

# MARKET WATCH

## Does Reimbursement Influence Chemotherapy Treatment For Cancer Patients?

Medicare reimbursement has little effect on who gets cancer treatment, but it does influence the kind of treatment received.

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**ABSTRACT:** Before the Medicare Prescription Drug, Improvement, and Modernization Act (MMA) of 2003, Medicare reimbursed physicians for chemotherapy drugs at rates that greatly exceeded physicians' costs for those drugs. We examined the effect of physician reimbursement on chemotherapy treatment of Medicare beneficiaries older than age sixty-five with metastatic lung, breast, colorectal, or other gastrointestinal cancers between 1995 and 1998 (9,357 patients). A physician's decision to administer chemotherapy to metastatic cancer patients was not measurably affected by higher reimbursement. Providers who were more generously reimbursed, however, prescribed more-costly chemotherapy regimens to metastatic breast, colorectal, and lung cancer patients. [*Health Affairs* 25, no. 2 (2006): 437-443; 10.1377/hlthaff.25.2.437]

**I**N THE LATE 1990s, investigations by the Department of Health and Human Services, the Department of Justice, and the House Committee on Energy and Commerce revealed that Medicare payments for Part B-covered drugs, of which chemotherapy agents represent the vast majority, were much higher than physicians' costs of acquiring these drugs.<sup>1</sup> Before 2004, Medicare reimbursed for chemotherapy drugs at the lesser of the billed charge or 95 percent of the average wholesale price (AWP) (100 percent before 1998).<sup>2</sup> But

oncologists and institutions purchased these drugs at prices well below the AWP. For example, in 1999 the average widely available discount to physicians was 12-30 percent of the AWP and reached as high as 86 percent.<sup>3</sup>

Although the Medicare Prescription Drug, Improvement, and Modernization Act (MMA) altered the structure of chemotherapy reimbursements, so that physicians are now paid based on manufacturers' average sales price (ASP) plus 6 percent and an administrative fee, data exploring the relationship between vari-

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ous reimbursement incentives and practice patterns are still important. First, they provide clues for how MMA might change chemotherapy treatment for Medicare beneficiaries. Second, since reimbursement rates for chemotherapy vary greatly within the private market, with many insurance companies basing their rates on the AWP, this research could uncover treatment distortions that persist in the private market. More generally, this work should help us understand the extent to which financial incentives—in this case, unintentional ones—can affect physicians' clinical decisions.

In this paper we analyze the relationship between physicians' prescribing decisions and Medicare reimbursement. An alternative would have been to analyze the spread between Medicare reimbursement and the prices at which oncologists purchased the drugs, but we could not observe purchase prices. Nonetheless, because chemotherapy drugs can be bought directly from manufacturers or through national group purchasing organizations, similar types of clinics or physicians in terms of bargaining power and volume of business should have been able to purchase drugs at similar prices.<sup>4</sup> Thus, variation in reimbursement—the variable we analyze—should track closely with variation in physicians' profit from dispensing drugs.

Specifically, we asked two questions: Were physicians who were more highly reimbursed or who experienced greater increases in their reimbursement more likely to prescribe chemotherapy? And, conditional on prescribing chemotherapy, were such physicians more likely to use expensive drugs?

## Study Methods And Data

■ **Study methods.** To assess how reimbursement affected treatment, we exploited differences in Medicare reimbursement rates across physicians at a point in time and for the same physician over time. Variation at a point in time stemmed from local carriers' discretion before October 2002 to determine the composition of the Healthcare Common Procedure Coding System (HCPCS), the basis for Medicare reimbursement. In particular, individual

carriers processing Part B claims chose the specific National Drug Code (NDC, corresponding to a unique chemical entity, form, strength, package size, manufacturer, and AWP) that determined the reimbursement rate for all NDCs in the HCPCS. Because their choices varied, the reimbursement for a HCPCS covering a multisource drug, or a single-source drug available in different forms or package sizes, varied across carriers.<sup>5</sup> Although such variation was typically on the order of 10 percent or less, it was much larger for some commonly prescribed chemotherapy drugs.<sup>6</sup> For example, in 1999 the spread between the highest and lowest reimbursement for 10 mg doxorubicin was about 27 percent (\$52.44 versus \$38.03). Moreover, these reimbursements changed differentially over time based on revisions to the AWP for specific NDCs.

