



Estimating Cancer Care Spending in the California Medicare Population: Methodology Detail

This paper describes in detail the methods used by Deborah Schrag, MD, MPH, (Department of Medicine, Harvard Medical School/ Dana-Farber Cancer Institute, Boston, MA) and her research team to estimate Medicare spending on cancer care in California found in *Cancer Care Spending in California: What Medicare Data Say*. California Cancer Registry data were linked with administrative claims data from the Medicare program. The ability to link California Cancer Registry data to other databases is critical for studies involving cancer spending, as it allows researchers to assess spending by cancer stage.

This study used the linked CCR-Medicare database. The interpretation and reporting of these data are the sole responsibility of the authors. The authors acknowledge the efforts of the Healthcare Delivery Research Program, National Cancer Institute; the Office of Research, Development and Information, Centers for Medicare & Medicaid Services; Information Management Services, Inc.; and the SEER Program tumor registries in the creation of the CCR-Medicare database.

Overview

Spending estimates from *Cancer Care Spending in California: What Medicare Data Say* are from the linkage of the California Cancer Registry (CCR), which is a contributor to the National Cancer Institute's Surveillance Epidemiology and End Results Program (SEER), and administrative claims data from the Medicare program. This linkage is referred to as CCR-Medicare throughout this paper. This linked dataset includes tumor registry variables, demographics, and vital status as well as Medicare claims for inpatient, outpatient, nursing home, hospice, and durable medical equipment. Starting in 2007, files also include most pharmacy claims covered under Medicare Part D plans.

CCR-Medicare data are only available for Californians enrolled in traditional Medicare plans, also known as fee-for-service plans. CCR-Medicare spending records are not available for people enrolled in Medicare Advantage plans (frequently referred to as HMO, or managed care, plans) because these may involve capitated payments, and itemized billing records are not mandated. Fifty-three percent of Californians diagnosed in 2007-2011 with one of

the four cancers studied were continuously enrolled in Medicare parts A and B from the month of their diagnosis through their death or the end of data availability (December 31, 2013), whichever came first. Myriad prior studies have demonstrated the feasibility of identifying utilization and spending from Medicare claims for fee-for-service beneficiaries.

The report represents patients diagnosed with cancer in California in 2007-2011, with Medicare claims through 2012. These patients are tracked for vital status through the end of 2012. All spending estimates have been adjusted for inflation to 2013 constant US dollars.

Table 1. Summary of Data Sources and Methods Used

California Medicare Population of Cancer Patients	
CCR-Medicare:	
<ul style="list-style-type: none"> ▶ MEDPAR file (contains inpatient hospital and/or skilled nursing facility) ▶ From the files: carrier, outpatient, HHA (home health agency), hospice, DME (durable medical equipment), and PDE (Part D events) 	
Inclusion Criteria	
This report focuses on Medicare spending for California cancer patients diagnosed with one of the four major solid tumors:	
<ul style="list-style-type: none"> ▶ Lung cancer (including both small cell and non-small cell) ▶ Breast cancer ▶ Colorectal cancer ▶ Prostate cancer 	
All cancer diagnoses were first primary cancers and made antemortem.	
All patients were continuously enrolled in Medicare Part A, Part B, and not in an HMO from the month before diagnosis until death/censoring date.	
When patients had a secondary diagnosis of a cancer not included in this study, these patients (and the spending on the secondary cancer) were retained.	
Medicare-insured patients were included irrespective of their age at diagnosis. Patients under age 65 constituted only about 6% of the CCR-Medicare cases, and sensitivity analyses excluding them did not significantly alter spending estimates. Therefore, estimates reflect spending for patients of all ages.	
Spending Estimates	
<p>First Year of Diagnosis. These spending estimates include the first 12 months of spending on a cancer patient, beginning with the month of diagnosis. Patients who die within the 12-month period only contribute to the numerator and to the denominator in months during which they survived for at least a day.</p>	
<p>Last Year of Life. These estimates reflect spending in the last year of life prior to and including the month of death. These estimates consider months irrespective of when patients were diagnosed with cancer. For example, if a patient was diagnosed with cancer one calendar month before death, that person's last year of life would include 2 months when the cancer was known and 10 months when it was not. Deaths can be from any cause, not just cancer.</p>	

Note: For those who died in 2007, the year before death may have included claims during some months of 2006. We did not exclude these patients and included their 2006 costs in our mean spending estimates. Part D data is not available for 2006, so the spending estimates are slightly lower in these cases.

