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ORIGINAL RESEARCH
Economic Evaluation

The Effect of Supplemental Medical and Prescription Drug Coverage on Health Care Spending for Medicare Beneficiaries with Cancer

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ABSTRACT

Objectives: To examine whether patients with newly diagnosed cancer respond differently to supplemental coverage than the general Medicare population. **Methods:** A cohort of newly diagnosed cancer patients (n = 1,799) from the 1997-2007 Medicare Current Beneficiary Survey and a noncancer cohort (n = 9,726) were identified and matched by panel year. Two-year total medical care spending was estimated by using generalized linear models with gamma distribution and log link—including endogeneity-corrected models. Interactions between cancer and type of insurance allowed testing for differential effects of a cancer diagnosis. **Results:** The cancer cohort spent an adjusted $15,605 more over 2 years than did the noncancer comparison group. Relative to those without supplemental coverage, beneficiaries with employer-sponsored insurance, other private with prescription drug coverage, and public coverage had significantly higher total spending ($3,510, $2,823, and $4,065, respectively, for main models). For beneficiaries with cancer, supplemental insurance effects were similar in magnitude yet negative, suggesting little net effect of supplemental insurance for cancer patients. The endogeneity-corrected models produced implausibly large main effects of supplemental insurance, but the Cancer × Insurance interactions were similar in both models. **Conclusions:** Medicare beneficiaries with cancer are less responsive to the presence and type of supplemental insurance than are beneficiaries without cancer. Proposed restrictions on the availability of supplemental insurance intended to reduce Medicare spending would be unlikely to limit expenditures by beneficiaries with cancer, but would shift the financial burden to those beneficiaries. Policymakers should consider welfare effects associated with coverage restrictions.

Keywords: cancer, cost-sharing, Medicare, supplemental insurance.

Introduction

The availability of supplemental insurance has been identified as one cause of increased health care spending by Medicare beneficiaries. Basic Medicare coverage includes various cost-sharing mechanisms designed, in part, to restrain spending. Supplemental Medicare coverage, however, lowers—and in some cases eliminates—cost sharing at the point of consumption and thus dramatically reduces the effectiveness of these mechanisms [1,2]. Most Medicare beneficiaries have some type of supplemental coverage. According to 2008 estimates, 51% of the Medicare beneficiary population had some sort of private medical insurance, 15% had Medicaid, and 24% were enrolled in Medicare Advantage plans [3]. Concern about the effects of supplemental insurance on spending led Congress to prohibit supplemental coverage for prescription drugs for beneficiaries enrolled in Part D [4].

There is a large body of evidence concerning the effect of supplemental medical coverage on treatment and spending for Medicare beneficiaries [5–11]. Early estimates suggested that beneficiaries with Medigap plans (i.e., privately purchased supplemental insurance) spent 25% more than did beneficiaries with only Medicare fee-for-service [5,6], while more recent evidence suggests effects of smaller magnitude [7]. Estimates of the effect of supplemental coverage differ depending on how supplemental coverage is measured, and whether supplemental coverage is treated as endogenous in models of service use and spending [8,9]. For

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example, Atherly [8] estimated total Medicare spending models controlling for endogeneity of the supplemental insurance choice and found strong insurance effects despite evidence of favorable selection into supplemental insurance plans without prescription drug coverage and adverse selection into supplemental insurance plans with prescription drug coverage. The consensus among economists is that policies designed to reduce supplemental coverage will serve to reduce total Medicare spending [1,5–8].

One open question is how such policies would affect selected subgroups of Medicare beneficiaries, and in particular, patients with life-threatening illness, such as cancer. Economic theory suggests that the decision to pursue health care is a function of individual, provider, and health care system factors, including the out-of-pocket price of care, as reflected in the presence and type of supplemental insurance. The overall demand for health care is inelastic, with estimates ranging around −0.20 [12]. Health shocks or serious chronic conditions may shift the demand for health care, rendering it even more inelastic. Remler and Atherly [13] examined cost-sharing responsiveness of Medicare beneficiaries with varying levels of health status and found that those in poorer health were significantly less responsive to cost-sharing than were those in better health. A 2006 study by Goldman et al. [14] found that demand for specialty drugs used to treat cancer and other critical conditions was highly inelastic. Although these two studies are far from definitive, it would appear that limiting access to supplemental Medicare insurance would be ineffective in reducing expenditures for beneficiaries in poor health and with critical illness; rather, it would shift the financial burden from the Medicare program to the beneficiary via increased out-of-pocket spending.

