | 0.01 | 0.83 (0.73–0.94) | 0.004 |
| After 65 years of age | | | | | | |
|   Unadjusted for supplemental and prescription-drug coverage | 1.04 (0.94–1.14) | 0.46 | 1.09 (0.97–1.21) | 0.13 | 0.92 (0.77–1.10) | 0.35 |
|   Adjusted for supplemental and prescription-drug coverage† | 1.11 (1.01–1.23) | 0.03 | 1.13 (1.00–1.28) | 0.04 | 1.00 (0.83–1.19) | 0.96 |
| **Hospitalizations** | | | | | | |
| Before 65 years of age | 0.86 (0.75–0.99) | 0.04 | 0.81 (0.67–0.98) | 0.03 | 0.89 (0.67–1.18) | 0.40 |
| After 65 years of age | | | | | | |
|   Unadjusted for supplemental and prescription-drug coverage | 1.17 (0.91–1.51) | 0.19 | 1.17 (0.99–1.39) | 0.07 | 1.21 (0.44–3.33) | 0.66 |
|   Adjusted for supplemental and prescription-drug coverage† | 1.24 (0.98–1.56) | 0.07 | 1.20 (1.01–1.42) | 0.04 | 1.25 (0.50–3.09) | 0.57 |
| **Total medical expenditures** | | | | | | |
| Before 65 years of age | 0.78 (0.54–1.14) | 0.20 | 0.85 (0.55–1.32) | 0.47 | 0.64 (0.29–1.40) | 0.24 |
| After 65 years of age | | | | | | |
|   Unadjusted for supplemental and prescription-drug coverage | 1.47 (1.09–1.99) | 0.01 | 1.53 (0.95–2.49) | 0.08 | 1.26 (0.63–2.54) | 0.48 |
|   Adjusted for supplemental and prescription-drug coverage† | 1.51 (1.13–2.01) | 0.007 | 1.51 (0.92–2.49) | 0.09 | 1.37 (0.72–2.60) | 0.31 |

* RU denotes relative biennial use of health services, RE relative biennial expenditures, and CI confidence interval. All reported results are adjusted by propensity-score weighting. Because propensity-score models were fitted separately within strata, overall estimates do not necessarily fall between stratum-specific estimates.
† Comparisons after 65 years of age were further adjusted for differences in supplemental insurance and prescription-drug coverage to estimate relative differences in health care use and expenditures related to previous lack of coverage but not to differences in coverage after the age of 65.

(ratio of relative expenditures, 1.78; 95% CI, 1.11 to 2.87; P=0.02), but not for adults without these conditions (ratio of relative expenditures, 1.98; 95% CI, 0.82 to 4.76; P=0.12). After adjustment for differences in supplemental and prescription-drug coverage, previously uninsured adults with cardiovascular disease or diabetes reported significantly more doctor visits and hospital stays and tended to report total medical expenditures after the age of 65 years that were higher than those reported by previously insured adults with these conditions (Table 2). However, among adults without these conditions, adjusted health care use and expenditures after age 65 did not differ significantly between previously insured and uninsured adults.

## DISCUSSION

In this nationally representative longitudinal study, obtaining Medicare coverage at 65 years of age was associated with greater increases in doctor visits, hospital stays, and total medical expenditures for previously uninsured beneficiaries than for previously insured beneficiaries. Previously uninsured adults reported consistently greater use of health services and total medical expenditures after age 65 than previously insured adults with similar characteristics at ages 59 to 60 and comparable coverage after age 65. Self-reported use of health services for previously uninsured adults with cardiovascular disease or diabetes remained elevated through 72 years of age, indicating that

**Figure 1. Self-Reported Doctor Visits According to Age, Health Insurance Coverage before 65 Years of Age, and History of Cardiovascular Disease or Diabetes.**

