

ORIGINAL ARTICLE

Medicare spending, managed care and pre-Medicare insurance coverage and associated risks of mortality, deterioration of self-rated health and mental health after four years of Medicare coverage

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Abstract

National spending on Medicare keeps growing and managed care is reimbursed differently in the United States. Health returns from Medicare spending are not certain. This study aims to quantify the effects of Medicare spending in the first two years of Medicare coverage, managed care and insurance coverage before Medicare (pre-Medicare) on mortality, mental health and self-rated health status after first four years of Medicare coverage. Individuals, who were interviewed from age 65 to 68 years, without Medicare coverage before age 65 years, were included. Health spending (out-of-pocket, OOP) in the first two years of Medicare coverage, their pre-Medicare characteristics and Medicare managed care were used to predict associated risks of mortality, self-rated health status and mental health (Center for Epidemiologic Studies-Depression, CESD scale). Eligible Medicare enrollees ($N = 3,503$) in the Health and Retirement Study from 1992 to 2011 were chosen. Total health spending was associated with higher likelihood of worse mental health and self-rated health, but OOP spending was associated with risks of health deterioration ($p < .05$ for all). More OOP health spending in the first two years of Medicare coverage was associated with slightly higher chance of more mental problems, but the magnitude of this association became smaller over time. Medicare managed care did not seem to be beneficial for mortality, mental health or self-rated health status. Expanding pre-Medicare health coverage (through the Affordable Care Act) may not influence health status after first four years of Medicare coverage. Preventing pre-Medicare health conditions may be the priority.

Key words

Medicare, Managed care, Health returns, Mortality, Health status, Mental health, CESD scale

1 Introduction

The purpose of Medicare's creation in 1965 was to provide universal health insurance for the elderly (age 65 years and over) and thus to improve their access to health services in the United States^[1]. Medicare includes four major Parts (A, B, C [Medicare Advantage] and D) that are reimbursed differently^[2]. The complex structure and older age distributions of Medicare enrollees lead to three major concerns. The first concern is that the sevenfold increase of national Medicare

spending since 1965^[3] may not be associated with more effective medical technology or interventions beneficial to health. Historically, returns from national health expenditures, such as extension of life expectancy^[4] or the estimated value of the deaths averted^[5, 6], were estimated to be high for decades, assuming the changes in life expectancy or deaths averted are the result of the application of advances in health technology that are closely associated with more health spending. However, there is evidence showing that current medical care is on the flat of the curve with little marginal benefits for health^[7]. The evidence for or against historically incremental health returns from spending does not address this issue under Medicare and can not answer whether spending over time is associated with health returns after certain years of coverage among Medicare enrollees age 65 years and over.

The second concern is unknown returns from different financing mechanisms under Medicare, because enrollees in Medicare Advantage plans (managed care plans) are better paid than those in the traditional fee-for-service (FFS) ones^[8]. Although there is evidence to show more welfare gain from Medicare managed care plans than traditional FFS plans^[9, 10], the evidence to demonstrate direct health returns (disease prevention or management) from Medicare spending for managed care or FFS enrollees may be largely biased by favorable selection issues among Medicare enrollees^[11]. It is necessary not only to adjust for the selection into managed care, but also to control for the effects of managed care on health and healthcare utilization^[12]. The third concern is that uninsured individuals may impose extra healthcare cost to Medicare when they become eligible for age (65 years). It has been found that individuals may shift their health care cost to Medicare^[13, 14], but it is not certain whether this behavior may induce health risks for them and lead to worse health outcomes after years of Medicare coverage because of the lack of the beneficial health effects of insurance for them^[15].

With longitudinal data sets, this study aims to investigate these three concerns by using (1) OOP health spending in the first two years of Medicare coverage, (2) the interaction term between spending and time these two (to measure the effects of health spending over time), (3) Medicare managed care coverage and (4) pre-Medicare health coverage to predict their effects on mortality, health status and mental health after four years of Medicare coverage.

2 Method

This study used longitudinal data set that helped to understand temporal relationship of predictors and health status changes, but attrition^[16] and death^[17] could bias this relationship over time. This study only adopted three health outcomes (mortality, self-rated health status, and mental health) within the first four years of Medicare coverage to limit the bias from attrition, while adjusting for other individual characteristics before Medicare.

