

Medicare Breast Surgery Fees and Treatment Received by Older Women with Localized Breast Cancer

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Objective. To determine whether area-level Medicare physician fees for mastectomy and breast conserving surgery were associated with treatment received by Medicare beneficiaries with localized breast cancer and to compare these results with an earlier analysis conducted using small areas (three-digit zip codes) as the unit of observation.

Data Source. Medicare claims and physician survey data for a national sample of elderly (aged 67 or older) Medicare beneficiaries with localized breast cancer treated in 1994 (unweighted $n = 1,787$).

Study Design. Multinomial logistic regression analysis was used to estimate a model of treatment received as a function of Medicare fees, controlling for other area economic factors, patient demographic and clinical characteristics, physician experience, and region.

Principal Findings. In 1994, average Medicare fees (adjusted for the effects of modifiers and procedure mix) for mastectomy (MST) and breast conserving surgery (BCS) were \$904 and \$305, respectively. Holding other fees and factors fixed, a 10 percent increase in the BCS fee increased the odds of breast conserving surgery with radiation therapy relative to mastectomy to 1.34 ($p = 0.02$), while a 10 percent decrease in the MST fee increased the odds of breast conserving surgery with radiation therapy to 1.86 ($p < 0.01$).

Conclusions. Among older women with localized breast cancer, financial incentives appear to influence the use of mastectomy and breast conserving surgery with radiation therapy. This finding is consistent with the hypothesis that physicians are responsive to financial incentives when the alternative procedures have clinically equivalent outcomes and the patient's clinical condition does not dominate the treatment choice. We also find that the fee effects derived from this analysis of individual data with more precise measurement of both diagnosis and treatment are qualitatively similar to the results of the small-area analysis. This suggests that the earlier study was not severely affected by ecological bias or other data limitations inherent in Medicare claims data.

Key Words. Breast cancer, breast surgery fees, older women, economics, Medicare

Despite an increasing trend in the use of breast conserving surgery (BCS) to treat early-stage breast cancer (Silliman et al. 1997; Guadagnoli et al. 1998), substantial variability exists in use of BCS among older women (Nattinger et al. 1996; Wennberg and Cooper, 1996), with the oldest women receiving less BCS, and when treated by BCS, receiving radiotherapy less often than others (Mandelblatt et al. 2000; Busch et al. 1996; Ballard-Barbash et al. 1996). Numerous studies have examined the roles of factors such as underlying health (Silliman et al. 1997; Albain et al. 1996), age, or socioeconomic biases (Lazovich et al. 1991; Albain et al. 1996; Michalski and Nattinger 1997), physicians' attitudes toward treatment, and patient involvement in treatment decisions (Silliman et al. 1989; Liberati et al. 1987; Liberati et al. 1991), geographic variations or barriers in access to services (Farrow, Hunt, and Samet 1992; Nattinger et al. 1992; Nattinger et al. 1996; Albain et al. 1996; Osteen et al. 1994; Hand et al. 1991), and different care delivery systems (Riley et al. 1999; Potosky et al. 1997).

Only one study (Hadley, Mitchell, and Mandelblatt 2001) has investigated whether variations in Medicare's fees for BCS and mastectomy (MST) influence the surgical treatment received by elderly Medicare beneficiaries who had breast surgery. Analyzing small-area data on the percentage of elderly Medicare breast surgery patients receiving BCS in 1994, that study found that a 10 percent higher fee for BCS was associated with a 7–10 percent increase in the percentage of beneficiaries receiving BCS in an area, while a 10 percent lower MST fee increased the BCS percentage by 2–3 percent. While suggestive of a fee effect, these findings may have been influenced by several potential limitations. The results may reflect an ecological fallacy because the analysis was conducted at the area level—the

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same results may not hold for individual patients. The Medicare claims data used in the analysis were not limited to confirmed cases of newly diagnosed localized breast cancer. Thus, it was not possible to exclude cases where minimally invasive surgery was used to rule out a cancer diagnosis from those where the procedure was used as a treatment. Nor was it possible to distinguish women who received breast conserving surgery only (BCSO) from those who received breast conserving surgery plus radiation therapy (BCSRT). If there are differences in the factors that determine the receipt of either of these treatments relative to mastectomy, then the inability to distinguish between them may have biased the earlier result. In particular, it is not clear that the potential effects of the MST and BCS fees should be the same in considering these two treatments relative to mastectomy.