Table 2. Analytic Cohort

	BREAST	PROSTATE	LUNG	COLORECTAL
Cancer diagnosis in California, 2007-2011	66,878	76,779	56,994	45,443
Primary diagnosis of index cancer	60,935	74,845	51,617	42,143
Alive at diagnosis	60,633	74,196	50,820	41,841
Diagnosis pathologically confirmed	60,100	72,586	44,893	40,629
Continuous enrollment in Medicare parts A & B from the month before diagnosis through death or 12/31/2013, whichever came first	40,621	49,168	37,311	30,253
No managed care enrollment from month before diagnosis through death or 12/31/2013, whichever came first	21,238	25,885	21,435	15,896
Elimination of records with diagnoses of more than one of the four cancers studied	20,837	25,336	20,683	15,237

Source: PEDSF file of the 2014 SEER-Medicare data linkage, Healthcare Delivery Research Program, National Cancer Institute.

Table 3. Analytic Cohort Used to Estimate Mean Medicare Spending in First Year of Diagnosis, 2007 to 2011

	BREAST		PROSTATE		LUNG		COLORECTAL	
	<65	65+	<65	65+	<65	65+	<65	65+
Cases, by age	1,694 (8%)	19,143 (92%)	1,344 (5%)	23,992 (95%)	1,609 (8%)	19,074 (92%)	1,005 (7%)	14,232 (93%)
Total cases	20,837		25,336		20,683		15,237	
Cases per year (average)	4,167		5,067		4,137		3,047	

Source: PEDSF file of the SEER-Medicare 2014 data linkage, Healthcare Delivery Research Program, National Cancer Institute.

Table 4. Analytic Cohort Used to Estimate Mean Medicare Spending in Last Year of Life, 2007 to 2011

	BREAST		PROSTATE		LUNG		COLORECTAL	
	<65	65+	<65	65+	<65	65+	<65	65+
Cases, by age	274 (8%)	3,124 (92%)	158 (5%)	3,306 (95%)	1,297 (8%)	15,067 (92%)	426 (6%)	6,339 (94%)
Total cases*	3,398		3,464		16,364		6,765	
Died in 2007	132		91		1,701		543	
Died in 2008	314		332		2,859		992	
Died in 2009	496		489		3,250		1,202	
Died in 2010	709		710		3,347		1,329	
Died in 2011	842		869		3,352		1,566	
Died in 2012	905		973		1,855		1,133	

*Diagnosed in 2007 to 2011 and died 2007 to 2012.

Source: PEDSF file of the SEER-Medicare 2014 data linkage, Healthcare Delivery Research Program, National Cancer Institute.

Table 5. Diagnoses per Year in the SEER-Medicare Fee-for-Service Analytic Cohort, by Race/Ethnicity, 2007 to 2011

	WHITE	BLACK	HISPANIC	ASIAN
Breast	3,433	234	120	211
Prostate	3,991	375	215	259
Lung	3,281	265	122	310
Colorectal	2,335	189	113	264

Source: SEER-Medicare 2014 data linkage, Healthcare Delivery Research Program, National Cancer Institute.

Table 6. Number of Deaths* in the SEER-Medicare Fee-for-Service Analytic Cohort, by Race/Ethnicity, 2007 to 2011

	WHITE	BLACK	HISPANIC	ASIAN
Breast	2,765	295	115	130
Prostate	2,635	330	180	185
Lung	12,935	1,085	520	1,220
Colorectal	5,140	515	265	575

*Diagnosed in 2007 to 2011 and died 2007 to 2012.

Source: SEER-Medicare 2014 data linkage, Healthcare Delivery Research Program, National Cancer Institute.

Mean Spending During First Year of Cancer Diagnosis

Calculation Using CCR-Medicare

Step 1a: Define files to be used from CCR-Medicare linked dataset. Use the MEDPAR file for hospital spending, carrier, outpatient, HHA (home health agency), hospice, DME (durable medical equipment), and PDE (Part D drug spending).

Medicare reimbursement data were used as the estimate of spending. Patient copayments are not included. These vary substantially based on whether the patient has secondary coverage through a supplemental plan or through Medicaid.

Spending estimates are based on Medicare reimbursement. Reimbursement represents the amount paid (not billed or charged) for services.

Step 1b: Aggregate reimbursement data by patient service date. One individual patient may have multiple records from different dates and multiple records from different services provided on the same day. All services for a patient rendered on the same day were first aggregated.