2.1 Data

The longitudinal survey, the Health and Retirement Study (HRS), consisted of interviews that were implemented every two years from 1992 with the latest cohort enrolled in 2010 and provided information on health status, health care consumption and expenditures from individuals age 50 years and over^[18]. Because of the availability of information before and after individuals' health plan selection, the information from the HRS was ideal for this study that requires individual longitudinal information to address the health plan selection issue^[19-21].

According to the RAND HRS data documentation it was feasible to identify HRS participants with traditional FFS Medicare (the reference group), Medicare HMOs (health maintenance organization), dual eligibility with Medicare and Medicaid, and Medicare with employer-sponsored or retirement plans for the HRS participants age 65 years and over^[18]. Although the types of coverage under Medicare were identifiable, self-reported total health spending was not available in all years. Information on total health spending, including the medical bills paid by the third parties, was not asked after 2002. By contrast, self-reported out-of-pocket medical expenses were available from 1992 to 2010^[22]. Goldman, Zissimopoulos and Lu found that out-of-pocket spending in the HRS was consistent with the statistics in the Medical Expenditure Panel Survey (MEPS) and Medicare Current Beneficiary Survey (MCBS), but the total health spending

surveyed before 2002 in HRS was overstated, compared to the results in MEPS and MCBS^[23]. Since the data on total medical expenses was limited and imprecise, total health spending was not used for analysis.

2.2 Selection of eligible Medicare enrollees

There were four major stages to select eligible Medicare enrollees from HRS participants. First, the individuals whose characteristics were observed only after age 65 years were excluded, because their health status before Medicare (pre-Medicare health status) and their selection behavior were unknown. Of all 36,986 HRS participants from 1996 to 2011, the number of HRS observations with pre-Medicare information (individual information before Medicare coverage) was a seventh of the number of total participants – 5,457.

Second, the individuals aged less than 65 years covered with Medicare for reasons other than age were not taken into consideration because they were more likely to have specific diseases or conditions (such as end-stage renal disease) and maintain Medicare coverage after age 65^[24]. Therefore they were treated as outliers that might bias the results away from null. The requirement of enrolling those without Medicare coverage before age 65 years further restricted the sample size to 4,666 individuals. Third, individuals had to be interviewed twice (four years of observation) after obtaining Medicare coverage. Individuals enrolled in the HRS after 2008 were excluded because they were only observed from 2008 to 2011, less than the desired length in this study (four years from age 65 to 68 years). Finally, observations with missing data in other independent variables and health plan transition during Medicare were excluded. The sample singular sizes were 3,503 in OOP spending models.

This number of observations was still more than the minimal number required for multivariable modeling according to the method proposed by Long^[25], as Peduzzi *et al.* had simulation that indicated that ten or more observations in a single variable would not lead to problematic logit results^[26].

2.3 Health and functional status

Health outcomes included mortality, mental health and self-rated health after four years of Medicare coverage. In the HRS, health indicators were grouped into health status and its change, health conditions (hypertension, heart disease, stroke, psychiatric problems and arthritis), activities of daily living (ADL), other functional limits (difficulties in IADLs [Instrumental Activities of Daily Living] and mobility), health behaviors, physicians' diagnosis, and mental health (CESD scale)^[18]. Mortality was also recorded with an exit survey^[18]. This study adopted two of frequently used indicators, (1) mortality, (2) mental health, to assess the return from health spending^[5] and (3) self-assessed health status was also used as the other outcome in this analysis. Pre-Medicare health and functional status (numbers of difficulties in ADL, IADL and mobility, from zero to five) were used to predict the health outcomes after four years of Medicare coverage.

The total or out-of-pocket spending on health care in the first two years of Medicare coverage (equivalent to 65 to 66 years of age of Medicare enrollees) was summed to determine its influence on health outcomes. The changes in the effects of health spending on health outcomes over time were captured by the interaction terms between spending and birth cohorts (from 1928 to 1942, eligible for Medicare due to age between 1993 to 2007).

