Health of Previously Uninsured Adults After Acquiring Medicare Coverage

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Context Uninsured near-elderly adults, particularly those with cardiovascular disease or diabetes, experience worse health outcomes than insured adults. However, the health benefits of providing insurance coverage for uninsured adults have not been clearly demonstrated.

Objective To assess the effect of acquiring Medicare coverage on the health of previously uninsured adults.

Design and Setting We conducted quasi-experimental analyses of longitudinal survey data from 1992 through 2004 from the nationally representative Health and Retirement Study. We compared changes in health trends reported by previously uninsured and insured adults after they acquired Medicare coverage at age 65 years.

Participants Five thousand six adults who were continuously insured and 2227 adults who were persistently or intermittently uninsured from ages 55 to 64 years.

Main Outcome Measures Differential changes in self-reported trends after age 65 years in general health, change in general health, mobility, agility, pain, depressive symptoms, and a summary measure of these 6 domains; and adverse cardiovascular outcomes (all trend changes reported in health scores per year).

Results Compared with previously insured adults, previously uninsured adults reported significantly improved health trends after age 65 years for the summary measure (differential change in annual trend, +0.20; $P=.002$) and several component measures. Relative to previously insured adults with cardiovascular disease or diabetes, previously uninsured adults with these conditions reported significantly improved trends in summary health (differential change in annual trend, +0.26; $P=.006$), change in general health (+0.02; $P=.03$), mobility (+0.04; $P=.05$), agility (+0.08; $P=.003$), and adverse cardiovascular outcomes (–0.015; $P=.02$) but not in depressive symptoms (+0.04; $P=.32$). Previously uninsured adults without these conditions reported differential improvement in depressive symptoms (+0.08; $P=.002$) but not in summary health (+0.10; $P=.17$) or any other measure. By age 70 years, the expected difference in summary health between previously uninsured and insured adults with cardiovascular disease or diabetes was reduced by 50%.

Conclusion In this study, acquisition of Medicare coverage was associated with improved trends in self-reported health for previously uninsured adults, particularly those with cardiovascular disease or diabetes.

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UNINSURED NEAR-ELDERLY adults, particularly those with cardiovascular disease or diabetes, experience worse health outcomes[1-4] and use more health services as Medicare beneficiaries after age 65 years than insured near-elderly adults.[5] Because chronic diseases are prevalent and insurance coverage is often unaffordable for older uninsured adults, the impact of near-universal Medicare coverage at age 65 years on the health of previously uninsured adults may be substantial.[6-10]

Most studies assessing the health consequences of lacking coverage have relied on cross-sectional data and study designs that have not allowed coverage effects to be distinguished from unobserved differences between insured and uninsured persons.[11,12] A few studies have used cross-sectional data that span multiple years or ages to conduct more rigorous comparisons.[13,14] For example, an assessment of the introduction of Medicare in 1965 found no discernible impact on mortality for beneficiaries,[15] but subsequent medical advances may have improved the effectiveness of health care for elderly Americans.[16] A recent cross-sectional analysis of age profiles found that Medicare eligibility at age 65 years was associated with modest gains in self-reported general health status for less-educated adults and minority groups, but uninsured adults and those with specific conditions could not be longitudinally followed as they became eligible for Medicare.[17]

Quasi-experimental analyses of longitudinal data redress many limitations of other observational studies and may support more robust conclusions,[18,19] but few such analyses have been conducted for contemporary co-

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horts of uninsured adults. Among low-income adults with hypertension, random assignment to less-extensive coverage[20] and local termination of public insurance benefits[21,22] each led to worse blood pressure control. Medicare increases access to effective clinical services for previously uninsured adults,[23] but the associated health benefits remain unclear. Studies using instrumental variables have demonstrated health benefits of insurance coverage for near-elderly adults before age 65 years.[24,25] However, in 2 longitudinal studies that assessed health effects of Medicare coverage for previously uninsured adults, one study followed participants for only 2 to 4 years after age 65 years,[26] the other analyzed just a single general health measure,[27] and neither identified subgroups with conditions that may benefit most from gaining coverage.