■ **Data sources.** *Study cohort.* To study chemotherapy treatment, we analyzed the Surveillance, Epidemiology, and End Results (SEER) cancer registries and linked Medicare claims.<sup>7</sup> Our sample consisted of all Medicare-eligible patients older than age sixty-five with lung, breast, colorectal, or other gastrointestinal (GI—pancreatic, esophageal, liver, and stomach) cancers who had metastatic cancer between 1995 and 1998 and had filed Medicare claims during this period.<sup>8</sup>

We chose these cancers because they account for more than 60 percent of cancer deaths in North America and, when they are metastatic, chemotherapy is a primary component of their treatment.<sup>9</sup> We did not use data from before 1995 because of changes in recommended treatment. We defined *metastasis* as presentation with Stage IV disease, as documented by SEER abstractors within four months of diagnosis, or documentation of two or more Medicare claims separated by thirty days for a secondary cancer site.<sup>10</sup>

We studied only patients with metastatic disease because such patients have a relatively short expected survival time, regardless of treatment. In other words, we expected little effect on outcomes from any variation in treatment. Moreover, treatment options are less

standardized than in early stages, when cure is the goal. Thus, observed treatment differences across metastatic patients, in contrast to those at earlier stages of the disease, are more likely to result from physicians' decisions and patients' preferences than from unobservable differences in health. And since patients' preferences are unlikely to vary systematically with financial incentives, any relationship between treatment and reimbursement is most likely attributable to the physician's response.

*Outcomes studied.* We analyzed whether the patient received chemotherapy treatment in the three-month period after a metastatic cancer diagnosis, conditional on the patient's surviving at least twenty-eight days, not having been in chemotherapy treatment three months prior to this diagnosis, and not entering hospice. Patients were deemed to have received any chemotherapy if they had a single claim for a chemotherapy-related code.<sup>11</sup>

Specific agents (J9s) were identified from outpatient settings (Physician/Supplier [NCH] or Outpatient [OUTPT] files); drugs administered to inpatients are not recorded on the claim because they are bundled with the diagnosis-related group (DRG) payment. We included anti-emetics that could be administered intravenously and were thus reimbursed by Medicare, as well as calcium leucovorin, which is given intravenously with chemotherapy agents such as fluorouracil.<sup>12</sup>

In addition to analyzing whether reimbursement affected the likelihood of chemotherapy, we also analyzed the costliness of the agents used when chemotherapy was prescribed. Reimbursement amounts were garnered from the NCH files only, because drug payments cannot be identified in institutional claims. We excluded the roughly 15 percent of reimbursements for (J9) chemotherapy claims with unidentified agents (J9999) because we could not determine the drugs used or their standard dosages.

To remove variability in spending caused by patient-specific dosing—which is affected by the patient's height, weight, and organ functioning—and the number of doses a patient received—which is affected by therapy tolerance

and response—we defined the initial treatment regimen as the combination of chemotherapeutic agents, anti-emetics, and leucovorin administered to the patient within the first twenty-eight days after a metastatic cancer diagnosis. Each regimen was treated as if a standard quantity were administered by assuming that (1) each drug was given according to the most common dose and schedule recommended in the Dana-Farber Cancer Institute's Oncology Protocol System; and (2) each patient had a body surface area of 1.7 m<sup>2</sup>. Anti-emetics were dosed in combination with the highest-frequency-dosed chemotherapy agent a patient received.