For the health coverage after age 65 years, Medicare managed care coverage was the alternative to traditional FFS Medicare coverage because of the limited sample size and data gathering in HRS datasets that could not reflect the diverse choices of Medicare supplement private coverage, for example, more than nine types of Medigap plans for the Medicare enrollees^[27]. The other advantage of grouping the Medicare coverage into these two major categories was its similarity to the approach introduced by the Centers for Medicare & Medicaid Services (CMS)^[28] that guides the public to choose their own Medicare plans.

Functional forms

The likelihood of mortality was estimated using binary logit models. Self-rated health status (categorical variable; either excellent, very good, good, fair, or poor) after four years of Medicare coverage was estimated using ordered logit regression models to control for other covariates and to evaluate the effects of spending on health care and health status. Mental health measured with the CESD scale that was rated by eight indicators with scores ranging from 0 to 8^[18] was assessed by ordered logit regression to control for other factors. OOP health spending (health care expenditure incurred after individuals were covered in the first two years of Medicare coverage [equivalent to Medicare enrollees' age from 65 to 66 years]) was denoted by Spending in the following equations. The birth cohorts, denoted by Cohort, could influence the exposure to medical technology and other health determinants^[29, 30]. The interaction term between spending and birth cohorts (Spending $\times$ Cohort) could test the hypothesis, whether spending in more recent years could be associated with better health outcomes. The notation 65-66 or 65-68 in the equations was used to indicate the first two or four years of Medicare coverage (equivalent to Medicare enrollees' 65 to 66 or 65 to 68 years of age). The models were specified as:

$$\ln(\text{odds of Outcomes}_{i(68)}) = \beta_0 + \beta_1 X_{ij} + \beta_2 HC_{i(65-68)} + \beta_3 \text{Spending}_{i(65-66)} + \beta_4 \text{Cohort}_i + \beta_5 (\text{Spending}_{i(65-66)} \times \text{Cohort}_i) + \varepsilon \quad (1)$$

Individual health outcomes, $Outcome_{i(68)}$, and individual health coverage from age 65 to 68 years, $HC_{(65-68)}$, are the other two important predictors. Individuals' characteristics before being covered by Medicare, X_{ij} , included not only their demographic (gender, race and ethnicity), socioeconomic (income before Medicare and education), health (general health and mental health [in CESD scale]), and functional status (difficulties in ADL, IADL and mobility), but also their pre-Medicare health coverage and chronic conditions (hypertension). The pre-Medicare health coverage documented in HRS datasets included Medicaid, Champus/VA coverage, and private plans purchased by the enrollees themselves or their spouses, as those covered by Medicare before age 65 years were excluded. Because of the multilevel structure of longitudinal data, multilevel analysis was applicable^[31] and generalized linear mixed model was one of the candidate models^[32]. Generalized linear mixed model was selected for its support for both logit and ordered logit models to accommodate binary and ordinal outcomes evaluated in this study^[33]. The STATA user-defined procedure, gllamm, was used^[33, 34]. The results were presented as ORs with 95% confidence intervals (95% CI). Odds ratios greater than one suggested higher likelihoods of mortality, health deterioration or mental problem. Odds ratios less than one suggested lower likelihoods. The statistical package used to execute the regression models was STATA 11 (STATA Corp, Texas).

The HRS is sponsored by the National Institute on Aging (grant number NIA U01AG009740) and is conducted by the University of Michigan^[22]. This study adopted a data set open for the public and was not required for ethics review, determined by the review board of the University of Medicine and Dentistry of New Jersey in January 2012.

3 Results

In Table 1, there are 3,181 individuals surviving after four years of Medicare coverage and 322 deceased ones (3,503 in total). Those survivors who were more likely to enroll in managed care coverage, be female, have more years of education, earn more income, less mental problems (lower CESD scores), and be free of hypertension ($p < .05$ for all). The survivors were less likely to have Medicaid coverage before 65 years of age ($p < .001$). These two groups also had significantly different distribution in the categories of general health and difficulties in ADL, IADL and mobility ($p < .05$ for all).