Propensity-score–adjusted means in biennial self-reported doctor visits are plotted by age and previous coverage for adults with (Panel A) and adults without (Panel B) a reported diagnosis of hypertension, diabetes, heart disease, or stroke before 65 years of age. Average absolute differences in biennial health care use are presented before and after Medicare eligibility at age 65 for previously uninsured adults relative to previously insured adults. Obtaining Medicare coverage was associated with significantly greater increases in biennial self-reported doctor visits for previously uninsured adults relative to previously insured adults with these conditions (ratio of relative use, 1.28; 95% CI, 1.11 to 1.46; P<0.001) but not for adults without these conditions (ratio of relative use, 1.11; 95% CI, 0.93 to 1.33; P=0.23).

and major chronic ailments such as kidney disease and congestive heart failure,[32-41] thereby increasing the need for costly hospitalizations, ambulatory care, procedures, and medications. For uninsured adults with these conditions, adjusted absolute increases in self-reported use of health services after the age of 65 years approximated their decreased use before age 65. Therefore, the costs of expanding coverage for uninsured near-elderly adults with these conditions may be partially offset by subsequent reductions in health care use and expenditures after they reach age 65.

Having Medicare coverage substantially reduced the risk of incurring high out-of-pocket medical costs for previously uninsured adults, confirming the results of one previous study.[42] The effect of Medicare coverage on financial security may be even greater for previously uninsured enrollees now eligible for Medicare prescription-drug benefits.[43]

Our study builds on previous research assessing health care use and outcomes as Americans age. Rather than relying on cross-sectional and community-level data[44] or simulations of health care spending,[45,46] we used longitudinal data to follow participants as they became eligible for Medicare, thereby allowing more direct assessment of the effect of coverage before the age of 65 years on the subsequent need for health services.

Our study had several limitations. The observational design did not allow us to make definitive conclusions about the causal effects of acquiring health insurance on subsequent reductions in health care use or expenditures. Unmeasured predictors of both coverage and use of services, such as unobserved health differences before the age of 65 years, could explain some of our findings. However, propensity-score weighting balanced numerous health-related characteristics equally between groups of previously uninsured and previously insured adults. To alter our findings substantially, unmeasured confounders would need to predict coverage and use of services independently of all variables in the propensity-score model. With this adjustment, we may have actually underestimated the additional health care needs of previously uninsured adults if differences in health at ages 59 to 60 were due to earlier differences in coverage.

Differences in the use of health services between uninsured and insured adults before the

the earlier lack of insurance was associated with persistent increases in health care needs rather than with transient spikes. These findings support the hypothesis that previously uninsured adults used health services more intensively and required costlier care as Medicare beneficiaries than they would have if previously insured.