Step 1c: Aggregate reimbursement data in relationship to the cancer diagnosis date and observation period. Patients diagnosed between January 1, 2007, and December 31, 2011, inclusive, composed the analytic cohort for spending analyses such that complete information was available for the initial year of diagnosis on all patients. Follow-up data including Medicare enrollment, spending, and vital status were available through December 2012.

Step 1d: Allocate data to each patient's "month from diagnosis" using the following method:

$$\frac{\text{Date of service} - \text{Date of diagnosis} + 15}{30 \text{ days}} = \text{Months from diagnosis date}$$

For example: If patient X was diagnosed on January 1, 2007, and received services on January 28, 2007, then:

$$(28 - 1 + 15) / 30 = 1.4 \text{ months}$$

So the services rendered on January 28, 2007, would be attributed to month 1 (i.e., the month after the month of diagnosis).

To further illustrate:



Step 1e: Adjust for inflation. All dollar amounts are adjusted and reported in 2013 USD using price adjusters.

	PRICE ADJUSTERS USING 2013 DOLLARS*						
	2006	2007	2008	2009	2010	2011	2012
Part A	0.828081	0.858275	0.970938	0.976033	0.974523	0.987356	0.998490
Part B	0.840523	0.877735	0.878348	0.965242	0.977305	1.010018	1.067675
Part D	0.829932	0.756074	0.730807	0.873664	0.862488	0.908649	0.893100

*Source: 2012 Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds, Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds, table V.D1, April 23, 2012, www.treasury.gov.

For example: If Part A Service X spent \$356, and the date of service was in 2008, then this would be adjusted as follows: \$356 / 0.970938 = \$367.

Step 1f: Calculate mean and total month-specific spending for the first year of cancer diagnosis.

After completing steps 1a-1e, the spending in 2013 dollars for each patient in each month relative to his/her diagnosis are known. Denote by x_{ij} the cost of patient i in the j th month from diagnosis, and by I_{ij} the indicator whether patient i is still alive in the j th month. The mean month-specific spending is calculated as:

$$y_j = \frac{\sum_{i=1}^N x_{ij}}{\sum_{i=1}^N I_{ij}}$$

where N is the total number of patients. For example, to find mean spending in month -1 (the month prior to diagnosis, during which patient underwent diagnostic work-up), add each patient's month -1 spending together and divide by the number of patients in month -1. Repeat for month 0 (the month of diagnosis), month 1, ..., month 11. If a patient is alive but does not receive any services in a given month, then that patient is included in the

denominator, and zero is set as the spending for that month. Mean spending was censored for death each month, such that patients stop contributing to both denominator and numerator after death. To calculate total mean spending for the first year of cancer diagnosis, Y , sum the mean costs from month 0 through month 11, or $Y = \sum_{j=0}^{11} y_j$. See Table 7 for an example.

Table 7. Mean and Total Month-Specific Spending for the First Year of Cancer Diagnosis

	MONTH(S) FROM DIAGNOSIS												
	-1*	0†	1	2	3	4	5	6	7	8	9	10	11
Patient A	\$100	\$150 (dx Jan 2007)	\$140	\$130	\$120	\$110	\$100	\$90	\$80	\$70	\$70	\$70	\$70
Patient B	\$150	\$200 (dx Mar 2008)	\$185	\$175	\$165	\$190 (died mo. 4)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Patient C	\$0	\$180 (dx Dec 2009)	\$175	\$160	\$150	\$140	\$130	\$120	\$115	\$115	\$115	\$115	\$115
Patient D	\$200	\$300 (dx Feb 2008)	\$275	\$250	\$240	\$230	\$200	\$175	\$175	\$160	\$160	\$160	\$150
Calculating Mean Spending	(100 + 150 + 0 + 200) / 4	(150 + 200 + 180 + 300) / 4	(140 + 185 + 175 + 275) / 4	(130 + 175 + 160 + 250) / 4	(120 + 165 + 150 + 240) / 4	(110 + 190 + 140 + 230) / 4	(100 + 130 + 200) / 3	(90 + 120 + 175) / 3	(80 + 115 + 175) / 3	(70 + 115 + 160) / 3	(70 + 115 + 160) / 3	(70 + 115 + 160) / 3	(70 + 115 + 150) / 3
Mean Spending	\$113	\$208	\$194	\$179	\$169	\$168	\$128	\$123	\$115	\$115	\$115	\$115	\$112
Total Mean Spending	208 + 194 + 179 + 169 + 168 + 128 + 123 + 115 + 115 + 115 + 115 + 112 = \$1,741												

Notes: The denominator represents the total patients contributing to mean spending each month. Even though patient C has spending of \$0 in month -1, patient C still contributes to mean spending. Because patient B died in month 4, patient B no longer contributes to the mean spending from month 5 onward.