The objective of our study was to assess the effect of Medicare coverage at age 65 years on trends in self-reported health outcomes from ages 55 through 72 years for previously uninsured adults, particularly those with cardiovascular disease or diabetes. We compared cohorts of insured and uninsured near-elderly adults using a quasi-experimental design and longitudinal data on a broad array of general, physical, and mental health measures from the nationally representative Health and Retirement Study. We hypothesized that acquiring Medicare coverage would attenuate adverse health trends for previously uninsured adults relative to previously insured adults, as improved access to care, greater use of beneficial medications and procedures, and more effective management of chronic conditions helped to alleviate symptoms, maintain functioning, and prevent or postpone complications.[11]

METHODS

Study Population

We analyzed data from the Health and Retirement Study, a nationally representative, longitudinal survey.[28] In 1992, this study enrolled noninstitutionalized adults and eligible spouses aged 51 to 61 years in the continental United States. Initial interviews conducted in 7705 households yielded 9760 participants (82% response rate) who provided oral informed consent at enrollment. Biennial follow-up survey data were available through 2004. Our study cohort included participants old enough in 1992 to reach Medicare eligibility at age 65 years by 2004. We assessed self-reported health from up to 5 surveys before and up to 4 surveys after age 65 years, depending on participants' initial ages. In addition, a sample of participants with diabetes underwent hemoglobin A_{1c} (HbA_{1c}) testing in 2003.[29] Because our study used publicly available deidentified 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 insured, whether they lacked coverage at any time in the prior 2 years.[30] We classified participants as continuously insured if they reported continuous private or public coverage in the 2 years preceding each completed survey from ages 55 to 64 years and otherwise as uninsured. We classified uninsured adults as persistently uninsured if they reported no coverage in half or more of the surveyed years between ages 55 and 64 years and otherwise as intermittently uninsured. In addition, we identified participants who reported any coverage for prescribed medications after age 65 years. Participants reported their race and ethnicity based on categories specified by Health and Retirement Study investigators; these study variables were included because insurance coverage varies widely among racial and ethnic groups (TABLE 1).

Measures of self-reported health in the Health and Retirement Study have been rigorously evaluated.[31] To approximate the general health, physical functioning, mental health, and pain scales of the 36-item Short-Form Health Survey (SF-36),[24,32] and based on prior factor analyses of these data,[31] we constructed a component health measure for each of the following 6 domains: general health status, change in general health, mobility, agility, pain, and depressive symptoms. Participants rated their general health status from 0 (excellent) to 4 (poor) and changes in general health in the prior 2 years from 0 (much better) to 4 (much worse). The mobility score (0-5) was defined as the sum of reported difficulties with walking across a room, walking 1 block, walking several blocks, climbing 1 flight of stairs, and climbing several flights of stairs. The agility score (0-6) was defined as the sum of reported difficulties with sitting for 2 hours, getting up from a chair, stooping, kneeling, or crouching, lifting 10 lb, pushing or pulling large objects, and extending one's arms above shoulder level. The pain score (0-3) was derived from 2 questions in which participants were asked if they were often troubled with pain and to rate the pain, if present, as mild, moderate, or severe. The depressive symptoms measure was adapted from the Center for Epidemiologic Studies Depression (CES-D) scale.[33] Participants were asked if they experienced the following 8 items all or most of the time in the prior week: depressed, sad, lonely, everything was an effort, restless sleep, could not get going, happy, and enjoyed life. Depression scores (0-8) were calculated as the sum of affirmative responses to the first 6 items and negative responses to the last 2 items.

All component scales were inverted so that higher scores indicated better health, and a summary score ranging from 0 to 30 was calculated by summing these inverted component scores. Correlations between component health scores indicated a high degree of internal consistency (Cronbach coefficient $\alpha = 0.82$), suggesting that the summary scale was a reliable measure of composite health.

We also assessed more objective measures of cardiovascular disease severity and glycemic control. We created a measure of adverse cardiovascular outcomes ranging from 0 to 3 based on participants' biennial reports of experiencing a myocardial infarction, angina that limited usual activities, or hospitalization for congestive heart failure. For a sample of study participants with diabetes in 2003, we assessed HbA_{1c} levels.

Statistical Analysis

For the summary health measure and each component measure, we fitted the following linear spline regression model[34]:

$$E(Y_{ij}) = \beta_0 + \beta_1 \text{uninsured}_i + \beta_2 \text{age}_{ij} + \beta_3 \text{uninsured}_i \times \text{age}_{ij} + \beta_4 (\text{number of years older than 65 years}_{ij}) + \beta_5 \text{uninsured}_i \times (\text{number of years older than 65 years}_{ij}),$$

where Y_{ij} = health score for the ith individual at the jth survey, uninsured = 1 if uninsured prior to age 65 years and 0 if insured, age = (age in years) − 65 = centered age ranging from −10 to +8, and (number of years older than 65 years) = centered age if centered age >0 and 0 if centered age ≤0.