The longitudinal effects of being uninsured were concentrated among near-elderly adults with cardiovascular disease or diabetes. Suboptimal control of high blood pressure and glucose and cholesterol levels can cause life-threatening complications such as myocardial infarction or stroke
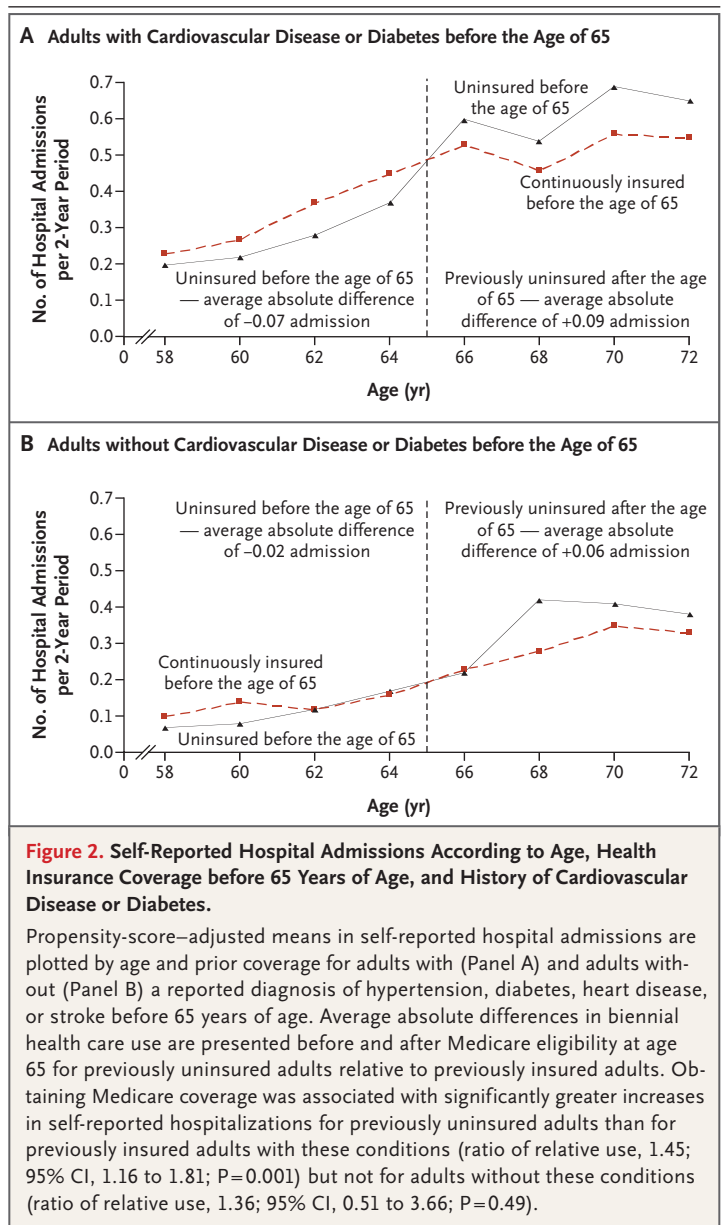
age of 65 years could reflect differences in health care preferences if uninsured adults place less value on seeking health care and obtaining insurance.[47] However, this explanation would be inconsistent with the greater use of health services after age 65 among previously uninsured adults with cardiovascular disease and diabetes as compared with previously insured adults with the same diagnoses. More plausibly, uninsured adults who lacked regular care were probably undertreated before age 65 for often asymptomatic but poorly controlled conditions such as hypertension and hyperlipidemia,[48] and the undertreatment probably contributed to health declines and a greater need for services after age 65.

We could not measure cumulative lifetime health care use or expenditures. Expanding insurance coverage for near-elderly adults may improve life expectancy,[4] so the potential economic benefits we identified could be diminished by additional health care use associated with greater longevity.[45,46,49]

Finally, health care use and expenditures were self-reported and could not be validated. However, self-reports of ambulatory doctor visits and hospital admissions are highly correlated with actual use of services, as shown by administrative claims and medical records, and the magnitude of reporting errors tends to be small.[50-52] Self-reports are particularly accurate for major events such as hospitalizations.[51-54] Previous studies have not found consistent associations between accuracy of self-reported use of health services and many demographic, socioeconomic, and clinical characteristics.[52,55] Moreover, because greater use of health services is typically associated with underreporting of these services,[50-53,56,57] our study probably provides conservative estimates of differences in health care use between insurance groups before and after 65 years of age.

Our findings have important policy implications. Near-elderly adults who were uninsured required more intensive and costlier care in the Medicare program after the age of 65 years than previously insured adults who were otherwise similar at ages 59 to 60. Therefore, providing health insurance coverage for uninsured near-elderly adults may improve their health outcomes and reduce their health care use and spending after age 65. Particularly for those with cardiovas-



**Figure 2. Self-Reported Hospital Admissions According to Age, Health Insurance Coverage before 65 Years of Age, and History of Cardiovascular Disease or Diabetes.**

Propensity-score–adjusted means in self-reported hospital admissions are plotted by age and prior coverage for adults with (Panel A) and adults without (Panel B) a reported diagnosis of hypertension, diabetes, heart disease, or stroke before 65 years of age. Average absolute differences in biennial health care use are presented before and after Medicare eligibility at age 65 for previously uninsured adults relative to previously insured adults. Obtaining Medicare coverage was associated with significantly greater increases in self-reported hospitalizations for previously uninsured adults than for previously insured adults with these conditions (ratio of relative use, 1.45; 95% CI, 1.16 to 1.81; P=0.001) but not for adults without these conditions (ratio of relative use, 1.36; 95% CI, 0.51 to 3.66; P=0.49).

cular disease or diabetes, these benefits may be substantial and may partially offset the costs of expanding coverage.