*Month prior to diagnosis or diagnostic "work up". Month -1 does not contribute to total mean spending calculation.

†Month of diagnosis (dx) is defined as January 1, 2007 through December 31, 2011.

Step 1g: Calculate mean and total month-specific spending for the first year of cancer diagnosis by covariate. Reporting spending by cancer site (breast, lung, colorectal, prostate) is performed using the same method described above. For breast spending reporting, only patients diagnosed with breast cancer contribute to the mean month-specific spending and denominators. See Table 8 for an example.

Report spending by cancer site and stage. If patient A has stage I breast cancer and patient C has stage II breast cancer, then only patient A would contribute to the mean and month-specific spending for the first year of cancer diagnosis for breast stage I. This method is repeated for each stage of breast, lung, colorectal, and prostate cancers.

Report spending by gender. If patients A and C are female and patients B and D are male, then patients A and C would contribute to the mean and month-specific spending for the first year of cancer diagnosis for females, and patients B and D would contribute for males.

Report spending by race/ethnicity. If patients A and C are White and patients B and D are Asian, then patients A and C would contribute to the mean and month-specific spending for the first year of cancer diagnosis for Whites, and patients B and D would contribute for Asians.

Report spending by county. If patients A and C are from Napa County and patients B and D are not,

then patients A and C would contribute to the mean and month-specific spending for the first year of cancer diagnosis for Napa County. Only the total mean spending is reported for each county. Counties that contain fewer than 11 patients have been masked to protect patient confidentiality and comply with data use agreements. It is important to note that small cell sizes also yield unstable estimates.

Step 1h: Estimate standard deviations around means using standard formulas. For ease of display, these data are not shown, but are available upon request.

Step 1i: Estimate median spending given the inherent right skewness inherent in cost data.

Table 8. Mean and Total Month-Specific Spending for the First Year of Breast Cancer Diagnosis by Covariate

	MONTH(S) FROM DIAGNOSIS												
	-1*	0†	1	2	3	4	5	6	7	8	9	10	11
Patient A	\$100	\$150 (dx Jan 2007)	\$140	\$130	\$120	\$110	\$100	\$90	\$80	\$70	\$70	\$70	\$70
Patient C	\$0	\$180 (dx Dec 2009)	\$175	\$160	\$150	\$140	\$130	\$120	\$115	\$115	\$115	\$115	\$115
Calculating Mean Spending	$(100 + 0) / 2$	$(150 + 180) / 2$	$(140 + 175) / 2$	$(130 + 160) / 2$	$(120 + 150) / 2$	$(110 + 140) / 2$	$(100 + 130) / 2$	$(90 + 120) / 2$	$(80 + 115) / 2$	$(70 + 115) / 2$	$(70 + 115) / 2$	$(70 + 115) / 2$	$(70 + 115) / 2$
Mean Spending	\$50	\$165	\$158	\$145	\$135	\$125	\$115	\$105	\$98	\$93	\$93	\$93	\$93
Total Mean Spending	$165 + 158 + 145 + 135 + 125 + 115 + 105 + 98 + 93 + 93 + 93 + 93 = \mathbf{\$1,418}$												

*Month prior to diagnosis or diagnostic “work up”. Month -1 does not contribute to total spending calculation.

†Month of diagnosis (dx) is defined as January 1, 2007 through December 31, 2011.

Mean Spending During Last 12 Months of Life

These analyses were performed on a subset of the analytic cohort used for first year spending estimates. Californians who, according to the CCR, were diagnosed with cancer between January 1, 2007, and December 31, 2011, inclusive, and who died between January 1, 2007, and December 31, 2012, composed the analytic cohort for the end-of-life (EOL) spending analyses. In contrast to the initial spending estimates, the choice of time window has significant implications for end-of-life cost estimation. Most of the patients who die of prostate and breast cancer within a few years of diagnosis are those who present with advanced disease. The costs of a patient diagnosed in 2001 who survives 11 years and dies in 2011 are not reflected in this analysis.