TABLE 2 shows how coefficients β_0 through β_5 yield the following estimates of interest: health trends before and after age 65 years, differences in health scores at age 65 years, differences in health trends before age 65 years, and differential changes in health trends after age 65 years for previously uninsured adults relative to previously insured adults. Trends are reported as changes in health scores per year. To improve precision, we adjusted these analyses for all baseline characteristics listed in Table 1 and report adjusted estimates of differential changes in trend (β_5) for all summary and component health measures as the principal findings of our study.

Positive differential changes would indicate that trends in these health measures became less divergent after age 65 years, suggesting relative improvements for previously uninsured adults. Similar models were estimated for adverse cardiovascular outcomes, for which negative differential changes would indicate relative improvements in trend after age 65 years for previously uninsured adults. Wald tests of coefficient estimates were conducted to obtain 2-sided *P* values, and statistical significance was defined as $P \leq .05$.

Adjusted estimates of differential changes were more precise but otherwise similar to unadjusted estimates. Therefore, we also present unadjusted model coefficients for the summary health measure that may be used to predict health scores for each insurance group at different ages. To illustrate comparisons of observed and expected health trends after age 65 years, we plotted mean summary health scores by age and insurance group and juxtaposed observed health trends with expected trends for previously uninsured adults after age 65 years, as predicted by the null hypothesis of no

Table 1. Baseline Characteristics of the Study Cohort in 1992 by Insurance Coverage Before Age 65 Years[a]

Characteristics	Insurance Coverage, Age 55-64 y: Continuously Insured (n = 5006)	Insurance Coverage, Age 55-64 y: Persistently or Intermittently Uninsured (n = 2227)	*P* Value
Age, mean (SE), y	57.0 (0.03)	56.8 (0.05)	.01
Female	51.3	54.8	<.001
Race or ethnic group			
Non-Hispanic white	85.7	71.4	<.001
Non-Hispanic black	8.7	13.8	
Hispanic	4.1	11.2	
Other	1.6	3.5	
Married	77.9	66.9	<.001
Census region			
Northeast	22.4	19.7	<.001
Midwest	26.6	19.9	
South	32.7	39.3	
West	18.4	21.1	
Education			
Not a high school graduate	19.4	35.4	<.001
High school graduate or GED	41.2	34.8	
Some college	19.5	16.7	
College graduate	19.8	13.0	
Employment			
Employed full-time	55.7	48.8	<.001
Employed part-time	9.3	11.5	
Unemployed	1.5	5.1	
Partly retired	4.1	3.9	
Retired	17.3	11.3	
Disabled	3.3	4.1	
Not in labor force	8.8	15.3	
Annual household income, percentile			
≤25th	17.1	39.0	<.001
26-50th	24.7	24.9	
51-75th	28.7	17.5	
>75th	29.5	18.6	
Total household wealth, percentile			
≤25th	14.9	33.3	<.001
26-50th	22.7	23.3	
51-75th	28.9	19.5	
>75th	33.6	23.8	
Current smoker	23.5	31.3	<.001

Abbreviation: GED, general equivalency degree.
[a] Data are presented as percentages unless otherwise noted. All estimates have been adjusted for the complex design of the survey. The χ^2 test was used to compare distributions of categorical variables and the *t* test for mean age.

differential change in trend associated with Medicare eligibility. To contrast coverage effects for intermittently and persistently uninsured adults, we excluded insured adults and fitted similar linear spline models comparing these 2 groups of uninsured adults.

Because uninsured near-elderly adults are less likely to receive important preventive services and medications,[11,23,35] those with cardiovascular disease or diabetes may be at particularly high risk of severe complications.[3,4,36-44] Therefore, as in previous research,[5] we stratified our cohort into those with and without diagnosed hypertension, heart disease, stroke, or diabetes before age 65 years. Among adults with these conditions for whom prescription drug coverage after age 65 years could be assessed, we also stratified comparisons by this factor.

Among those who responded to the 2004 survey, both unit and item nonresponse rates were low. These participants responded to an average of 6.8 of the 7 surveys, and their item nonresponse rates for component health questions were less than 0.2% for general health, mobility, and pain assessments, 1.9% for agility assessments, and 5.9% for depressive symptoms. However, 15.1% of the study cohort died and 14.9% dropped out before 2004. Ignoring nonresponse in this 30% of the cohort could lead to biased estimates of differential changes in health trends.

Therefore, we adjusted all longitudinal analyses for nonresponse due to death or dropout except analyses stratified by prescription drug coverage, which were restricted to participants who responded to surveys after age 65 years. We used an inverse probability weighting technique[45,46] to obtain estimates that would have been observed had those who died or dropped out remained in the study with health status similar to respondents with comparable antecedent health trends, insurance coverage before age 65 years, and demographic and socioeconomic characteristics.