This research brief extends that research, offering several improvements in methodology. We analyze data for individual elderly Medicare beneficiaries with confirmed cases of newly diagnosed early-stage breast cancer. Using data on individual patients avoids the ecological fallacy. In addition, we treat BCSO and BCSRT as distinct surgical outcomes relative to MST, which allows fee effects to differ among the three possible treatment choices. We also use more refined measures of Medicare fees than the prior study. Adjusting average fees across areas for the use of modifiers and variations in specific procedure codes provides a more accurate measure of the true variation in Medicare fees for these procedures.

METHODS¹

Patient Population

The sample for this analysis was a subset of 1,787 elderly Medicare patients who were treated for early-stage (I, IIa, and IIb) breast cancer in 1994 and were part of the Breast Cancer OPTIONS (Outcomes and Preferences for Treatment in Older Women, Nationwide Study) Project. The OPTIONS sample was designed to be representative of all elderly beneficiaries with newly diagnosed, early-stage breast cancer in Medicare's fee-for-service program between 1992 and 1994. Approximately 3,800 cases were sampled over the three years. This analysis is limited to women treated in 1994 because that is the year for which the Medicare fee variables were constructed.

The sample was drawn from Medicare's database containing all (inpatient and outpatient) claims for a 5-percent random sample of all beneficiaries. Potentially eligible cases were extracted from claims with either

a breast cancer diagnosis or a breast surgery procedure code. Following earlier studies (Nattinger et al. 1992; Nattinger et al. 1996), we excluded women whose claims indicated a history of prior breast cancer, carcinoma in-situ without invasive disease, codes for metastatic disease, bilateral breast procedures, and diagnoses of breast cancer without a surgical procedure code. We also excluded women for whom breast surgery was not the primary procedure code or for whom breast cancer was not the primary diagnosis. Women younger than 67 years old were deleted in order to allow for up to two years of prior Medicare claims to evaluate the effects of preexisting health status on treatment received. Finally, we excluded women whose claims were missing a physician identifier or where the physician provider number could not be matched in the Health Care Financing Administration's (HCFA) provider database.

To confirm the cancer diagnosis and determine cancer stage, which are not available from claims, we surveyed the physicians identified from the claims. Physicians were contacted in random order until the target sample size was attained. Of those contacted, 80.7 percent provided information, while 10.6 percent were unable to supply the information requested, and only 8.7 percent refused.

Based on physicians' reviews of their medical records, we deleted women who were ineligible (no cancer, late-stage disease, secondary or recurring cancer), whose eligibility could not be determined because of missing or incomplete records, or whose Medicare beneficiary numbers could not be matched to other Medicare data. We subsequently omitted approximately 2 percent of eligible women with some missing data, rather than imputing missing values, leaving a final analytic sample included 1,787 unweighted cases who were treated in 1994.

Data Sources

Most of the variables used in the analysis were constructed from Medicare data sources: the national claims history file, which contains all inpatient and outpatient claims; the beneficiary enrollment file, which contains location and basic demographic information; and the physician provider file. Disease stage was obtained from the physician survey to verify patients' eligibility. We used the 1990 census file of population characteristics by zip code to create proxy measures of socioeconomic status. Hospital information was obtained from the American Hospital Association's Annual Survey of Hospitals.

Model Specification

The empirical specification is motivated by an economic model of the demand for and supply of treatments for localized breast cancer. A woman's demand for a particular treatment is assumed to depend on out-of-pocket costs (money price), inconvenience costs (time and difficulty of travel, needing help at home), preferences, and clinical factors (disease stage and comorbidity).

The surgeon's likelihood of recommending one treatment over another (supply) is hypothesized to depend on the expected fee for each treatment, the costs of providing alternative treatments, and physicians' preferences. This model suggests that variations in either fee, holding the other constant, may affect the treatment recommendation when clinical factors are held constant. If provider costs are higher for one treatment than for another, then there may be a tendency to offer the lower cost treatment. Last, the surgeon's experience may reflect differences in preferences for alternative treatments if, for example, older surgeons were slower to adopt the 1991 National Institutes of Health consensus guideline on the equivalency of BCS and MST in treating localized breast cancer (National Institutes of Health 1991).