We conducted this analysis to extend the knowledge base regarding heterogeneous responses to Medicare supplemental insurance and, in particular, to determine whether beneficiaries with a new cancer diagnosis respond differently to the financial incentives embedded in supplemental policies than do beneficiaries without cancer. The cost to treat a newly diagnosed cancer patient can be substantial. In fact, per-person costs for treating cancer are higher than the costs of treating heart disease, trauma, mental disorders, and pulmonary conditions [15]. Cancer, a disease associated with aging, is almost 10 times more prevalent among the elderly than among the under-65 year population [16]. By one estimate, the combination of an aging population plus the introduction of new cancer treatments will cost $173 billion annually by 2020 [17].

Our primary data source was the Medicare Current Beneficiary Survey (MCBS), which not only provides a rich source of information on supplemental insurance and total health care spending but also contains essential information on income, assets, and other factors that may confound the effect of supplemental insurance. We hypothesize that after controlling for these factors, beneficiaries with cancer will be less responsive than beneficiaries without cancer to the presence and type of supplemental insurance.

Methods

Data Set

Data for this study come from the MCBS, a rotating panel design surveying approximately 4,500 new beneficiaries each year, for the years 1997-2007. MCBS respondents are followed for up to 4 years or until death or loss to follow-up. During that period they are interviewed in the fall of their induction year and then three times annually during the second through fourth survey years. Information captured includes use and expenditures for health services, insurance coverage, access to care, health and functional status, socioeconomic status, and demographic characteristics. We also used the annual spring MCBS Income & Asset supplements that provide detailed self-reported information on assets and source of income for the previous year. MCBS respondents are asked about their use and cost of all health care services whether covered by Medicare or not, including prescription drugs. Finally, the MCBS provides all Part A and B claims for each beneficiary including hospital inpatient, outpatient, physician, laboratory, durable medical equipment, skilled nursing facility, home health agency, and hospice claims.

Sample Design and Cohort Selection

We constructed nine panels from the MCBS files, the first panel representing respondents inducted in 1997 and tracked through 2000 and the last panel representing those inducted in 2006 but followed through 2007.

We identified a cohort of community-dwelling beneficiaries with newly diagnosed cancer by using a claims-based algorithm described below. A noncancer cohort was identified that did not meet criteria for a cancer diagnosis any time during the period of MCBS participation. In both cases, sample beneficiaries had to be continuously enrolled in Part A and B during the study period. We excluded Medicare Advantage enrollees from the sample because Medicare claims data necessary to identify a cancer diagnosis were either missing or incomplete. We also excluded beneficiaries residing in a long-term care facility at any point during the 4-year panel because prescription drug data are not collected during a long-term care residence. Beneficiaries with incomplete MCBS surveys for reasons other than death were excluded from the analysis.

Our cancer cohort was based on the presence of cancer-related *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) diagnosis codes (140-172, 174-208, 225, 227.3, or 227.4) in claims. An algorithm for study eligibility was used that required beneficiaries to have a diagnosis of any cancer including melanoma (but not other skin cancers) on at least one inpatient claim, or two outpatient claims within 13 months of the first claim identified. To generate a subset of newly diagnosed cancer cases, we imposed a 12-month washout period during which the beneficiary did not qualify as having cancer. To avoid selecting beneficiaries with "rule-out" cancer diagnoses, we did not count any additional *ICD-9-CM* diagnosis codes in the 30-day period right after the first *ICD-9-CM* cancer code found. Each cancer patient was assigned an index date according to the first time we observed a claim with a qualifying cancer diagnosis. We assigned a randomly selected index date for the noncancer controls to match the temporal distribution of index dates for beneficiaries with cancer. The final sample included 11,525 beneficiaries: 1,799 with newly diagnosed cancer and 9,726 without cancer.