## REFERENCES

**1.** McWilliams JM, Zaslavsky AM, Meara E, Ayanian JZ. Impact of Medicare coverage on basic clinical services for previously uninsured adults. JAMA 2003;290:757-64.
**2.** Ayanian JZ, Weissman JS, Schneider EC, Ginsburg JA, Zaslavsky AM. Unmet health needs of uninsured adults in the United States. JAMA 2000;284:2061-9.
**3.** Baker DW, Sudano JJ, Albert JM, Borawski EA, Dor A. Lack of health insurance and decline in overall health in late middle age. N Engl J Med 2001;345:1106-12.
**4.** McWilliams JM, Zaslavsky AM, Meara E, Ayanian JZ. Health insurance coverage and mortality among the near-elderly. Health Aff (Millwood) 2004;23(4):223-33.
**5.** Baker DW, Sudano JJ, Durazo-Arvizu R, Feinglass J, Witt WP, Thompson J. Health insurance coverage and the risk of decline in overall health and death among the near elderly, 1992-2002. Med Care 2006;44:277-82.
**6.** Levine DA, Kiefe CI, Houston TK, Allison JJ, McCarthy EP, Ayanian JZ. Younger stroke survivors have reduced access to physician care and medications: National Health Interview Survey from years 1998 to 2002. Arch Neurol 2007;64:37-42.
**7.** Friedland RB, Summer L. Demography is not destiny, revisited. Report no. 789. New York: Commonwealth Fund, 2005.
**8.** Employer health benefits: 2004 annual survey. Report no. 097512. Menlo Park, CA: Kaiser Family Foundation and Health Research and Educational Trust, 2004.
**9.** Stuart B, Singhal PK, Fahlman C, Doshi J, Briesacher B. Employer-sponsored health insurance and prescription drug coverage for new retirees: dramatic declines in five years. Health Aff (Millwood) 2003;Suppl Web Exclusives:W3-334–W3-341.
**10.** Simantov E, Schoen C, Bruegman S. Market failure? Individual insurance markets for older Americans. Health Aff (Millwood) 2001;20(4):139-49.
**11.** Collins SR, Schoen C, Doty MM, Holmgren AL, How SK. Paying more for less: older adults in the individual insurance market: findings from the Commonwealth Fund Survey of Older Adults. Issue Brief (Commonwealth Fund) 2005;841:1-12.
**12.** Health, United States, 2005 with chartbook on trends in the health of Americans. Hyattsville, MD: National Center for Health Statistics, 2005. (DHHS publication no. (PHS) 2005-1232.).
**13.** Institute of Medicine. Hidden costs, value lost: uninsurance in America. Washington, DC: National Academy Press, 2003.
**14.** Baker DW, Feinglass J, Durazo-Arvizu R, Witt WP, Sudano JJ, Thompson JA. Changes in health for the uninsured after reaching age-eligibility for Medicare. J Gen Intern Med 2006;21:1144-9.
**15.** Dor A, Sudano J, Baker DW. The effect of private insurance on the health of older, working age adults: evidence from the Health and Retirement Study. Health Serv Res 2006;41:759-87.
**16.** H.R. 2072, Medicare Early Access Act of 2005. Washington, DC: Government Printing Office, 2005. (Accessed June 15, 2007, at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_bills&docid=f:h2072ih.txt.pdf.)
**17.** Developing a Medicare buy-in program: position paper. Philadelphia: American College of Physicians, 2006.
**18.** Long SH, Marquis MS. The uninsured 'access gap' and the cost of universal coverage. Health Aff (Millwood) 1994;13(2):211-20.
**19.** Hadley J, Holahan J. Covering the uninsured: how much would it cost? Health Aff (Millwood) 2003;Suppl Web Exclusives:W3-250–W3-265.
**20.** Miller E, Banthin JS, Moeller JF. Covering the uninsured: estimates of the impact on total health expenditures for 2002. Report no. 04007. Rockville, MD: Agency for Healthcare Research and Quality, 2004.
**21.** Johnson RW, Moon M, Davidoff AJ. A Medicare buy-in for the near-elderly: design issues and potential effects for coverage. Menlo Park, CA: Henry J. Kaiser Family Foundation, 2002.