Each standardized dose was then priced using the average "national" (across all SEER regions) reimbursement for that agent within a tumor site and year and summed for all drugs a patient received.<sup>13</sup> Because we used national average prices to determine expenditure, any variation across patients is attributable to the drugs prescribed rather than the prices paid to physicians. Furthermore, by standardizing dosages, this measure captures a physician's initial regimen choice, rather than any adjustments dictated by a patient's tolerance of and response to treatment.

*Explanatory variables.* To measure how generously each physician was reimbursed, we defined a summary measure or index for the regimens prescribed for a given tumor site in a given year. The index was the sum of the weighted average difference between the physician's and the national mean reimbursement for each agent the physician prescribed, where the weights were the ratio of national spending on a regimen to total spending on all chemotherapy regimens for that tumor site.<sup>14</sup> In some analyses we deflated the index by Medicare's 1997 Geographic Practice Cost Index (GPCI) for the relevant region, to account for variation across regions in the cost of administration. In summary, this index captured how generously an individual physician was reimbursed relative to the national average for the set of agents that physician prescribed.

*Statistical analyses.* To model the impact of reimbursement generosity on a patient's likeli-

hood of chemotherapy treatment, we used probit regressions with provider-specific random effects. Our models include year-indicator variables to control for national trends in treatment patterns.<sup>15</sup> We also controlled for patients' age and age squared, year of metastatic cancer diagnosis, sex, race (white, black, Asian, Hispanic, or other), marital status (single, married, separated/divorced, or widowed), tumor grade (well, moderately, or poorly differentiated; undifferentiated; or unknown), census tract per capita income or the state average if missing; and a dummy variable for whether the state average income was used. Comorbidities were identified from diagnostic billing codes in both inpatient and outpatient claims, assigned scores based on severity, and then summed to form an index, called the Deyo-Charlson score.<sup>16</sup> When we estimated results across all tumor sites, we also included indicator variables for tumor site.

To estimate the impact of the reimbursement generosity on the costliness of chemotherapeutic agents prescribed, we used linear regressions with provider-specific random effects. We conducted our analysis pooling across tumor sites as well as separately by site,

since the types and costs of regimens varied markedly by cancer site. We included year-indicator variables in all models and controlled for the same set of patient characteristics as in the probability-of-chemotherapy models.

## Results

■ **Chemotherapy use.** Almost half of the sample presented with Stage IV disease at diagnosis (SEER stage distant), although this proportion varied considerably across tumor sites. About 40 percent of the sample was treated with chemotherapy (Exhibit 1). Breast cancer patients were much less likely than others to receive chemotherapy, possibly because of the hormone therapy option, which we cannot observe in Medicare claims. Lung cancer patients also had relatively low chemotherapy rates, likely because chemotherapy was just gaining acceptance for this group during the study period.<sup>17</sup>

Overall and within tumor sites, we did not find measurable effects of variation in reimbursement on the likelihood of treatment (Exhibit 2). In fact, only in the case of breast cancer did the estimated effect of reimbursement generosity on the likelihood of chemotherapy treatment go in the expected positive direc-

### EXHIBIT 1 Characteristics Of End-Stage Cancer Patients, Overall And By Site Of Cancer, 1995-1998

	Overall	Breast	Colorectal	Other GI	Lung
Index of physician reimbursement 28-day spending on chemotherapy	0.697 (15.4) \$2,103 (\$2,215)	0.014 (1.76) \$848 (\$767)	0.103 (0.113) \$733 (\$661)	3.43 (46.4) \$1,443 (\$1,423)	0.919 (11.5) \$3,675 (\$2,421)
Chemo within 3 months	41%	25%	53%	50%	42%
Age (years)	74 (5.73)	74 (5.99)	75 (6.00)	74 (5.50)	74 (5.39)
Percent male	39	0	46	56	54
SEER stage <sup>a</sup>					
Local	20%	46%	15%	14%	10%
Regional	34	40	48	28	24
Distant	46	14	37	59	66
Deyo-Charlson score	.292 (.623)	.188 (.515)	.239 (.555)	.355 (.739)	.363 (.671)
Observations	9,357	2,246	2,173	544	4,014

**SOURCE:** Surveillance, Epidemiology, and End Results (SEER) program. Coexisting illness and treatment came from both SEER and Medicare-linked claims, 1995-1998.