Measures

Outcome variables

Our outcome variable was total health care spending across 2 years comprising the index year and the subsequent year. This measure captured total payments for all health care services received, including inpatient and outpatient care, medical services, equipment and supplies, home health visits, skilled nursing facility stays, hospice, and prescription medications. Ideally, we would have measured expenditures for a period beginning with the index date, for a period of 12 months. While it would have been possible to create such a measure by using only services reported in claims, we sought to include spending on services not universally covered by Medicare, including prescription drugs, which were reported only on an annual basis. Expenditures for all nine panels were inflated to constant 2007 dollars by using the Consumer Price Index.

Key explanatory measure

The key variable of interest was the presence and type of Medicare supplemental medical and prescription drug coverage.

The MCBS provides extensive information on insurance coverage, and from this we generated five exhaustive and mutually exclusive categories of coverage, applying a hierarchy in which beneficiaries had more than one type of coverage. The categories were (in hierarchical order) as follows: 1) public insurance (supplemental medical with or without prescription drug), 2) employer-sponsored insurance (ESI) (supplemental medical with or without prescription drug coverage), 3) other private medical with prescription drug coverage, 4) other private medical without prescription drug coverage, and 5) no supplemental insurance. Public insurance includes full and partial Medicaid dual eligibles, and anyone reporting that he or she has some other type of publicly subsidized medical coverage. The source of supplemental medical and prescription drug coverage would affect the generosity of the insurance. Employment-related plans are known to provide the most generous coverage, and they usually include prescription drug coverage. Medigap plans vary in generosity compared with employment-related plans. Although Medicaid theoretically provides the most comprehensive coverage with minimal to no cost sharing, the program suffers from reductions in access [18].

Although not all beneficiaries with ESI or other public reported prescription drug coverage, there were inadequate numbers to split the categories. We did differentiate, however, between other private medical with and without prescription drug coverage following Atherly [8] who found particularly strong selection effects associated with this distinction.

Control variables

The MCBS provides a rich set of control variables. In our multivariate analysis, we controlled for beneficiary demographic characteristics including age, race, sex, marital status, living situation, urban residence, geographic region, education, income, and assets. We also included health status variables such as functional status (activities of daily living and instrumental activities of daily living) [19], comorbidities via hierarchical condition categories [20], and death (a dummy indicator whether the beneficiary died during the observation period). We included a variable to capture attitudes toward care seeking ("do you usually go to the doctor as soon as you feel bad"). We also controlled for the index year and the number of months a beneficiary was observed during the 2-year period.

Instrumental variables

We collected county- and state-level instrumental variables (IVs) to correct for possible endogeneity related to supplemental insurance coverage by using data sources such as Area Resource File, National Association of Health Underwriters, Kaiser Family Foundation, and Medical Expenditure Panel Survey Insurance Component. Following Atherly [8] and others [21–25], we selected IVs for our auxiliary equation that we expected would be highly predictive of availability and enrollment in each supplemental coverage group. For example, state small group issue and rating regulations have been used as indicators for ESI offer and take-up and nongroup market regulations have been used as predictors of coverage in the nongroup and Medigap markets [21–25]. Table 1 summarizes the descriptive statistics for the IVs used in the multivariate model. The IVs were merged in at the county or state levels by year for each beneficiary.

Multivariate Analysis

This analysis was designed to estimate the differential effect of supplemental insurance on health care spending among newly diagnosed cancer patients compared with beneficiaries without cancer, controlling for potential confounders. Interactions

Table 1 – Descriptive statistics.