3.1 Health outcome one: mortality after the first four years of Medicare coverage

In Table 2, the OOP health expenditure model ($N = 3,503$) was statistically significant ($p < .001$). Medicare managed care coverage was insignificant regarding mortality risks after the first four years of Medicare coverage (Odds Ratios, OR = 0.92, 95% CI = 0.52 to 1.63, $p = .77$). The OOP health expenditure in the first two years of Medicare coverage was insignificant regarding the likelihood of mortality after four years of Medicare coverage (OR = 1.00 per \$1000, 95% CI =

0.95 to 1.06, $p = .99$). Later birth cohorts were not significantly associated with survival advantage (OR = 0.63, 95% CI = 0.39 to 1.00, $p = .05$). The interaction terms of birth cohorts and spending were not significant ($p = 0.70$). The survival advantage of females was confirmed in the OOP model (OR = 0.22, 95CI = 0.05 to 0.98, $p < .05$). Health status, pre-Medicare income and health coverage, divorce or widowhood and pre-Medicare functional status were not significant regarding mortality risk ($p > .05$ for all).

Table 1. Characteristics of those survivors and the deceased covered after the first four years of Medicare coverage (N = 3,503)

	Surviving individuals (N = 3,181, 90.81%)		Deceased individuals (N = 322, 9.19%)		P
	Mean (SD) or N (%)		Mean (SD) or N (%)		
Medicare coverage and spending					
Out-of-pocket spending*	2.76	(7.49)	3.47	(9.58)	.14
Medicare managed care (%)	2287	(71.9%)	106	(32.9%)	< .001
Individual characteristics before Medicare (Pre-Medicare)					
Birth year (1928 to 1945)*	1937.15	(3.98)	1933.17	(2.83)	< .001
Pre-Medicare Insurance (%)					
Medicaid	101	(3.2%)	27	(8.4%)	< .001
Champus/VA	194	(6.1%)	16	(5.0%)	.42
Private insurance (from self)	1498	(47.1%)	138	(42.9%)	.15
Private insurance (from spouse)	694	(21.8%)	54	(16.8%)	.04
Female (%)	1870	(58.8%)	126	(39.1%)	< .001
Race (%)					.01
White	2676	(84.1%)	259	(80.4%)	
Black	429	(13.5%)	60	(18.6%)	
Other	76	(2.4%)	3	(0.9%)	
Hispanic (%)	267	(8.4%)	23	(7.1%)	.44
Regions (%)					.26
Northeast	520	(16.3%)	45	(14.0%)	
Midwest	838	(26.3%)	89	(27.6%)	
South	1282	(40.3%)	143	(44.4%)	
West	541	(17.0%)	45	(14.0%)	
Years of education*	12.59	(2.99)	11.56	(3.16)	< .001
Income (\$1,000)/year*	13.72	(29.38)	8.57	(24.07)	< .01
Self-rated health status (%)					< .001
Excellent	470	(14.8%)	15	(4.7%)	
Very good	1094	(34.4%)	65	(20.2%)	
Good	1034	(32.5%)	119	(37.0%)	
Fair	473	(14.9%)	78	(24.2%)	
Poor	110	(3.5%)	45	(14.0%)	
CESD score (0 to 8)*	1.16	(1.77)	1.68	(2.04)	< .001
Difficulty in ADL (0 to 5) (%)					< .001
0	2951	(92.8%)	265	(82.3%)	
1	149	(4.7%)	27	(8.4%)	
2	38	(1.2%)	15	(4.7%)	
3	22	(0.7%)	6	(1.9%)	
4-5	21	(0.7%)	9	(2.8%)	

(Table continued on page 25)

Table 1. (continued.)

	Surviving individuals (N = 3,181, 90.81%)		Deceased individuals (N = 322, 9.19%)		P
	Mean (SD) or N (%)		Mean (SD) or N (%)		
Difficulty in IADL (0 to 5) (%)					< .01
0	3097	(97.4%)	303	(94.1%)	
1	71	(2.2%)	14	(4.3%)	
2-3	13	(0.4%)	5	(1.6%)	
Difficulty in mobility (0 to 5) (%)					< .001
0	1993	(62.7%)	157	(48.8%)	
1	648	(20.4%)	62	(19.3%)	
2	292	(9.2%)	51	(15.8%)	
3	127	(4.0%)	18	(5.6%)	
4	86	(2.7%)	21	(6.5%)	
5	35	(1.1%)	13	(4.0%)	
Marital status (%)					.29
Married/partnered	2371	(74.5%)	226	(70.2%)	
Separated/Divorced	358	(11.3%)	47	(14.6%)	
Widowed	348	(10.9%)	38	(11.8%)	
Never married	104	(3.3%)	11	(3.4%)	
Hypertension (%)	1450	(45.6%)	174	(54.0%)	< .001

Note. SD: standard deviation. The *p* values for continuous outcomes were obtained through *t* tests (*) and those for categorical outcomes were through Chi-square tests. The out-of-pocket spending was the amount of money spent on health care after in the first two years of Medicare coverage.