**NOTES:** Standard deviations are in parentheses. GI is gastrointestinal.

<sup>a</sup>SEER stage of tumor is given at first diagnosis.

**EXHIBIT 2**  
**Effect Of A One-Standard-Deviation Increase In The Mean Reimbursement Index On The Probability Of Chemotherapy Treatment**

	Overall	Breast	Colorectal	Other GI	Lung
Excess reimbursement index	-0.008 [-.0013] (1.35)	0.011 [.020] (1.06)	-0.15 [-.032] (1.08)	-0.025 [-.0016] (1.30)	-0.0008 [-.0002] (0.08)
Treatment rate	0.411	0.253	0.525	0.496	0.418
Sample size	9,357	2,246	1,822	984	4,014

**SOURCE:** Surveillance, Epidemiology, and End Results (SEER) program. Coexisting illness and treatment came both from SEER and Medicare-linked claims, 1995–1998.

**NOTES:** The percentage increase in price associated with a one-standard-deviation increase in the reimbursement index is 0.114, 0.008, 0.866, and 0.223 for breast, colorectal, gastrointestinal (GI), and lung cancer patients, respectively. Probit coefficients for the estimated effect of a variable are in brackets. Z statistics from Probit coefficients in are parentheses.

tion, with a one-standard-deviation increase in the excess reimbursement index increasing the probability of chemotherapy treatment by an insignificant 0.011, or 1.1 percentage points off a base chemotherapy treatment rate of 25 percent. Based on the upper limit of a 95 percent confidence interval (CI) for the breast cancer effect, it is unlikely that the true effect exceeds 3.1 percentage points [0.031 = 0.011 + 1.96(0.011/1.06)]. For colorectal, GI, and lung cancer, the upper limits of the 95 percent CI imply effects no larger than 1.2, 1.3, and 1.9 percentage points, respectively.

Results were qualitatively similar when we deflated the reimbursement index by Medicare’s GPCI. In all cases, we could rule out large effects of reimbursement on chemotherapy treatment, with the upper limits of the 95 percent CIs indicating effects no larger than 3.1 percentage points for breast cancer and less than 2.0 percentage points for the other cancer sites. Results were also similar when we restricted the sample to those who initially presented with Stage IV disease or considered the probability of chemotherapy treatment within twenty-eight days rather than three months of diagnosis (results not shown).

■ **Costliness of agents used.** Monthly chemotherapy spending varied markedly across tumor sites (Exhibit 1). Patients with metastatic breast and colorectal cancer, on average, received regimens that cost less than \$1,000 per month, whereas the regimens prescribed to other GI cancer patients cost on av-

erage \$1,400 per month and to lung cancer patients, more than \$3,600 per month.

The reimbursement index had a clear effect on the costliness of chemotherapeutic agents prescribed (Exhibit 3). More generously reimbursed providers prescribed more-costly regimens to breast ( $p < .038$ ), colorectal ( $p < .079$ ), and lung ( $p < .039$ ) cancer patients. In contrast, more generously reimbursed providers prescribed less costly regimens to metastatic GI cancer patients ( $p < .038$ ). For breast cancer patients, a one-dollar increase in a physician’s reimbursement resulted in the use of agents that cost twenty-three dollars more. Another way to interpret the values in the exhibit is to estimate the effect of a one-standard-deviation increase in the index. Among breast cancer patients receiving chemotherapy, a one-standard-deviation increase in the reimbursement index (2.89, data not shown) was associated with a \$67 increase in spending on chemotherapeutic agents (evaluated by multiplying 2.89 by the regression coefficient of 23.1). For colon and lung cancer patients, a one-standard-deviation increase in physicians’ reimbursement index (1.14 and 33.9, respectively) raised spending by \$40 and \$150, respectively. With average chemotherapy spending of \$858, \$705, and \$3,772 for breast, colon, and lung cancer patients, respectively, such increases would raise spending 4–8 percent.