Table 2. Differential Changes in Self-reported Health Trends After Age 65 Years for Previously Uninsured Adults Relative to Previously Insured Adults[a]

	Entire Cohort (n = 7233)		Cardiovascular Disease or Diabetes Before Age 65 y (n = 4443)		No Cardiovascular Disease or Diabetes Before Age 65 y (n = 2790)	
	β (SE)	*P* Value	β (SE)	*P* Value	β (SE)	*P* Value
Summary measure (range, 0-30)						
Model coefficients with interpretation						
Intercept (β_0): mean for insured at age 65 y	22.29 (0.11)	<.001	21.10 (0.15)	<.001	24.03 (0.11)	<.001
Uninsured (β_1): mean difference relative to insured at age 65 y	−1.54 (0.16)	<.001	−1.93 (0.22)	<.001	−1.21 (0.19)	<.001
Age (β_2): trend for insured before age 65 y	−0.15 (0.01)	<.001	−0.18 (0.02)	<.001	−0.11 (0.01)	<.001
Uninsured × age interaction (β_3): difference in trend relative to insured before age 65 y	−0.08 (0.02)	.002	−0.11 (0.03)	.001	−0.06 (0.02)	.03
Years older than 65 y (β_4): change in trend for insured after age 65 y	−0.04 (0.03)	.21	−0.01 (0.05)	.84	−0.10 (0.03)	.004
Uninsured × years older than 65 y interaction (β_5): differential change in trend relative to insured after age 65 y	0.20 (0.06)	.003	0.25 (0.10)	.01	0.10 (0.07)	.19
Trends by insurance group and age						
Trends before age 65 y						
Insured (β_2)	−0.15		−0.18		−0.11	
Uninsured ($\beta_2+\beta_3$)	−0.23		−0.29		−0.17	
Trends after age 65 y						
Previously insured ($\beta_2+\beta_4$)	−0.19		−0.19		−0.21	
Previously uninsured ($\beta_2+\beta_3+\beta_4+\beta_5$)	−0.07		−0.05		−0.17	
Adjusted differential changes in trend for summary and component measures (β_5) (score range)[b]						
Summary measure (0-30)	0.20 (0.06)	.002	0.26 (0.09)	.006	0.10 (0.07)	.17
General health (0-4)	0 (0.01)	.90	0.01 (0.01)	.64	−0.01 (0.02)	.49
Change in general health (0-4)	0.02 (0.01)	.01	0.02 (0.01)	.03	0.01 (0.01)	.17
Mobility (0-5)	0.03 (0.02)	.06	0.04 (0.02)	.05	0.01 (0.02)	.74
Agility (0-6)	0.05 (0.02)	.004	0.08 (0.02)	.003	0.01 (0.02)	.51
Pain (0-3)	0.02 (0.01)	.18	0.02 (0.01)	.08	0 (0.02)	.96
Depressive symptoms (0-8)	0.06 (0.02)	.01	0.04 (0.04)	.32	0.08 (0.03)	.002

[a] Previously uninsured adults include those who were persistently or intermittently uninsured before age 65 years. All estimates have been adjusted for the complex design of the survey and for nonresponse due to dropout or death. Age has been centered at 65 years so that the intercept represents the mean summary health score for previously insured adults at age 65 years. Higher scores indicate better health for the summary and component measures. Trends are reported as changes in health scores per year. To focus on principal findings, only adjusted estimates of differential changes in trend are reported for component measures. The full set of unadjusted model coefficients is also presented for the summary health measure.

[b] Adjusted for all characteristics listed in Table 1.

Specifically, we used logistic regression to model separate probabilities of death and dropout as functions of respondents' age and component health scores in the preceding survey, interactions between age and health, insurance status prior to age 65 years, sex, race, ethnicity, education, and smoking history, and employment, household income, and wealth in 1992. To allow death and dropout to vary by age and insurance group differently before and after age 65 years, model covariates also included number of years older than 65 years, an indicator for age 65 years or older, and an interaction between prior insurance status and this indicator. For stratified analyses, models were fitted separately within subgroups. From these models, predicted probabilities of responding to each biennial survey were determined for those who responded to the preceding survey. The inverse probability of remaining in the survey, calculated as the inverse of the cumulative product of a participant's response probabilities through each survey, was used to weight observations such that reports from individuals at higher predicted risk of death or dropout were assigned greater weight in the analysis.