Table 2. Odds ratios of mortality among Medicare enrollees for the first four years of Medicare coverage (N = 3,503)

	Odds Ratios	(95% CI)	P
Medicare coverage and spending			
Medicare managed care coverage	0.92	(0.52 to 1.63)	.77
Spending (per \$1,000)	1.00	(0.95 to 1.06)	.99
Pre-Medicare characteristics			
Insurance			
Uninsured	(reference)		
Medicaid	1.79	(0.60 to 5.38)	.30
Champus/VA	0.69	(0.25 to 1.88)	.46
Private insurance (from self)	0.71	(0.41 to 1.24)	.23
Private insurance (from spouse)	0.82	(0.45 to 1.50)	.52
Birth year (1928 as reference)	0.63	(0.39 to 1.00)	.05
Interaction term			
Birth year & Spending	1.00	(0.99 to 1.01)	.70
Female	0.22	(0.05 to 0.98)	< .05
Races			
White	(reference)		
Black	1.11	(0.62 to 2.00)	.73
Other	0.26	(0.03 to 2.67)	.26
Hispanic	0.54	(0.21 to 1.38)	.20

(Table continued on page 26)

Table 2. (continued.)

	Odds Ratios	(95% CI)	P
Regions			
Northeast	(reference)		
Midwest	1.39	(0.68 to 2.87)	.37
South	1.26	(0.67 to 2.39)	.47
West	1.34	(0.62 to 2.93)	.46
Years of education	0.97	(0.89 to 1.05)	.43
Income (per \$1,000)	1.00	(0.99 to 1.00)	.35
Self-rated health status			
Excellent	(reference)		
Very good	3.09	(0.72 to 13.27)	.13
Good	7.87	(0.85 to 73.04)	.07
Fair	9.91	(0.82 to 119.67)	.07
Poor	29.29	(0.73 to 1171.75)	.07
CESD score (0 to 8)	1.01	(0.90 to 1.14)	.84
Difficulty in ADL (0 to 5)			
0	(reference)		
1	0.97	(0.42 to 2.22)	.94
2	2.46	(0.48 to 12.53)	.28
3	0.82	(0.12 to 5.53)	.84
4-5	2.20	(0.32 to 15.26)	.42
Difficulty in IADL (0 to 5)			
0	(reference)		
1	0.60	(0.17 to 2.05)	.41
2-3	0.94	(0.10 to 9.20)	.96
Marital status			
Married/partnered	(reference)		
Separated/Divorced	2.08	(0.80 to 5.41)	.14
Widowed	1.57	(0.70 to 3.49)	.27
Never married	1.15	(0.38 to 3.48)	.80
Difficulty in mobility (0 to 5)			
0	(reference)		
1	1.38	(0.75 to 2.54)	.31
2	2.82	(0.89 to 8.91)	.08
3	1.18	(0.42 to 3.30)	.76
4	2.02	(0.56 to 7.32)	.28
5	1.99	(0.32 to 12.43)	.46
Hypertension	1.52	(0.88 to 2.64)	.13

3.2 Health outcome two: mental health (CESD scale) deterioration

In Table 3, Medicare managed care coverage is not significantly associated with less mental problems ($OR = 0.90, p = .37$). OOP spending was associated with worsening of mental health ($OR = 1.06, p < .01$). Later birth cohorts were not associated with mental health change ($OR = 1.00, p = .82$). However, the effects of spending remained significant over time (significant interaction terms, $p = .03$). Those with more years of education were less likely to have mental health worsening ($OR = 0.94, p < .001$). However, blacks, worse health status, more mental problems before 65 years of age, difficulties in mobility and hypertension were associated with risks of mental health worsening ($p < .05$ for all).