These results were even stronger and more precise when we used the GPCI to deflate the reimbursement index and projected chemo-

### EXHIBIT 3

#### Effect Of Excess Reimbursement For Chemotherapy Drugs On Spending, By Site Of Cancer, 1995–1998

	Not deflated				
	Overall	Breast	Colorectal	Other GI	Lung
Excess reimbursement index	2.82 (1.16)	23.1 (2.08)	35.5 (1.76)	-6.33 (2.08)	13.0 (2.06)
	Deflated using Medicare's 1997 practice expense GPCI				
Excess reimbursement index	2.90 (1.20)	29.9 (3.19)	44.1 (2.62)	-7.35 (2.58)	15.4 (2.40)
Sample size	3,170	492	919	375	1,384

**SOURCE:** Surveillance, Epidemiology, and End Results (SEER) program. Coexisting illness and treatment came both from SEER and Medicare-linked claims, 1995–1998.

**NOTES:** T statistics are in parentheses. GI is gastrointestinal. GPCI is Geographic Practice Cost Index.

therapy spending (Exhibit 3). We could not know the administrative costs of each physician, but because any practice cost deflator should apply to only administrative costs and not the cost of the drug itself, the results with and without the practice cost deflator should bound the true effect of variation in reimbursement.

### Discussion

We found no evidence that reimbursement incentives affected oncologists' decisions to administer chemotherapy to metastatic cancer patients. Once a decision to give chemotherapy was taken, however, physicians receiving more-generous Medicare reimbursements used more-costly treatment regimens. Except for the noncolorectal GI cancer site, which was so heterogeneous that such patients might not have been well characterized in our data, these results were similar whether aggregated or stratified by tumor site.

■ **Study limitations.** Our study has some limitations. To ascertain chemotherapy, we relied on claims data, which are not created for research and could be less accurate than desired. Claims-based comorbidity measurement is not the same as performance status, on which clinicians make treatment decisions.

The use of Medicare data limited us to elderly patients, and practice patterns and incentives might differ for younger, commercially insured patients. Nonetheless, many commercial insurance companies also base re-

imbursement rates on AWP. A survey of thirty-two health plans found that many reimbursed for chemotherapy drugs at 95 percent of AWP, but others reimbursed at rates as low as 75 percent, and still others at rates as high as 125 percent.<sup>18</sup> If our results generalize to the commercially insured, they suggest that the administration of chemotherapy to such patients should be little affected by such variation, but the mix of agents may well respond.

■ **Policy implications.** As noted in the introduction, Medicare no longer uses AWP as a basis for reimbursement. Our results suggest that rates of chemotherapy administration will not change much, provided that oncologists continue to accept Medicare patients. On the other hand, since physicians will no longer differentially profit from using particular agents, this new reimbursement method could modify the mix of chemotherapy drugs used.

Oncologists are loath to acknowledge that financial motives can affect treatment decisions. Although reimbursement seems to have little effect on the primary decision to administer palliative chemotherapy to patients with advanced solid tumors, it appears to affect the choice of drugs used.

Oncologists have maintained that in the past, the markup on the drugs compensated for Medicare's prior failure to reimburse for the cost of administering the drug. In response, Medicare now pays a fee for administration but, as noted above, reimburses the drug at a 6 percent markup over what the physician paid

for it. These changes should make choice of agents based more on clinical considerations and patients' preferences and less on reimbursement decisions.

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