Researchers focused on obtaining cost estimates that reflect contemporary care. However, this choice does erode the sample size of decedents available. For lung cancer this choice is less consequential because the majority of lung cancer patients diagnosed in 2007 through 2011 die by 2012. This is less true for patients with cancers that have long survival horizons such as breast cancer. Nevertheless, the relatively large size of the decedent cohorts, even for breast and prostate cancer, provides good estimates of spending in the last year of life for dying patients. This issue plagues all analyses of cancer costs. In general, confidence intervals are wider around the EOL spending estimates because there are fewer decedents than there are diagnosed patients.

All steps for estimating EOL spending are analogous to the methods described above for initial-year estimation except steps 1c and 1f, redefined as:

Step 1c (EOL): Aggregate data by months from death date. Each service record was allocated to each patient's month from death using the following method:

$$\frac{\text{Date of death} - \text{Date of service} + 15}{30 \text{ days}} = \text{Months prior to death}$$

The month of death was defined as the anchor point for each patient. There are some drops in sample size when tracing backward from death because the exposure availability was set between January 1, 2007, and December 31, 2011.

For example: If patient X was diagnosed on June 2, 2007; received services on June 29, 2007; and died on August 15, 2007, then:

$$(47^* + 15) / 30 = 2.06 \text{ months}$$

*Calculated as 1 day in June + 31 days in July + 15 days in August.

So the services rendered on June 29, 2007, would be attributed to month 2 (i.e., two months prior to the month of death).

Step 1f (EOL): Calculate mean and total month-specific spending for the last year of life. After completing steps 1a-1e, the spending in 2013 dollars for each patient in each month relative to death are known. To find mean spending in month 0 (the

month of death), add each patient's month 0 spending together and divide by the number of patients contributing to month 0 (i.e., the denominator). Repeat for month 1 (the month prior to death), month 2, ..., month 11. If a patient is alive and enrolled in Medicare but has a spending of \$0 in a given month, then that patient is included in the denominator, and \$0 is set as the spending for that month. Mean spending estimates were not censored for diagnosis in the analyses presented, meaning that patients contribute to the denominator and the mean spending in the month of death and in all 11 months preceding their death, irrespective of when they were diagnosed with cancer. To find total mean spending for the last year of life, sum the mean spending from month 0 (month of death) through month 11. See Table 9 on the following page for an example.

Table 9. Mean and Total Month-Specific Spending for the Last Year of Life

	MONTH(S) PRIOR TO DEATH											
	0*	1	2	3	4	5	6	7	8	9	10	11
Patient A (died May 2008)	\$300	\$250	\$225	\$200	\$175 (dx Jan 2008)	\$170	\$160	\$150	\$150	\$150	\$145	\$145
Patient B (died Sep 2007)	\$150	\$100	\$90	\$80	\$70	\$60	\$50	\$40	\$40	\$0	\$0	\$0
Patient C (died Aug 2011)	\$400	\$375	\$350	\$325	\$300	\$280	\$270	\$260	\$250	\$240	\$240	\$0
Calculating Mean Spending	$(300 + 150 + 400) / 3$	$(250 + 100 + 375) / 3$	$(225 + 90 + 350) / 3$	$(200 + 80 + 325) / 3$	$(175 + 70 + 300) / 3$	$(170 + 60 + 280) / 3$	$(160 + 50 + 270) / 3$	$(150 + 40 + 260) / 3$	$(150 + 40 + 250) / 3$	$(150 + 240) / 3$	$(145 + 240) / 3$	$145 / 3$
Notes: The denominator represents the total patients contributing to mean spending each month. Even though patient A had not yet been diagnosed with cancer in month 5 (December 2007), patient A still contributes to mean EOL spending. Even though patient C has spending of \$0 in month 11, patient C still contributes to mean spending.												
Mean Spending	\$283	\$242	\$222	\$202	\$182	\$170	\$160	\$150	\$147	\$130	\$128	\$48
Total Mean Spending	$283 + 242 + 222 + 202 + 182 + 170 + 160 + 150 + 147 + 130 + 128 + 48 = \mathbf{\$2,064}$											

*Month of death is defined as January 1, 2007 through December 31, 2012.

Note: Diagnosis noted as "dx".

Annual Total Spending

The annual total spending in the initial year from diagnosis was calculated for this analytic cohort by summing (not averaging) the monthly spending across patients. Using the notations defined in step 1e, the total spending can be calculated as $\sum_{j=1}^{12} \sum_{i=1}^N r_{ij} / 5$. The sum was divided by five because researchers used data from five years (2007 to 2011)

but want to report annual total spending. See the example below. These totals represent seminal 12-month periods. A similar calculation is performed for spending in the last year of life.