Table 3. Odds ratios of having one more score over the CESD scale (0 to 8) among Medicare enrollees after the first four years of Medicare coverage (N = 2,965)

	Odds Ratios	(95% CI)	P
Medicare coverage and spending			
Medicare managed care coverage	0.90	(0.73 to 1.13)	.37
Spending (per \$1,000)	1.06	(1.03 to 1.10)	< .01
Pre-Medicare characteristics			
Insurance			
Uninsured	(reference)		
Medicaid	1.57	(1.02 to 2.43)	.04
Champus/VA	1.44	(1.07 to 1.94)	.02
Private insurance (from self)	0.93	(0.78 to 1.10)	.40
Private insurance (from spouse)	1.07	(0.88 to 1.31)	.47
Birth year (1928 as reference)	1.00	(0.97 to 1.03)	.82
Interaction term			
Birth year & Spending	0.99	(0.99 to 1.00)	.03
Female	0.87	(0.75 to 1.02)	.08
Races			
White	(reference)		
Black	1.25	(1.01 to 1.55)	.04
Other	0.97	(0.61 to 1.55)	.91
Hispanic	1.29	(0.95 to 1.74)	.10
Regions			
Northeast	(reference)		
Midwest	0.95	(0.77 to 1.18)	.66
South	1.06	(0.86 to 1.30)	.58
West	1.00	(0.78 to 1.27)	.99
Years of education	0.94	(0.92 to 0.97)	< .001
Income (per \$1,000)	1.00	(1.00 to 1.00)	.43
Self-rated health status			
Excellent	(reference)		
Very good	3.54	(2.80 to 4.47)	< .001
Good	12.42	(9.61 to 16.03)	< .001
Fair	57.72	(41.52 to 80.23)	< .001
Poor	145.90	(86.71 to 245.51)	< .001
CESD score (0 to 8)	1.10	(1.05 to 1.15)	< .001
Difficulty in ADL (0 to 5)			
0	(reference)		
1	0.97	(0.68 to 1.38)	.86
2	0.99	(0.52 to 1.92)	.99
3	0.72	(0.28 to	.49
4-5	0.76	(0.26 to 2.24)	.61
Difficulty in IADL (0 to 5)			
0	(reference)		
1	1.60	(0.99 to 2.60)	.06
2-3	1.49	(0.42 to 5.28)	.54

(Table continued on page 28)

Table 3. (continued.)

	Odds Ratios	(95% CI)	P
Marital status			
Married/partnered	(reference)		
Separated/Divorced	1.22	(0.97 to 1.54)	.10
Widowed	1.24	(0.98 to 1.57)	.07
Never married	1.27	(0.85 to 1.91)	.24
Difficulty in mobility (0 to 5)			
0	(reference)		
1	1.42	(1.19 to 1.71)	< .001
2	1.73	(1.34 to 2.24)	< .001
3	1.13	(0.76 to 1.68)	.55
4	1.90	(1.18 to 3.08)	< .01
5	4.03	(1.69 to 9.60)	< .01
Hypertension	1.35	(1.17 to 1.56)	< .001

Note. CESD = Center for Epidemiologic Studies Depression.

3.3 Health outcome three: self-rated health worsening

In Table 4, Medicare managed care coverage is not significantly associated with general health worsening (OR = 0.97, $p = .83$). Later birth cohorts were less likely to have health deterioration (OR = 0.96, $p = .02$). OOP spending in the first two years of Medicare coverage were associated with health worsening (OR = 1.01, $p = .39$) and this association was not significant over time (interaction terms: OR = 1.00, $p = .67$). Females, worse health status, more mental problems and difficulties in mobility before Medicare coverage were significantly associated with health status deterioration (OR > 1.00, $p < .05$ for all). More years of education were related to lower risks of health deterioration ($p < .001$).

Table 4. Odds ratios of having worse health status among Medicare enrollees after the first four years of Medicare coverage (N = 2,965)

	Odds Ratios	(95% CI)	P
Medicare coverage and spending			
Medicare managed care coverage	0.97	(0.77 to 1.23)	.83
Spending (per \$1,000)	1.01	(0.98 to 1.04)	.39
Pre-Medicare characteristics			
Insurance			
Uninsured	(reference)		
Medicaid	1.27	(0.85 to 1.90)	.25
Champus/VA	1.12	(0.81 to 1.54)	.49
Private insurance (from self)	1.03	(0.86 to 1.23)	.72
Private insurance (from spouse)	1.09	(0.89 to 1.34)	.41
Birth year (1928 as reference)	0.96	(0.93 to 0.99)	.02
Interaction term			
Birth year & Spending	1.00	(1.00 to 1.00)	.67
Female	1.21	(1.03 to 1.42)	.02
Races			
White	(reference)		
Black	1.20	(0.97 to 1.48)	.09
Other	0.70	(0.42 to 1.14)	.15

(Table continued on page 29)

Table 4. (continued.)