**22.** Shea DG, Short PF, Powell MP. Betwixt and between: targeting coverage reforms to those approaching Medicare. Health Aff (Millwood) 2001;20(1):219-30.
**23.** Sheils J, Chen YJ. Medicare buy-in options: estimating coverage and costs. Report no. 441. New York: The Commonwealth Fund, 2001.
**24.** Health and Retirement Study: 1992-2004 final release public use datasets. Ann Arbor: University of Michigan, 2006.
**25.** Heeringa SG, Connors JH. Technical description of the Health and Retirement Survey sample design. Ann Arbor: University of Michigan, 1995. (Accessed June 15, 2007, at http://hrsonline.isr.umich.edu/docs/userg/HRSSAMP.pdf.)
**26.** Baker DW, Sudano JJ. Health insurance coverage during the years preceding Medicare eligibility. Arch Intern Med 2005;165:770-6.
**27.** St. Clair P, Blake D, Bugliari D, et al. RAND HRS data documentation, version F. Santa Monica, CA: RAND Center for the Study of Aging, 2006. (Accessed June 15, 2007, at http://www.rand.org/labor/aging/dataprod/randhrsf.pdf.)
**28.** Economic report of the President, transmitted to the Congress February 2005. Washington, DC: Government Printing Office, 2005.
**29.** Rubin DB, Little RJA. Statistical analysis with missing data. 2nd ed. Hoboken, NJ: John Wiley, 2002.
**30.** Rosenbaum PR, Rubin DB. Reducing bias in observational studies using subclassification on the propensity score. J Am Stat Assoc 1984;79:516-24.
**31.** Buntin MB, Zaslavsky AM. Too much ado about two-part models and transformation? Comparing methods of modeling Medicare expenditures. J Health Econ 2004;23:525-42.
**32.** The EUCLID Study Group. Randomised placebo-controlled trial of lisinopril in normotensive patients with insulin-dependent diabetes and normoalbuminuria or microalbuminuria. Lancet 1997;349:1787-92.
**33.** UK Prospective Diabetes Study (UKPDS) Group. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). Lancet 1998;352:837-53. [Erratum, Lancet 1999;354:602.]
**34.** The Long-Term Intervention with Pravastatin in Ischaemic Disease (LIPID) Study Group. Prevention of cardiovascular events and death with pravastatin in patients with coronary heart disease and a broad range of initial cholesterol levels. N Engl J Med 1998;339:1349-57.
**35.** Executive summary of the third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). JAMA 2001;285:2486-97.
**36.** Brenner BM, Cooper ME, de Zeeuw D, et al. Effects of losartan on renal and cardiovascular outcomes in patients with type 2 diabetes and nephropathy. N Engl J Med 2001;345:861-9.
**37.** Chobanian AV, Bakris GL, Black HR, et al. The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. JAMA 2003;289:2560-72. [Erratum, JAMA 2003;290:197.]
**38.** Collins R, Armitage J, Parish S, Sleigh P, Peto R. MRC/BHF Heart Protection Study of cholesterol-lowering with simvastatin in 5963 people with diabetes: a randomised placebo-controlled trial. Lancet 2003;361:2005-16.
**39.** Lewis EJ, Hunsicker LG, Bain RP, Rohde RD. The effect of angiotensin-converting–enzyme inhibition on diabetic nephropathy. N Engl J Med 1993;329:1456-62. [Erratum, N Engl J Med 1993;330:152.]
**40.** Lewis EJ, Hunsicker LG, Clarke WR, et al. Renoprotective effect of the angiotensin-receptor antagonist irbesartan in patients with nephropathy due to type 2 diabetes. N Engl J Med 2001;345:851-60.
**41.** The Heart Outcomes Prevention Evaluation Study Investigators. Effects of an angiotensin-converting–enzyme inhibitor, ramipril, on cardiovascular events in high-risk patients. N Engl J Med 2000;342:145-53. [Errata, N Engl J Med 2000;342:748, 1376.]
**42.** Finkelstein A, McKnight R. What did

Medicare do (and was it worth it)? Report no. 11609. Cambridge, MA: National Bureau of Economic Research, 2005.