This strategy includes spending for all months that patients are alive. If a patient dies four months from diagnosis, the patient contributes spending for only five months (month 1 is included). The snapshots

of initial health spending in the year after diagnosis present total spending estimates for patients diagnosed in a typical year. The total estimates for spending in the last year of life are less relevant, particularly for breast and prostate cancers, where there may be decedents who were diagnosed many years earlier. See Table 10 for an example.

Table 10. Annual Total Month-Specific Spending for the First Year of Cancer Diagnosis

	MONTH(S) FROM DIAGNOSIS												
	-1*	0†	1	2	3	4	5	6	7	8	9	10	11
Patient A	\$100	\$150 (dx Jan 2007)	\$140	\$130	\$120	\$110	\$100	\$90	\$80	\$70	\$70	\$70	\$70
Patient B	\$150	\$200 (dx Mar 2008)	\$185	\$175	\$165	\$190 (died mo. 4)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Patient C	\$0	\$180 (dx Dec 2009)	\$175	\$160	\$150	\$140	\$130	\$120	\$115	\$115	\$115	\$115	\$115
Patient D	\$200	\$300 (dx Feb 2008)	\$275	\$250	\$240	\$230	\$200	\$175	\$175	\$160	\$160	\$160	\$150
Grand Total	450	830	775	715	675	670	430	385	370	345	345	345	335
Annual Grand Total (07-11)	450 / 5 = \$90	830 / 5 = \$166	775 / 5 = \$155	715 / 5 = \$143	675 / 5 = \$135	670 / 5 = \$134	430 / 5 = \$86	385 / 5 = \$77	370 / 5 = \$74	345 / 5 = \$69	345 / 5 = \$69	345 / 5 = \$69	335 / 5 = \$67

*Month prior to diagnosis or diagnostic “work up”. Month -1 does not contribute to total spending calculation.

†Month of diagnosis (dx) is defined as January 1, 2007 through December 31, 2011.

Notes: Using these methods, if breast cancer spending was an average of \$35,000 in the first year of diagnosis and \$53,000 in the last 12 months of life, it is not reasonable to add these two numbers together because they are not mutually exclusive. For example, if a patient was diagnosed January 1, 2007, and died April 31, 2008, then their January 2007 to December 2007 spending would be captured in their “first year of diagnosis,” and their May 2007 to April 2008 spending would be captured in their “last 12 months of life.” Their spending during May 2007 to December 2007 is captured in both their “first year of diagnosis” and their “last 12 months of life.”

Discussion and Rationale for Methods Used

Calculating mean and total month-specific spending for the last year of life. Mean spending was not censored for diagnosis in the base case analyses presented, meaning that patients contribute to the denominator and the mean spending in the month of death and in all 11 months preceding their death, irrespective of when they were diagnosed with cancer. Sensitivity analyses were conducted, censoring patients based on the diagnosis month. In other words, patients who were diagnosed with cancer within less than a year of death contribute to the numerator and denominator only in months in which they were known to have cancer. Censoring based on diagnosis date resulted in marginally higher month-specific spending estimates.

Cause-of-death analyses. In the base case analyses, researchers considered EOL spending irrespective of whether patients died of cancer or another cause. In sensitivity analyses, EOL spending estimates were restricted to cancer patients who died of cancer. This decreased the number of decedents but had marginal impact on mean EOL spending estimates.

“Total” versus “cancer-attributable” costs. Cancer patients incur costs that are attributable to causes other than their cancer. A variety of methods have been proposed to parse these other causes. One method is to identify a control group of Medicare patients who are cancer free, assign each a dummy diagnosis date, and then follow Medicare spending for 12 months from the anchor date. Estimates can

vary substantially based on whether costs for cancer-free control patients are obtained from subjects matched on age, race, ethnicity, gender, region, and year. Estimates also vary based on whether controls are matched to the level of patient comorbidity. Lung cancer patients typically have more comorbidity than breast cancer patients. In sum, comorbidity matching can influence the proportion of spending attributable to cancer.

To avoid obfuscating the straightforward estimates of mean per month spending on patients diagnosed with cancer in a typical year, the cancer-attributable estimates are not presented. It is important to recognize that the estimates presented reflect the totality of spending for cancer patients irrespective of the cause. The researchers suggest that inspection of spending for early-stage cancer patients toward the end of the first year of diagnosis typifies mean non-cancer spending in a given month. The cancer-attributable costs typically involve subtracting a common amount from each month-specific estimate. The size of this constant varies based on the method selected.

About the Author

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