Because assigning health scores of living persons to deceased persons, no matter how similar when alive, may not fully capture health declines leading to death, we also conducted a sensitivity analysis in which deceased participants were assigned permanent scores after death equal to the 10th percentile of the study cohort's distribution.

In secondary analyses of cross-sectional data from 2003, we compared HbA_{1c} levels between uninsured and insured adults with diabetes younger than 65 years and previously uninsured and insured adults with diabetes aged 65 years or older.

We conducted 4 additional sensitivity analyses. First, because adults with permanent disabilities may have distinct health trajectories, we excluded 7.1% of participants who reported having Medicare or Medicaid coverage at baseline or before age 57 years. Second, to adjust for changes in health trends that might be related to fixed characteristics such as race, ethnicity, or education but not due to changes in coverage, we fitted additional models that also allowed the effects of these fixed characteristics on health to vary by age and number of years older than 65 years. Third, using survey data on employment, job stress, and Social Security retirement benefits, we similarly adjusted for changes in health trends that might be related to retiring from high-stress or low-stress jobs or receiving Social Security income between ages 62 and 68 years. In addition, we excluded those who retired between ages 62 and 68 years and reestimated effects of Medicare coverage at age 65 years. Fourth, because the effects of gaining coverage on health trends may be most marked during the first several years of Medicare eligibility, we restricted the study period to ages 55 to 70 years.

All analyses were adjusted for the complex survey design[47] and repeated measures using SAS statistical software, version 9.1 (SAS Institute Inc, Cary, North Carolina).

RESULTS

Of the 9760 participants interviewed in 1992, we excluded 2527 (25.9%) who were too young in 1992 to reach age 65 years by 2004. Of the remaining 7233 participants, 5006 (69.2%) reported continuous coverage and 2227 (30.8%) reported being uninsured in at least 1 survey between ages 55 and 64 years and for more than half the surveyed years on average. Insured and uninsured adults differed significantly in many characteristics in 1992 (Table 1). Uninsured and insured adults were similarly likely to die by 2004 (14.8% vs 13.9%; $P=.25$), and uninsured adults were less likely to drop out of the study (12.8% vs 16.0%; $P=.001$).

Among 5766 adults (79.7%) who completed at least 1 survey after age 65 years, previously uninsured adults were less likely to report coverage for prescribed medications after age 65 years (62.7% vs 77.9%; $P<.001$). Among the study cohort, 4443 adults (61.4%) reported diagnoses of hypertension, heart disease, stroke, or diabetes before age 65 years, of whom 3103 (69.8%) were insured and 1340 (30.2%) were uninsured. Among 838 adults with diabetes in our study cohort who were also surveyed in 2003, 541 (64.6%) underwent HbA_{1c} testing.

Before age 65 years, summary health scores worsened at a greater rate for uninsured adults than for insured adults (mean annual trend, –0.23 vs –0.15; $P=.002$) and were significantly worse at age 65 years (mean score, 20.75 vs 22.29; $P<.001$) (Table 2). After age 65 years, however, this adverse trend differentially improved for previously uninsured adults (differential change in annual trend, +0.20; $P=.002$) such that summary scores after age 65 years indicated near maintenance of health for previously uninsured adults but continued deterioration for previously insured adults (mean annual trend after age 65 years, –0.07 vs –0.19; $P=.049$ [test not shown]). In comparisons of component health trends before and after age 65 years, previously uninsured adults reported significant improvements relative to previously insured adults in change in general health, agility, and depressive symptoms (Table 2). Persistently uninsured adults reported greater declines before age 65 years than intermittently uninsured adults and worse summary health scores at age 65 years (mean difference, –0.69; $P=.07$ [data not shown]), but changes in health trends after age 65 years were similar for these 2 groups of previously uninsured adults ($P=.81$).

Differential improvements in health trends after age 65 years were concentrated among previously uninsured adults with cardiovascular disease or diabetes. Among adults with these conditions, summary health scores decreased more rapidly for uninsured adults than insured adults before age 65 years, but this trend differentially improved after age 65 years for previously uninsured adults (Table 2). By age 70 years, therefore, the observed difference in summary health scores between previously uninsured and in-

sured adults was 50% of the difference expected if no differential change in trend had occurred (FIGURE, A). Among adults with these conditions who responded to at least 1 survey after age 65 years, differential improvements in health trends were concentrated among previously uninsured adults with prescription drug coverage after age 65 years (differential change in annual summary health trend, +0.24 [*P*=.01] with coverage vs +0.07 [*P*=.71] without coverage).