Characteristics	Mean/% (SE)	
	Cancer cohort	Noncancer cohort
Sample size	1,799	9,726
Dependent variable		
Total health care spending	41,789 (1,112.9)	17,701 (315.9)*
Policy variables		
Supplemental medical and prescription drug coverage (%)		
Public insurance	14 (0.9)	20 (0.6)*
ESI	42 (1.5)	40 (0.7)
Other private with Rx	8 (0.7)	10 (0.5)‡
Other private without Rx	15 (1.0)	15 (0.5)
None	20 (1.1)	14 (0.4)*
Observed control variables		
Age (y) (%)		
<65	6 (0.6)	16 (0.4)*
65–69	16 (1.0)	20 (0.5)*
70–74	21 (1.1)	23 (0.5)
75–79	25 (1.2)	18 (0.4)*
80–84	18 (0.9)	13 (0.3)*
85+	13 (0.7)	10 (0.3)*
Age 65+ y and former SSDI (%)	7 (0.6)	7 (0.3)
Sex (%)		
Female	48 (1.3)	56 (0.6)*
Male	52 (1.3)	44 (0.6)*
Race/ethnicity (%)		
White	84 (1.1)	81 (0.8)†
Black	9 (0.8)	9 (0.6)
Hispanic	4 (0.6)	5 (0.5)†
Other	4 (0.5)	5 (0.3)†
Marital status (%)		
Married	57 (1.3)	52 (0.6)*
Other	43 (1.3)	48 (0.6)*
Living situation (%)		
Lives alone	30 (1.0)	31 (0.6)
Other	70 (1.0)	69 (0.6)
Education (%)		
No high school	14 (0.9)	14 (0.6)
Some high school	15 (1.0)	16 (0.5)
High school graduate	29 (1.2)	30 (0.7)
Some higher education	42 (1.4)	40 (0.9)
Income as % of FPL (%)		
Up to 100%	13 (1.0)	16 (0.5)†
101%–200%	27 (1.1)	30 (0.6)*
201%–300%	21 (1.0)	20 (0.5)
Over 300%	39 (1.4)	34 (0.8)*
Assets (%)		
Under $2,500	17 (1.0)	23 (0.6)*
$2,500–$25,000	17 (1.0)	23 (0.6)*
$25,001–$100,000	23 (1.0)	20 (0.5)†
$100,001–$200,000	16 (0.9)	12 (0.4)*
$200,000+	27 (1.2)	22 (0.6)*
Location (%)		
Urban	72 (1.8)	70 (1.5)
Rural	28 (1.8)	30 (1.5)
Region (%)		
East	21 (1.4)	19 (0.9)
Midwest	25 (1.4)	25 (1.1)
South	40 (1.8)	39 (1.5)
West	14 (1.5)	16 (1.2)†
Index year (%)		
1997–1999	14 (0.9)	14 (0.7)
2000–2001	23 (1.3)	22 (1.0)
2002–2003	21 (1.1)	20 (0.4)
2004–2005	23 (1.4)	22 (0.9)
2006–2007	20 (1.3)	22 (0.9)
Months observed	18 (0.2)	19 (0.1)*
ADL/IADL limitations (%)		
None	54 (1.4)	60 (0.6)*

Table 1 – *continued*

Characteristics	Mean/% (SE)	
	Cancer cohort	Noncancer cohort
1–4	38 (1.3)	34 (0.5)*
>4	8 (0.7)	7 (0.3)‡
Vital status (%)		
Died during year	21 (1.0)	3 (0.2)*
HCCs (%)		
<2	3 (0.5)	21 (0.5)*
2–4	22 (1.0)	34 (0.6)*
5–8	45 (1.3)	34 (0.6)*
>8	30 (1.3)	11 (0.4)*
Attitudes about care seeking (%)		
Usually, you go to the doctor as soon as you start to feel bad	33 (1.3)	33 (0.8)
Adjusted average per capita cost	605 (5.0)	600 (4.4)
Instrumental variables		
% of employment by industry§		
Construction	6.91 (0.108)	6.92 (0.096)
Federal government	2.81 (0.191)	2.78 (0.176)
Other government	12.09 (0.259)	12.35 (0.264)*
State policy measures (%)		
Guaranteed issue regulations in nongroup market‖		
None	40.61 (3.387)	41.99 (3.218)
HIPAA requirements	35.45 (3.201)	35.26 (3.060)
GI all	23.95 (2.365)	22.75 (2.150)
Rating structure in nongroup market‖		
None	68.30 (2.955)	69.61 (2.771)
Rate band	8.04 (2.018)	8.13 (1.907)
Modified community rating	14.19 (1.935)	12.83 (1.727)†
Community rating	9.47 (1.701)	9.43 (1.622)
State with elimination rider status‖	65.80 (2.817)	66.99 (2.531)
Preexisting condition look-back period (>12 mo)‖	51.15 (3.092)	50.50 (3.037)
State offers pharmacy benefits through the qualified Medicare program¶	72.08 (3.179)	70.11 (3.214)
Qualified State Pharmaceutical Assistance Program#	42.05 (2.969)	41.54 (2.944)

ADL/IADL, activities of daily living/instrumental activities of daily living; ESI, employer-sponsored insurance; FPL, federal poverty level; GI, guaranteed issue; HCC, hierarchical condition categories; HIPAA, Health Insurance Portability and Accountability Act of 1996; Rx, prescription; SSDI, Social Security Disability Insurance.