Dependent Variable (Treatment Received)

We used procedure codes reported on Medicare claims to identify the treatment received, guided by current paradigms for the diagnosis and treatment of breast cancer. For example, if a woman with cancer is to have breast preservation, then the surgeon will perform an excisional biopsy. If the tissue margins are free of cancer, then this procedure serves to provide a tissue diagnosis of cancer as well as definitive treatment. Mastectomy would be done only as a follow-up procedure if the biopsy showed invasion of the tumor into the margins of excision or re-excision. If a woman with cancer is to have breast removal, then alternative diagnostic approaches, such as fine needle aspiration or core needle biopsy, would be done first to establish a pathological diagnosis before proceeding to mastectomy. Thus, expected surgical treatment influences the diagnostic approach, and the distinction between diagnosis and treatment can be blurred when the goal is breast preservation.

Taking these possible ambiguities into account, BCS was defined by HCPCS physician codes 19120, 19160, or 19162 and MST by HCPCS codes 19180, 19182, 19200, 19220, or 19240. (BCS procedure code 19125 was excluded because it is primarily a diagnostic procedure.) For women who received BCS, we searched the Medicare claims for six months following the date of surgery to determine whether there were two or more claims for

radiation therapy (RT). These cases were designated as BCSRT, and those with fewer than two RT claims as BCSO (breast conserving surgery only). If the woman had multiple BCS procedures during the year, the last procedure was used as the benchmark for identifying radiology claims. If a BCS procedure was followed by an MST procedure, the woman was classified as receiving MST.

Independent Variables—Medicare Fees for BCS and MST

Construction of the Medicare fee variables for BCS and MST from the 1994 universe of Medicare fee-for-service claims for breast surgery must address several problems:

- the amount charged by the physician may be endogenous;
- the claim provides no information on the fee for the alternative procedure, in effect, the procedure not provided;
- the dollar amounts reported on the claims are confounded by the use of modifiers that adjust the payment received based on the particular circumstances of each case; and
- there are three different procedure codes that can be used for BCS, and five for MST.

To address these problems, we constructed fee variables that measure the average amounts allowed for BCS and MST, adjusted for modifiers and differences in specific fee codes, under the Medicare fee schedule (MFS) *in the physician's geographic area*. We assumed that these measures were positively correlated with actual fees received, but were independent of the unobservable factors that may have influenced the specific procedure choice made for each patient.

In 1994 the MFS was in the third year of a five-year phase-in from Medicare's prior payment method to a fee schedule completely determined by resource-based relative values (RBRVS) and geographic cost adjustments (American Medical Association 1994). Payment levels set by the MFS were a weighted average of the fee determined by the MFS-RBRVS methodology and the updated (to 1994) 1992 transitional fee, which was also a weighted average of the MFS-RBRVS fee and the average "adjusted historical payment," which was based on average Medicare payments in 1991. If the difference between the two amounts was less than 15 percent, then the payment was set at the MFS amount. If the difference exceeded 15 percent,

then the payment was a blend of the two amounts (American Medical Association 1994).

While a physician’s own current and historical charges are probably correlated, we assume that the average payment amounts in a geographic area determined under the MFS in 1994 can be treated as exogenous to the individual physician’s treatment recommendation for a particular patient. Fee levels will also differ across areas because of the exogenous transitional phase-in. (We test the assumption of exogeneity by regressing the residuals from the treatment choice model against the independent variables in the model.) We used physicians’ three-digit zip codes to define the geographic area over which fees were measured.

The next step in constructing the fee variables was to purge the actual allowed amounts reported on the claims of the effects of modifiers. The 1994 universe of Medicare claims for breast surgery included almost 185,000 records spread over eight distinct procedure codes. Each claim can have up to two modifiers, which indicate, for example, whether the procedure was done in conjunction with other procedures or whether there was unusual complexity involved. We identified 64 different modifier codes, with 37.5 percent of claims having one modifier and 5.1 percent two modifiers.

To adjust the allowed amounts for the effects of the modifiers, we estimated a linear regression for each of the BCS and MST procedure codes of the allowed amount from the claim against dummy variables representing each possible modifier.

$$F_i = a_i + \sum b_{ij}M_j \tag{1}$$

The coefficients (b_{ij}) are estimates of the average value of modifier j for procedure code i . We then used these estimates, which were both positive and negative, to adjust the allowed amount on each claim by calculating

$$F_i^* = F_i - b_{ij}M_j - b_{ik}M_k, \quad k \neq j \tag{2}$$

where M_k and M_j are up to two different modifiers and F_i^* is the allowed amount adjusted for the effects of modifiers.

The last step in creating the fee variables was to combine the fees for the separate BCS or MST procedures into single fee variables for BCS and MST. Since fees for specific procedures vary substantially within the sets of BCS and MST codes, a simple average fee in an area would reflect both the fee schedule amount for each specific procedure code and the mix of procedures within the BCS and MST sets. To capture these two fee dimensions, we constructed separate measures of both the “pure” fees for BCS and MST, and “practice

style” variations in the intraprocedure mix of BCS and MST procedures in the area.