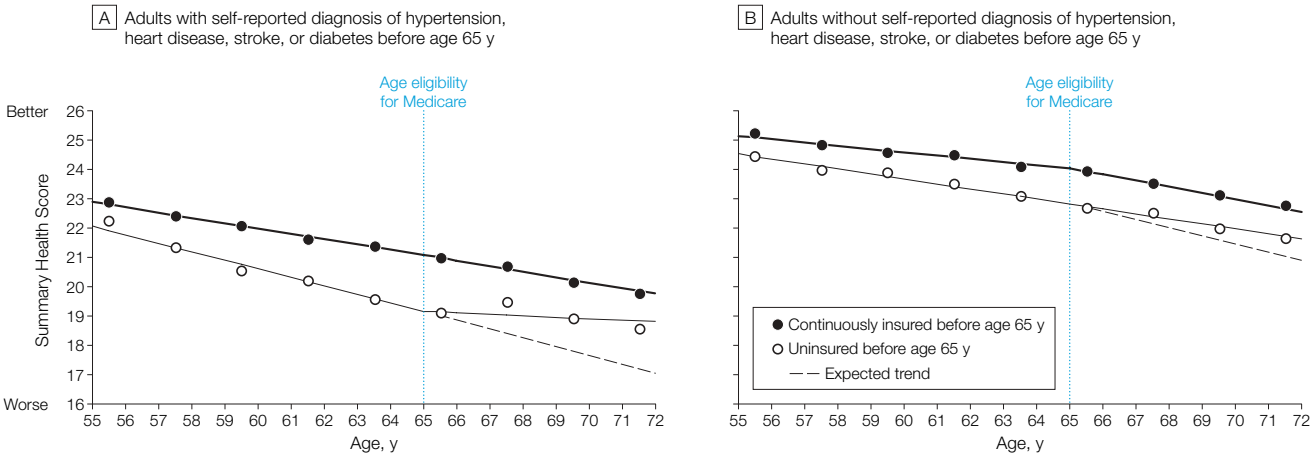
After age 65 years, previously uninsured adults with cardiovascular disease or diabetes also reported differential improvements in component health trends compared with previously insured adults, including relative gains in change in general health, mobility, and agility (Table 2). In contrast, previously uninsured adults without these conditions did not report a relative improvement in trend after age 65 years for any summary or component health measure except depressive symptoms when compared with previously insured adults (Table 2 and Figure, B).

Similarly, trends in adverse cardiovascular outcomes differentially improved for previously uninsured adults after age 65 years, as myocardial infarctions, severe angina, and hospitalizations for heart failure occurred with decreasing frequency relative to previously insured adults. These relative improvements were also concentrated among previously uninsured adults with cardiovascular disease or diabetes (TABLE 3).

Among adults with diabetes in 2003, mean HbA_{1c} levels were higher for uninsured adults (n=63) than insured adults (n=142) younger than 65 years (7.7% vs 7.2%; *P*=.05) but similar for previously uninsured (n=90) and previously insured (n=246) adults aged 65 years or older (7.2% vs 7.1%; *P*=.42).

Results from sensitivity analyses were consistent with our main findings. Estimates without adjustment for nonresponse were similar to reported estimates that were weighted for nonresponse due to death and dropout. When deceased participants were assigned extremely poor health scores, differential changes in health trends for previously uninsured adults were reduced but remained statistically significant for the full cohort and those with cardiovascular disease or diabetes. After excluding participants with Medicare or Medicaid coverage at baseline or before age 57 years, the results were essentially unchanged. Similarly, controlling for varying health trends by race, ethnicity, and education before and after age 65 years did not appreciably alter estimates of coverage effects. Between ages 62 and 68 years, previously uninsured and insured adults retired (18.5% vs 17.1%; *P*=.11) and began receiving Social Security retirement benefits (61.9% vs 63.6%; *P*=.17) at similar rates. After excluding those who retired between ages 62 and 68 years, the differential improvement in summary health trend for previously uninsured adults with cardiovascular disease or diabetes was 23% greater than the estimate reported in Table 2. In models adjusting for these coincidental events, neither retiring from high-stress or low-stress jobs nor receiving Social Security benefits substantially changed health trends, and effects of interest were unaltered. Finally, differential changes in summary health trends for previously uninsured adults with and without cardiovascular disease or diabetes were 17% to 21% greater when the study period was restricted to ages 55 to 70 years.