* Difference between cancer and noncancer cohort significant at $P < 0.01$.

† Difference between cancer and noncancer cohort significant at $P < 0.05$.

‡ Difference between cancer and noncancer cohort significant at $P < 0.10$.

§ County-level variables, source 2009 Area Resource Files.

‖ State-level variables, source National Association of Health Underwriters.

¶ State-level variables, source Kaiser Family Foundation.

between cancer and the insurance variables (with no supplementation as the reference category) generated the parameter estimates of interest. We estimated a series of progressively complex models. First, we estimated models in which supplemental medical and prescription drug coverage was presumed to be exogenous—referred to as the main model hereafter. Models were estimated by using a generalized linear model with a gamma distribution and a log link to correct for the positively skewed distribution of health care spending. We estimated a single model, as opposed to a two-part model, because there were only 161 individuals with 0 spending over the 2-year observation period. We calculated marginal (incremental) effects of cancer, insurance type, and Cancer × Insurance interactions by using the "margins" command in Stata 12.

The literature suggests that there is endogeneity of insurance decisions due to unobserved confounding effects [6,8,9]. Failure to correct for endogeneity can lead to biased coefficient estimates from the multivariate models. We estimated a model to assess the possible bias associated with the selection of insurance type on unobserved factors by using a two-stage residual inclusion (2SRI) instrumental variable model. The 2SRI approach provides a consistent estimator with endogeneity correction in nonlinear models [26].

2SRI is a two-stage estimation process. In the first stage, auxiliary regression models are estimated for each possibly endogenous variable. The right-hand side of the regression equation includes at least one IV for each endogenous variable and some or all of the observed control variables from the outcome model. The results from the first stage are used to generate predicted values and calculate residuals. In the second stage, the outcome of interest is estimated including all the observed control variables, the potentially endogenous variables, and the predicted residuals from the auxiliary equations.

An instrumental variables approach should satisfy two conditions: 1) the IVs should be strongly correlated with the endogeneous variable in the first-stage auxiliary equations and 2) the IVs should not be correlated with the error term in the outcome equation. Stock et al. [27] state that for models with one endogenous variable, the F-statistic higher than 10 in the auxiliary equation indicates strong IVs. In the 2SRI model, the significance of the residuals indicates whether there is evidence of endogeneity. The magnitude and sign on the residuals and the coefficient estimates are used to interpret any bias.

Briefly, in the first stage, insurance choice was estimated by using a multinomial logistic regression model as a function of the subset of same control variables as in the main model plus a set of instruments that captured state- and/or county-level data on industry mix, nongroup insurance market regulation, and Medicaid options. The selected IVs were expected to be highly predictive of availability and enrollment in each supplemental coverage group, and have been used in other studies as instruments for supplemental insurance [8,21–25]. The second-stage health care spending model incorporated predicted residuals from the initial regression in addition to the potentially endogenous insurance variables. We evaluated the 2SRI results on the basis of the strength of the first-stage instruments, and the sign, magnitude, and significance of the estimated insurance effects and those associated with the residuals.

All analyses were adjusted for the complex survey design of the MCBS by using Stata 12. The University of Maryland Institutional Review Board approved the study.

Results

Table 1 summarizes the characteristic of the two study cohorts. Mean 2-year health care spending was significantly higher in the cancer cohort ($41,789) than in the noncancer cohort ($17,701). In general, the cancer cohort was older, disproportionately male, white, and married, with more limitations in activities of daily living and a higher number of chronic conditions. Death during the study period was 21% for the cancer cohort and 3% for the

noncancer cohort. The cancer cohort had more financial resources, with a higher percentage of beneficiaries having income above 300% of the federal poverty level (39% vs. 34%) and a higher percentage with assets above $200,000 (27% vs. 22%).