To construct the pure fee, we selected the most frequently performed procedure in each group (19120, removal of breast lesion, for BCS, and 19240, removal of breast, for MST) as “benchmark” procedures, and converted the other procedures into “benchmark-equivalents” by dividing their number of relative value units by the number of relative value units for the benchmark procedure.²

The average fee for BCS was then computed as the total allowed amount for all BCS procedures (adjusted for modifiers and excluding the upper and lower 1 percent of claims as possible outliers) in the area divided by the total number of “19120-equivalent” procedures. The average MST fee was computed the same way using procedure “19240-equivalents.” These variables represent pure fees that are independent of the effects of both modifiers and variations in practice style within the BCS and MST procedure sets.

To capture intraprocedure practice-style variations, we constructed two measures of the frequencies with which different procedures are provided: the ratio of high-fee BCS procedures (19162) to all BCS procedures, and the ratio of low-fee MST procedures (19180 and 19182) to all MST procedures.³ We hypothesize that these variables should each have a positive impact on the likelihood of a patient receiving BCS.

Other Independent Variables

Physicians’ treatment recommendations might also be affected by medical care input costs and by their preferences. To capture variations in input costs, we obtained from HCFA values of the Geographic Adjustment Factor (GAF) used to adjust fees in the Medicare fee schedule. The GAF for federal fiscal year 1999 is based on historical wage data from the 1990 census, rental costs from 1994, and malpractice costs from 1992–1994 (Health Care Financing Administration 2000). The GAF is a cost index with 1.00 set equal to the national average cost. Values were assigned to physicians based on their geographic area.

To control for possible variations in physicians’ preferences, we obtained the physician’s year of graduation from medical school from Medicare data. We constructed two dichotomous variables indicating whether the physician graduated from medical school between 1965 and 1979, or after 1979. We hypothesize that physicians who are more

recent graduates would have adopted the NIH guidelines more readily than older physicians who may be less prone to change their practice style (Kotwall et al. 1996).

Data on patients' actual out-of-pocket costs could not be obtained. However, out-of-pocket costs should be higher for women who do not have any supplementary insurance coverage in addition to Medicare and should be more burdensome for women with lower incomes. Since BCSRT typically has the highest out-of-pocket costs, because of coinsurance and related costs associated with multiple visits to the RT provider, we expect that women without supplementary insurance or with lower incomes should be less likely to receive BCSRT. Since we do not have any direct observations of patients' incomes or supplementary insurance, we used area-wide per capita income to capture their effects, on the assumption that women living in higher-income areas are more likely to have higher incomes and to have supplementary insurance coverage.

The distance to the nearest hospital with a radiation therapy facility represents the potential inconvenience cost of receiving RT following BCS. We identified hospitals with radiation therapy facilities (from the American Hospital Association's 1994 Annual Survey of Hospitals), and then calculated straight-line distances by applying the Pythagorean theorem to distances derived from the latitudes and longitudes of the population centroids of patients' and hospitals' five-digit zip codes.

We constructed two dichotomous variables indicating whether the cancer was stage 2a or 2b, with stage 1 as the reference group, using stage information obtained from the physician survey to determine patients' eligibility. More advanced disease stage should be associated with receiving MST.

It is generally believed that the sickest women are less likely to receive either MST or BCSRT because of the physical stresses of major surgery or a course of radiation therapy. We assumed that prior medical care use reflects both the number and severity of comorbid conditions (Bierman et al. 1999). Examination of the distribution of total Medicare payments for all covered medical services showed that 70 percent of cases had payments less than \$3,000 over the prior year. We constructed four dichotomous variables indicating whether total Medicare payments in the prior year (excluding the two weeks before the date of surgery) were between \$3,000–5,999, \$6,000–12,999, \$13,000–21,999, or exceeded \$22,000. (These boundaries correspond to approximately the 70th, 80th, 90th, and 95th percentiles of the distribution of total payments.)