Figure. Summary Health Trends by Health Insurance Coverage Prior to Age 65 Years and History of Cardiovascular Disease or Diabetes



Mean summary health scores, adjusted for survey design and nonresponse, are plotted by age and prior coverage for adults with (A) and without (B) a self-reported diagnosis of hypertension, heart disease, stroke, or diabetes before age 65 years. The range of values for the summary health score is 0 (worst) to 30 (best). The regression model was fit to yearly age intervals from age 55 years through 72 years; data markers indicate observed means for each 2-year age interval. Solid lines represent observed health trends before and after age 65 years, as predicted by regression coefficients (Table 2), and the dashed line represents the expected trend for previously uninsured adults if no differential change in trend had occurred after age 65 years (if $\beta_5=0$ [Table 2]). Relative to previously insured adults, acquiring Medicare coverage at age 65 years was associated with significant improvement in health trend for previously uninsured adults with cardiovascular disease or diabetes (*P*=.006 for observed vs expected trend) but not for previously uninsured adults without these conditions (*P*=.17).

COMMENT

In this nationally representative longitudinal study, eligibility for Medicare coverage at age 65 years was associated with significant improvements in self-reported health trends for previously uninsured adults relative to previously insured adults. Our study builds on prior studies of uninsured adults by using a quasi-experimental design and longitudinal data to estimate effects of health insurance coverage more robustly. Using a comprehensive set of self-reported health measures, our study extends prior analyses[24-27] by providing compelling evidence of the benefits of Medicare coverage on a range of health outcomes for previously uninsured adults. Whereas another recent study demonstrated short-term adverse health effects of lacking insurance among nonelderly individuals with newly diagnosed chronic conditions,[48] our findings suggest long-term benefits of gaining insurance on the health of previously uninsured Medicare beneficiaries, particularly those with cardiovascular disease or diabetes.

Among adults with these conditions, health declined at a much faster rate for uninsured adults than insured adults before age 65 years, but this trend changed at age 65 years so that by age 70 years, predicted health differences between previously uninsured and insured adults were reduced by half. Proper management of blood pressure, glucose, and cholesterol substantially reduces morbidity and mortality for adults with these conditions,[36-44] and expanded use of effective treatments may produce considerable benefits for underserved populations.[49-53] Having prescription drug coverage after age 65 years was associated with particularly improved health trends for adults with cardiovascular disease or diabetes, suggesting greater benefits of Medicare coverage for previously uninsured adults now eligible for Medicare prescription drug coverage.[54] Furthermore, for every 10 previously uninsured adults with cardiovascular disease or diabetes before age 65 years, one less adverse cardiovascular outcome was reported between ages 65 and 72 years than expected if no differential improvement in trend had occurred. We previously found that acquiring Medicare coverage was associated with greater increases in physician visits for previously uninsured adults with these conditions.[5] Thus, improvements in health trends may have been mediated in part through expanded access to ambulatory care and effective medications for primary and secondary prevention of coronary heart disease and congestive heart failure.

Our analysis used health trends before age 65 years to predict trends after age 65 years that would be expected for previously uninsured and insured adults in the absence of Medicare coverage if differences in observable and unobservable characteristics between these groups and the effects of these characteristics on health trends remained constant. Therefore, comparisons between insurance groups before and after age 65 years identified changes in health trends for previously uninsured adults that would not be expected from aging or other events that occurred similarly in both groups. Nonetheless, these estimated health effects of gaining Medicare coverage could be biased if time-varying factors affecting health other than insurance also differentially changed between insured and uninsured adults at age 65 years. However, concurrent retirement from high-stress or low-stress jobs and receipt of Social Security retire-

Table 3. Differential Changes in Trends in Adverse Cardiovascular Outcomes After Age 65 Years for Previously Uninsured Adults Relative to Previously Insured Adults[a]

	Entire Cohort (n = 7233)		Cardiovascular Disease or Diabetes Before Age 65 y (n = 4443)		No Cardiovascular Disease or Diabetes Before Age 65 y (n = 2790)	
Adverse Cardiovascular Outcomes (Range, 0-3)[b]	β (SE)	*P* Value	β (SE)	*P* Value	β (SE)	*P* Value
Model coefficients with interpretation						
Intercept (β_0): mean for insured at age 65 y	0.071 (0.006)	<.001	0.115 (0.009)	<.001	0.002 (0.002)	.22
Uninsured (β_1): mean difference relative to insured at age 65 y	0.021 (0.009)	.02	0.038 (0.016)	.02	0.007 (0.004)	.11
Age (β_2): trend for insured before age 65 y	0.001 (0.001)	.17	0.002 (0.001)	.11	0.000 (0.000)	.79
Uninsured × age interaction (β_3): difference in trend relative to insured before age 65 y	0.003 (0.001)	.01	0.006 (0.002)	.01	0.001 (0.001)	.29
Years older than 65 y (β_4): change in trend for insured after age 65 y	0.002 (0.002)	.26	0.001 (0.003)	.84	0.006 (0.001)	<.001
Uninsured × years older than 65 y interaction (β_5): differential change in trend relative to insured after age 65 y	−0.009 (0.003)	.009	−0.014 (0.006)	.02	−0.002 (0.003)	.52
Adjusted uninsured × years older than 65 y interaction (β_5): adjusted differential change in trend[c]	−0.009 (0.003)	.006	−0.015 (0.006)	.02	−0.002 (0.003)	.52