**43.** Federman AD, Adams AS, Ross-Degnan D, Soumerai SB, Ayanian JZ. Supplemental insurance and use of effective cardiovascular drugs among elderly Medicare beneficiaries with coronary heart disease. JAMA 2001;286:1732-9.

**44.** Card D, Dobkin C, Maestas N. The impact of nearly universal insurance coverage on health care utilization and health: evidence from Medicare. Report no. 10365. Cambridge, MA: National Bureau of Economic Research, 2004.

**45.** Hadley J, Waidmann T. Health insurance and health at age 65: implications for medical care spending on new Medicare beneficiaries. Health Serv Res 2006; 41:429-51.

**46.** Joyce GF, Keeler EB, Shang B, Goldman DP. The lifetime burden of chronic disease among the elderly. Health Aff (Millwood) 2005;24 Suppl 2:W5R18-W5R29.

**47.** Monheit AC, Vistnes JP. Health insurance enrollment decisions: understanding the role of preferences for coverage. Report no. 31. Ann Arbor, MI: Economic Research Initiative on the Uninsured, July 2004.

**48.** Ayanian JZ, Zaslavsky AM, Weissman JS, Schneider EC, Ginsburg JA. Undiagnosed hypertension and hypercholesterolemia among uninsured and insured adults in the Third National Health and Nutrition Examination Survey. Am J Public Health 2003;93:2051-4.

**49.** Lubitz J, Cai L, Kramarow E, Lentzner H. Health, life expectancy, and health care spending among the elderly. N Engl J Med 2003;349:1048-55.

**50.** Cleary PD, Jette AM. The validity of self-reported physician utilization measures. Med Care 1984;22:796-803.

**51.** Weissman JS, Levin K, Chasan-Taber S, Massagli MP, Seage GR III, Scampini L. The validity of self-reported health-care utilization by AIDS patients. AIDS 1996; 10:775-83.

**52.** Bhandari A, Wagner T. Self-reported utilization of health care services: improving measurement and accuracy. Med Care Res Rev 2006;63:217-35.

**53.** Ritter PL, Stewart AL, Kaymaz H, Sobel DS, Block DA, Lorig KR. Self-reports of health care utilization compared to provider records. J Clin Epidemiol 2001;54: 136-41.

**54.** Marks AS, Lee DW, Slezak J, Berger J, Patel H, Johnson KE. Agreement between insurance claim and self-reported hospital and emergency room utilization data among persons with diabetes. Dis Manag 2003;6:199-205.

**55.** Reijneveld SA, Stronks K. The validity of self-reported use of health care across socioeconomic strata: a comparison of survey and registration data. Int J Epidemiol 2001;30:1407-14.

**56.** Roberts RO, Bergstralh EJ, Schmidt L, Jacobsen SJ. Comparison of self-reported and medical record health care utilization measures. J Clin Epidemiol 1996;49:989-95.

**57.** Norrish A, North D, Kirkman P, Jackson R. Validity of self-reported hospital admission in a prospective study. Am J Epidemiol 1994;140:938-42.

*Copyright © 2007 Massachusetts Medical Society.*

---

**POSTING PRESENTATIONS AT MEDICAL MEETINGS ON THE INTERNET**

Posting an audio recording of an oral presentation at a medical meeting on the Internet, with selected slides from the presentation, will not be considered prior publication. This will allow students and physicians who are unable to attend the meeting to hear the presentation and view the slides. If there are any questions about this policy, authors should feel free to call the *Journal*'s Editorial Offices.

---