	Odds Ratios	(95% CI)	P
Hispanic	0.91	(0.67 to 1.23)	.52
Regions			
Northeast	(reference)		
Midwest	1.06	(0.85 to 1.33)	.60
South	1.14	(0.92 to 1.42)	.22
West	1.02	(0.79 to 1.33)	.86
Years of education	0.93	(0.91 to 0.96)	< .001
Income (per \$1,000)	1.00	(0.99 to 1.00)	.07
Self-rated health status			
Excellent	(reference)		
Very good	1.16	(0.90 to 1.48)	.25
Good	1.53	(1.19 to 1.98)	< .01
Fair	1.88	(1.39 to 2.54)	< .001
Poor	1.75	(1.10 to 2.80)	.02
CESD score (0 to 8)	1.55	(1.48 to 1.62)	< .001
Difficulty in ADL (0 to 5)			
0	(reference)		
1	1.16	(0.83 to 1.63)	.39
2	1.40	(0.77 to 2.55)	.27
3	1.49	(0.64 to 3.49)	.36
4-5	1.37	(0.55 to 3.41)	.49
Difficulty in IADL (0 to 5)			
0	(reference)		
1	0.88	(0.55 to 1.42)	.61
2-3	2.50	(0.87 to 7.22)	.09
Marital status			
Married/partnered	(reference)		
Separated/Divorced	1.19	(0.94 to 1.51)	.14
Widowed	0.98	(0.77 to 1.24)	.86
Never married	0.82	(0.54 to 1.25)	.35
Difficulty in mobility (0 to 5)			
0	(reference)		
1	1.37	(1.14 to 1.66)	< .01
2	1.79	(1.39 to 2.31)	< .001
3	1.28	(0.88 to 1.86)	.20
4	2.20	(1.40 to 3.44)	< .01
5	1.77	(0.82 to 3.81)	.15
Hypertension	1.08	(0.93 to 1.25)	.33

4 Discussion

4.1 Health outcome three: self-rated health worsening

More OOP health spending in the first two years of Medicare coverage is associated with negative health outcomes (more mental health problems) after first four years of Medicare coverage. This implies the need to assess the effectiveness of Medicare spending that is partly sponsored by the general revenue. After establishing a value rating mechanism, an essential step would be to make patients aware and able to pay for the value.

This so-called value-oriented approach involves multiple players. Insurers (CMS in this case) need to assess and judge clinical values of comparable treatments^[35]. Physicians should be able to obtain and provide high-priority services to their patients so that patients could pay for the value they get from health care (for example, value-based cost sharing)^[36]. However, one problem is that this process requires an integrated health care systems and well-coordinated medical service delivery to help the informed patients to pay for the values.

The other issues for adopting this value-oriented approach is that we have to define the length of observation and the dimensions of health that we would like to evaluate. The challenge is information availability. In this study, the length of observation was determined based on the data availability and the concern regarding sample attrition. In addition to missing data and lack of follow-up, the datasets from the HRS also suffered from major changes in the questionnaires and many of the observations were excluded for the inconsistency. The same limitation applied to the outcomes in this study that are three of the best-reported health indicators in the HRS. To better formulate an analysis of the relationship between health care intensity and outcomes, data availability may limit the lengths of follow-up, the numbers of outcomes or treatments that we can use for analysis.

4.2 Medicare spending and its effects on health over time

Results shows spending in more recent years (interaction terms of birth cohorts and spending) may be associated with less mental problems in Table 3, but more OOP spending in the first two years is associated with more mental problems. Although the magnitude of the interaction term may be small (OR = 0.99) and the periods of analysis short (birth years from 1928 to 1942 or Medicare eligibility years from 1993 to 2007) compared to the history of Medicare (created in 1965), this finding partly helps to justify the Medicare spending growth over time because of the better outcomes in recent years.