[a] Previously uninsured adults include those who were persistently or intermittently uninsured before age 65 years. All estimates have been adjusted for the complex design of the survey and for nonresponse due to dropout or death. Age has been centered at 65 years so that the intercept represents the mean number of adverse cardiovascular outcomes for previously insured adults at age 65 years. Lower scores indicate better health for the measure of adverse cardiovascular outcomes. Trends are reported as changes in health scores per year.
[b] Cardiovascular outcomes are based on participants' biennial reports of myocardial infarction, angina that limited usual activities, or hospitalization for congestive heart failure.
[c] Adjusted for all characteristics listed in Table 1.

ment benefits did not explain our findings. Moreover, a recent study of British civil servants found that trends in self-reported physical and mental health continued to diverge after age 65 years for different social classes in the absence of differential coverage gains at age 65 years.[55]

Our study had several limitations. Different rates of death or dropout due to health differences between insurance groups could explain some of our findings. However, neither adjusting for nonresponse predicted by antecedent health nor assigning extreme values to observations censored by death negated our principal findings.

Our study relied on self-reported health measures rather than data from medical records. Although our measure of adverse cardiovascular outcomes summarized related items selected for their face validity, this scale has not been formally evaluated as a measure of cardiovascular disease severity. However, other self-assessments included in our study have been validated across diverse populations, including adults with hypertension, diabetes, congestive heart failure, coronary heart disease, and depression, and these measures accurately distinguish varying levels of disease severity and objectively measured functional status.[31,56-58] In particular, self-reported physical functioning correlates strongly with clinical complications of cardiovascular disease and diabetes, such as angina, dyspnea, neuropathy, visual impairment, myocardial infarction, and stroke.[58,59] Notably, we found consistently strong associations between acquisition of Medicare coverage and improved trends in self-reported physical functioning and cardiovascular outcomes for previously uninsured adults who had cardiovascular disease or diabetes before age 65 years. In a secondary cross-sectional analysis, Medicare coverage was also associated with improved glycemic control for previously uninsured adults with diabetes, consistent with a prior analysis of this measure.[29]

Self-reported measures of health may be subject to floor and ceiling effects, but these effects are typically negligible for multi-item health scales in population-based cohorts.[57] Furthermore, uninsured adults may have perceived their health to be good or stable before age 65 years if asymptomatic conditions remained undiagnosed until after age 65 years.[60] Such perceptions, however, would bias findings toward the null hypothesis and would be less likely to compromise reports of functional limitations.

Because health declines among uninsured adults may have increased demand for private health insurance or led to eligibility for public coverage before age 65 years, our analysis may understate the adverse health effects of uninsurance and the benefits of obtaining Medicare coverage. Moreover, because health differences between previously uninsured and insured adults after age 65 years remained much larger than at the outset of the study, universal coverage at an earlier age may have a greater impact than our estimates indicate.

Our findings have important policy implications. Proposals to extend insurance coverage to uninsured near-elderly adults have been introduced in the US Congress[61] and endorsed by the American College of Physicians.[62] Providing earlier health insurance coverage for uninsured adults, particularly those with cardiovascular disease or diabetes, may have considerable social and economic value for the United States by improving health outcomes.[5,63,64]

Author Contributions: Dr McWilliams had full access to all of the data in the study, performed all statistical analyses in close consultation with Drs Meara, Zaslavsky, and Ayanian, and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: McWilliams, Meara, Zaslavsky, Ayanian.
Acquisition of data: McWilliams.
Analysis and interpretation of data: McWilliams, Meara, Zaslavsky, Ayanian.
Drafting of the manuscript: McWilliams, Zaslavsky, Ayanian.
Critical revision of the manuscript for important intellectual content: McWilliams, Meara, Ayanian.
Statistical analysis: McWilliams, Meara, Zaslavsky, Ayanian.
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