Several studies have found that older women are less likely to receive BCS. This may reflect advanced age as a proxy for poorer general health, the relationship between age and mobility, or age-bias on the part of physicians. We measure age by two dichotomous variables indicating whether the woman is between the ages of 75 and 79, or 80 or older, with 67–74 as the reference group. Several studies have also shown that nonwhite women are less likely to receive mammograms, are more likely to be diagnosed at a later disease stage, and may have less information about the equivalency of BCS and MST (Chu et al. 1987; Diehr et al. 1989; Mandelblatt et al. 1995). We constructed a dichotomous variable indicating nonwhite race from information from the Medicare claims. We included an area-level measure of the proportion of adults with a college degree as a proxy for variations' in beneficiaries' educational attainment. Finally, we used census division dummy variables to control for the effects of other, unobserved factors that may influence practice patterns or styles across geographic areas.

Statistical Analysis

We used multinomial logistic regression analysis to estimate the relationships between the independent variables and the receipt of BCSO, BCSRT, or MST. Multinomial logit is appropriate because the treatment alternatives are considered clinically equivalent, and, based on consultation with several breast surgeons, are typically considered simultaneously.

RESULTS

Table 1 shows the mean values of the independent variables for all cases and by treatment received. Table 2 compares the distributions of treatments received for women grouped by quartiles of the BCS fee variable. As the BCS fee increases, the percentage of women receiving MST falls from almost 75 percent to 60 percent, while the percentages receiving each of the BCS procedures increases. The increase in the BCS fee across the groups of patients is relatively small. However, other factors, intraprocedure practice style, the practice cost index, and average distance to the nearest radiation therapy hospital, vary across the groups as well. Table 3 reports relative odds ratios calculated from the regression coefficients of the multinomial logistic regression model. The two fee variables have the expected opposite effects and are relatively similar in magnitude in both sets of comparisons (BCSRT versus MST and BCSO versus MST). A 10 percent increase in the BCS fee

Table 1: Means (Standard Deviations) by Treatment Received

Variable (Unweighted N)	Treatment Received			
	All Cases (1,796)	MST (1,218)	BCSRT (393)	CSO (185)
BCS fee (\$)	305 (40)	299 (33)	310 (42)	312 (47)
MST fee (\$)	904 (74)	892 (64)	910 (72)	917 (86)
BCS practice style (high-fee BCS codes as % of all BCS procedures)	11.2 (6.0)	11.1 (6.0)	12.2 (5.7)	11.8 (5.5)
MST practice style (low-fee MST codes as % of all MST procedures)	14.0 (7.3)	13.3 (6.7)	14.7 (7.0)	15.0 (8.6)
Geographic cost index	0.99 (0.08)	0.98 (0.07)	1.01 (0.08)	1.00 (0.09)
Distance to nearest RT hospital (miles)	16.9 (22)	18.4 (123)	13.8 (21)	14.7 (17)
Physician' year of graduation				
1965–1979	0.45	0.44	0.47	0.44
After 1979	0.23	0.22	0.26	0.25
Area per capita income (\$1,000)	14.6 (7)	14.0 (6)	16.0 (9)	15.1 (8)
Area college graduates (%)	19.7 (13)	18.8 (12)	21.7 (14)	20.2 (15)
Ages 75–79	0.28	0.28	0.29	0.23
Ages 80+	0.21	0.21	0.12	0.39
Nonwhite	0.12	0.12	0.10	0.16
Medicare payments in prior year				
\$3,000–5,999	0.16	0.16	0.17	0.14
6,000–12,999	0.13	0.14	0.12	0.15
13,000–21,999	0.07	0.07	0.07	0.10
22,000+	0.07	0.07	0.04	0.13
Stage 2a	0.36	0.38	0.30	0.35
Stage 2b	0.10	0.12	0.05	0.05
Census division				
Mid-Atlantic	0.17	0.15	0.19	0.32
S. Atlantic	0.20	0.21	0.19	0.15
E.S. Central	0.05	0.06	0.03	0.05
W.S. Central	0.09	0.10	0.07	0.05
E.N. Central	0.20	0.19	0.22	0.16
W.N. Central	0.09	0.10	0.09	0.05
Mountain	0.05	0.05	0.03	0.07
Pacific	0.10	0.09	0.12	0.11

(\$30) increases the odds of BCSRT and of BCSO relative to MST to 1.34 and 1.23, respectively. A 10 percent reduction in the MST fee (\$90) increases the relative odds to 1.86 and 1.46. These effects are statistically significant only for the comparison of BCSRT versus MST.