The results leave two questions unanswered. First, we are not sure about the mechanisms of better health outcomes in this period. Spending growth in the US is mostly led by the introduction of medical technology^[6] and later cohorts are more likely to enjoy the benefits of latest technology or improvement in health care, but there are other reasons that later cohorts can enjoy better health, such as better prenatal and postnatal care^[37, 38] and beneficial interaction between physical health and environment^[39]. The second issue is that we are not sure about how to justify spending growth according to the potential health benefits even if we can accurately quantify the share of health benefits attributable to spending growth. The human capital model only predicts that the attrition of health due to age lead to more spending on health in order to decrease the rate of health attrition or deterioration^[40], but it does not provide a model to assess how much should be invested in exchange of lower rates of health attrition.

4.3 Medicare managed care and health

Medicare managed care coverage is not associated with better health outcomes. This is important for policies regarding Medicare managed care and does not support the studies that show better returns from managed care^[9]. However, managed care coverage is famous for favorable selection and individuals with better health status may be more willing to enroll^[11, 41]. Although longitudinal data in this study can help to control for health and functional status that may be motivations to select managed care, it is possible that this favorable selection may not be fully controlled and confound the relationship between managed care and health status.

4.4 Pre-Medicare insurance and health

Pre-Medicare health insurance (Medicaid, Champus/VA and private insurance purchased by themselves or their spouses) is not significantly associated with health outcomes after four years of Medicare coverage, except for the association between pre-Medicare Champus/VA coverage and more mental problems. Health insurance and quality of care are important for population health^[42, 43], but the lack of insurance before Medicare doesn't seem to be important. This result has direct implications to the implementation of the Patient Protection and Affordable Care Act (PPACA) that aims to

expand insurance coverage^[44]. By expanding health coverage among uninsured individuals approaching 65 years of age, their health status after first four years of Medicare may not improve significantly, because pre-Medicare health coverage imposes little externality on their health outcomes during Medicare coverage. Instead, the preventive components of the PPACA and policies focusing on preventable conditions may be more favorable for health^[45]. This statement can be supported by the significant and strong (high ORs) relationships between worse pre-Medicare health (general health, mental issues, difficulties in mobility and hypertension) and higher risks of poor health after four years of Medicare coverage.

However, the lack of effectiveness of pre-Medicare insurance coverage remains unanswered. Levy and Meltzer reviewed different types of health studies and concluded that quasi-experiments and the RAND Health Insurance Experiment (HIE) consistently yield the evidence regarding the benefits of health insurance on health^[15]. This may be because the distributions of ages and health status of Medicare enrollees in this study are different from the studies being reviewed^[15], but the exact reasons are unknown.

4.5 Limitations

The sample size was limited by the available observations with spending information and many observations were excluded because of missing information on individual characteristics (difficulty in ADL, IADL and mobility, CESD scale). The other challenge was to establish a clear causal relationship between health expenditure and returns to health. This study was designed to use health spending as the main treatment that these observations received after being covered by Medicare. By using logit or ordered logit model, the original health status (before Medicare) and other individual characteristics were controlled for. The temporal relationship between spending (in the first two years of Medicare coverage) and later health (after four years of Medicare coverage) was clear, but the causality between health outcomes and spending was not.

5 Conclusion

More OOP health spending in the first two years of Medicare coverage was associated with slightly higher chance of more mental problems, but this magnitude of this association became smaller over time. Although this increased odds was not empirically meaningful, the accumulated spending was not associated health benefits after four years of Medicare coverage. Medicare managed care does not seem to be beneficial for mortality, mental health or self-rated health status.

Gender and pre-Medicare characteristics, especially health status, mental health and difficulties in mobility, had pervasive effects on these health outcomes. The effects of race were quite limited in the first four years of Medicare coverage. More years of education were only significantly associated with better mental and self-rated health, as pre-Medicare income was not associated with these three outcomes. These findings demonstrate that the influence of individual characteristics varied in these health outcomes.

Abbreviations

OOP – out-of-pocket; HMO – health maintenance organization; CESD – Center for Epidemiologic Studies-Depression; FFS – fee-for-service; OR – odds ratio; HRS – Health and Retirement Study

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