Table 2 presents average health care spending by type of supplemental medical and prescription drug coverage. Within each insurance group, beneficiaries with cancer had higher spending than did those without. In addition, for both cohorts, there were significant differences in spending by presence of supplemental medical and prescription drug coverage. The highest average health care spending was generated by beneficiaries with public medical coverage, at $44,842 (standard error [SE] 2,524) and $22,455 (SE 1,111), respectively, for beneficiaries with and without cancer. The lowest average spending was generated by beneficiaries with no supplemental coverage, at $37,498 (SE 1,680) and $14,221 (SE 760). Of note is that the absolute difference between those with Medicare only compared with those with public insurance was similar in the two cohorts, but the percentage difference was approximately twice as large for beneficiaries without cancer. Beneficiaries holding other private with prescription drug coverage had higher spending than did beneficiaries with other private without prescription drug coverage, overall, and by presence of cancer.

Table 3 shows the main and 2SRI model estimates side by side. The results from our 2SRI analysis provided mixed evidence with respect to endogeneity of supplemental coverage. The residuals in the second stage on ESI and other private without drug coverage were significant; however, statistical significance for each IV varied across equations in the first-stage multinomial logit (see the Appendix Table for first-stage estimation results in Supplemental Materials found at http://dx.doi.org/10.1016/j.jval.2013.11.003). The joint significance test for the IVs returned an F-statistic value of 7.41, below the proposed threshold, and alerting us to the potential for bias associated with weak instruments [27]. And while the marginal effects for the cancer and the interaction terms (Cancer × Supplemental Insurance Type) were very similar in the 2SRI and main models, the marginal effects for main supplemental insurance categories differed dramatically, and were implausibly large for the 2SRI model. For example, the estimated effects of ESI were $3,510 (SE 800.4) in the main model

Table 2 – Average total health care spending ($) by the type of supplemental medical and prescription drug coverage for overall, cancer, and noncancer cohorts.

Supplemental medical and prescription drug coverage	Mean (SE)	
	Cancer cohort	Noncancer cohort
Public insurance	44,842 (2,524)	22,455 (1,111)
ESI	43,499 (1,903)	17,486 (553)
Other private with Rx	42,175 (4,278)	17,519 (811)
Other private without Rx	39,547 (2,527)	15,379 (629)
None	37,498 (1,680)	14,221 (760)

Notes: Adjusted by MCBS survey design. Among the cancer cohort, ANOVA test result shows statistically significant ($P = 0.046$) differences within supplemental drug coverage groups, similar for noncancer cohort ($P < 0.01$). All difference between cancer and noncancer cohorts significant at $P < 0.01$.

ANOVA, analysis of variance; ESI, employer-sponsored insurance; MCBS, Medicare Current Beneficiary Survey; Rx, prescription; SE, standard error.

Table 3 – Marginal effect of supplemental medical and prescription drug coverage and cancer on total health care spending (N = 11,525).

	Marginal effect (SE)	
	Main model	2SRI model
Supplemental medical and prescription drug coverage (Reference: none)		
Public insurance	4,065* (966.3)	10,658† (4,938)
ESI	3,510* (800.4)	17,099* (5,595)
Other private with Rx	2,823* (1,038)	10,574 (8,148)
Other private without Rx	1,205 (887.3)	13,855‡ (7,325)
Cancer	15,605* (1,872)	15,285* (1,867)
Interaction terms		
Cancer × Public Insurance	−2,929† (1,292)	−2,732† (1,312)
Cancer × ESI	−1,997 (1,226)	−1,816 (1,234)
Cancer × Other Private with Rx	−2,931† (1,297)	−2,662† (1,315)
Cancer × Other Private without Rx	−203 (1,384)	−41 (1,395)
Months in the study	925* (38.72)	920* (38.40)
Age (y) (Reference: 65–69 y)		
<65	4,098* (956.2)	5,870* (1,129)
70–74	38 (706.7)	30 (717.4)
75–79	−902 (642.4)	−1,049 (694.6)
80–84	−650 (655.7)	−800 (716.0)
85+	−583 (681.9)	−364 (764.7)
Age 65+ y and former SSDI	1,571‡ (871.7)	2,213† (924.3)
Female	−2,437* (431.7)	−3,063* (496.3)
Race/ethnicity (Reference: white)		
Black	1,254 (1,143)	1,900‡ (1,134)
Hispanic	−251 (1,057)	375 (1,218)
Other	−1,448‡ (784.4)	−879 (868.8)
Currently married	347 (571.5)	−342 (594.8)
Lives alone	908 (600.5)	801 (612.2)
Education (Reference: no high school)		
Some high school	−26 (747.8)	−437 (727.5)
High school graduate	−420 (565.2)	−1,104‡ (620.1)
Some higher education	997 (620.3)	119 (677.4)
Income as % of FPL (Reference: up to 100%)		
101%–200%	1,882* (661.3)	1,120 (889.9)
201%–300%	1,944† (924.4)	−264 (1,229)
Over 300%	2,972* (799.1)	115 (1,418)
Assets (Reference: <$2,500)		
$2,501–$25,000	121 (612.7)	−649 (879.4)
$25,001–$100,000	735 (923.0)	−99 (1,227)
$100,001–$200,000	1,153 (963.8)	805 (1,210)
$200,001+	353 (898.4)	−120 (1,188)
Urban	−457 (568.7)	−837 (635.8)
Region (Reference: south)		
East	−204 (532.2)	−135 (624.2)
Midwest	−176 (528.4)	−677 (562.5)
West	432 (623.6)	247 (673.7)
HCC count (Reference: 0 or 1)		
2–4	10,113* (936.9)	9,068* (1,121)
5–8	22,208* (1,064)	20,708* (1,301)
≥9	61,341* (3,501)	58,653* (3,990)
Activities of daily living limitations (Reference: 0 or 1)		
2–3	7,149* (501.6)	7,365* (546.7)
≥4	18,761* (1,492)	20,472* (1,752)

Table 3 – *continued*

	Marginal effect (SE)	
	Main model	2SRI model
Usually go to doctor as soon as feeling bad	2,007* (457.3)	1,115† (516.8)
Calendar year cancer first observed (Reference: 2004–2005)		
1997–1999	−2,099* (808.9)	−1,903† (798.7)
2000–2001	−858 (794.1)	−697 (787.8)
2002–2003	−116 (671.7)	171 (667.1)
2006–2007	−443 (625.0)	−507 (943.1)
Adjusted average per capita cost	5‡ (2.802)	5‡ (2.796)
Died during observation period	24,435* (2,586)	24,077* (2,540)
Residuals		
Residual from public insurance equation		−5,288 (3,514)
Residual from ESI equation		−11,967* (4,250)
Residual from other private with Rx equation		−5,977 (5,162)
Residual from other private without Rx equation		−9,850† (4,346)

ESI, employer-sponsored insurance; FPL, federal poverty level; HCC, hierarchical condition categories; Rx, prescription; SE, standard error; SSDI, Social Security Disability Insurance; 2SRI, two-stage residual inclusion.
* Significant at $P < 0.01$.
† Significant at $P < 0.05$.
‡ Significant at $P < 0.10$.

compared with $17,099 (SE 5,595) in the 2SRI model. Previous research on the effect of presence and type of supplemental insurance on total health care spending suggested more modest values [2,10,11]—effect magnitudes similar to our main model results.

In the main model, the adjusted difference in spending between the cancer and noncancer comparison group without supplemental insurance was $15,605 (SE 1,872). Relative to those without medical or prescription drug coverage, beneficiaries with public coverage, ESI, and other private with prescription drug coverage had significantly higher total spending ($4,065 [SE 966.3], $3,510 [SE 800.4], and $2,823 [SE 1,038], respectively). The interaction terms between cancer and other private with prescription drug coverage and public coverage categories were negative, suggesting a dampening of the effect of supplemental insurance for the cancer cohort. To assess the full effect of insurance among the beneficiaries with cancer, we calculated and tested the linear sum of each insurance main effect and its corresponding cancer interaction term. For example, the Cancer × Public interaction effect was −$2,929 (SE 1,292). The linear sum of the main effect ($4,065) and the interaction effect was $1,136. The adjusted Wald test provided no evidence that the linear sum was different from zero (F-statistic = 0.13; $P = 0.72$). We did not find any nonzero net effects of the supplemental insurance categories for the cancer cohort, suggesting that beneficiaries with cancer did not have a significant response to supplemental insurance.

We note that the 2SRI results in this regard were somewhat different. In the case of public insurance, the main effect was $10,658 (SE 4,938) and the Cancer × Public interaction effect was −$2,732 (SE 1,312). The linear sum of these effects was $7,926, with an F-statistic of 2.66 ($P = 0.103$). Although the effect for public insurance did not meet significance using an alpha value of 0.05, we found significant effects associated with ESI and with other private medical without prescription coverage. Hence, the 2SRI results suggested that beneficiaries with cancer were less responsive to incentives associated with supplemental insurance relative to those without cancer, but for the two categories of coverage, still had a nonzero response.

Associations between total spending and age, sex, education, income, health status, attitudes about care seeking, number of months observed, index year, and death were also found.

Conclusions

This study considered whether the availability and type of supplemental medical and prescription drug coverage might affect health care spending by community-dwelling Medicare beneficiaries. The type of supplemental coverage represents a proxy for the different out-of-pocket prices faced by Medicare beneficiaries at the point of consumption. We hypothesized that although Medicare beneficiaries with supplemental coverage would spend more in general, beneficiaries with newly diagnosed cancer would be less responsive to insurance than those without cancer. Our findings strongly support this hypothesis, in that we found higher spending associated with supplemental insurance among beneficiaries without cancer, while these effects were substantially dampened for beneficiaries with cancer.

One of the complexities of analyzing demand under insurance is the possibility that insurance choice is endogenous (i.e., that those with the highest expected spending will choose the most generous coverage). Several previous studies of supplemental insurance effects among Medicare beneficiaries have found evidence of endogeneity and biased estimates [6,8,9]. In this study, we found mixed evidence for endogeneity in our 2SRI analysis, with evidence of a downward bias in some estimates. We found some evidence for endogeneity associated with ESI and other private insurance without drug coverage. When we adjusted for potential endogeneity by using a 2SRI method, however, we did not find differences in the estimated effects of cancer or the Supplemental Insurance × Cancer interaction terms—the key parameters of interest concerning heterogeneity of response. The strength of our instruments and the known tendency of 2SRI models to inflate estimates when instruments are not particularly strong were big concerns. Given that the essential parameter estimates related to the effects of cancer and interactions between cancer and supplemental insurance were very close for the two models, we conclude that Medicare beneficiaries with cancer are not responsive (main) or less responsive (2SRI model results) to incentives of supplemental insurance compared with beneficiaries without cancer.

We expect that by using the MCBS we were able to control for self-reported preferences concerning health care use, a measure that may not be available in more limited data sets. As a result, our study may be less subject to bias associated with unobservable confounders. In the end, the results of the 2SRI analysis were implausibly large, possibly due to bias associated with instruments that were not sufficiently strong. Finding strong instruments and justifying their use has been one of the most difficult tasks in the IV literature. It was particularly arduous for our model in which the variable of interest, supplemental insurance, was a categorical variable with five values.

Our study has additional limitations associated with the use of survey data, including the potential for reporting error in demographics, and type of private insurance. The scope of our study focuses on comparing response to insurance for beneficiaries with and without cancer. In this study, we did not address whether supplemental insurance within a cohort of beneficiaries with cancer has a differential effect on cancer-related as opposed

to other spending, whether spending is appropriate, or whether response to insurance differs by cancer site or stage at diagnosis. It is not clear that the MCBS would be the most appropriate data set to address these latter questions, because the MCBS does not provide definitive information on the cancer primary site and offers no information concerning stage at diagnosis or histology. Until data sets such as the Surveillance, Epidemiology, and End Results-Medicare include information on supplemental insurance, however, the MCBS remains the sole source for this type of analysis.

In conclusion, we find that Medicare beneficiaries with cancer are less responsive to the presence and type of supplemental insurance than are beneficiaries without cancer. Several recent proposals would change the Medicare fee-for-service benefit with concurrent restrictions on access to Medicare supplemental coverage [28]. Enactment of such policies might not affect out-of-pocket spending by Medicare beneficiaries, on average. Our results suggest that beneficiaries with cancer would be unlikely to reduce their total spending substantially in response to such restrictions, and could end up with a much greater burden in out-of-pocket spending. It will be important for policymakers to carefully consider the welfare effects associated with such coverage restrictions, particularly when viewed from the perspective of cancer care.

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Supplemental Materials

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