Table 2: Percentage Distribution of Treatment Received by BCS Fee Quartiles

<i>BCS Fee and Treatment</i>	<i>Lowest Fee Quartile</i>	<i>2nd and 3rd Fee Quartiles</i>	<i>Highest Fee Quartile</i>
Average BCS Fee	\$270	\$295	\$361
Treatment Received			
Mastectomy	74.5%	68.4%	60.1%
Breast conservation+radiation therapy	16.9%	21.8%	26.9%
Breast conservation w/o radiation	8.6%	9.8%	13.0%
Other Factors			
Average MST fee	\$835	\$893	\$1,001
BCS practice style (high-fee BCS codes as % of all BCS procedures)	8.9%	11.1%	13.3%
MST practice style (low-fee MST codes as % of all MST procedures)	12.7%	13.3%	15.6%
Geographic cost index	0.92	0.98	1.10
Distance to nearest RT hospital (miles)	22.3	14.0	8.3

The two practice style variables, which measure the intra-BCS and intra-MST procedure mix, indicate that in areas where the high-fee BCS procedure (19162) or the low-fee MST procedures (19180 and 19182) are more commonly provided, women are more likely to receive BCSRT relative to MST ($p = 0.06$). The BCS procedure mix has no impact on the relative odds of BCSO, but the MST procedure mix has a highly significant and positive effect on the odds of BCSO relative to MST.

The geographic cost index is positive, but statistically significant and relatively large in magnitude only in the BCSRT versus MST comparison. A 10 percent higher level of practice costs is associated with a BCSRT versus MST relative odds of 1.52. Since practice costs tend to be higher in more densely populated areas, this result could reflect both the general effects of population density and size, as well as the possibility that MST is relatively more costly than BCSRT in higher cost areas. This could be the case if the practice cost index is more heavily weighted toward hospital input prices, since MST is predominantly an inpatient procedure. Proximity to a hospital with radiation therapy is not statistically significant.

The fee and cost variables have large positive correlations of 0.83 and 0.86. The procedure mix and distance variables are also area-level measures and have correlations between 0.18 and 0.35 with each other and with the fee and cost variables. To test the sensitivity of the parameter estimates,

Table 3: Relative Odds of Alternative Treatments (Unweighted $n = 1,786$)

Variable ^a	<i>BCSRT versus MST</i>		<i>BCSO versus MST</i>	
	Relative Odds	P-value	Relative Odds	P-value
BCS fee (10% increase)	1.34	0.02	1.23	0.23
MST fee (10% decrease)	1.86	<0.01	1.46	0.23
BCS practice style ^{b,d}	1.24	0.06	0.92	0.63
MST practice style ^{a,d}	1.19	0.06	1.42	0.01
Geographic cost index ^e	1.52	0.01	1.08	0.74
Distance to nearest RT hospital ^f	1.10	0.14	1.12	0.26
Physician' year of graduation				
1965–1979	1.48	0.01	1.07	0.74
After 1979	1.69	<0.01	1.49	0.09
Area per capita income (\$1,000) ^e	1.04	0.06	1.05	0.11
Area College Grads ^e (%)	1.01	0.87	0.83	0.12
Ages 75–79	0.86	0.27	1.15	0.53
Ages 80+	0.44	<0.01	2.76	<0.01
Nonwhite	0.83	0.34	1.76	0.03
Medicare payments in prior year				
\$3,000–5,999	0.91	0.55	0.84	0.52
6,000–12,999	0.87	0.43	1.12	0.65
13,000–21,999	0.87	0.56	1.55	0.16
22,000+	0.44	<0.01	2.04	0.01
Stage 2a	0.52	<0.01	0.76	0.15
Stage 2b	0.26	<0.01	0.32	<0.01

Log Likelihood = 1,382; pseudo $R^2 = 0.09$; $\chi^2 = 273.95$.

Notes: a. Census division dummy variables were not statistically significant.

b. Ratio of high-fee procedure (19162) to all BCS procedures.

c. Ratio of low-fee procedures (19180,19182) to all MST procedures.

d. Increase of 1 percentage point.

e. Increase of 10 percent.

f. Decrease of 20 miles.

we reestimated the model first omitting the procedure mix variables and then also dropping the geographic cost index. Leaving out the procedure mix variables has virtually no effect on the BCSRT estimates, but reduces the BCSO fee coefficients by about one-third. Also dropping the geographic cost variable increases the BCS fee coefficient somewhat, and further reduces the effect of a reduction in the MST fee on the relative odds to 1.43 ($p = 0.06$) in the BCSRT comparison, and to 1.20 ($p = 0.53$) in the BCSO comparison.

The effects of patient characteristics are generally as expected. Nonwhite beneficiaries are 1.8 to 2.0 times more likely than white beneficiaries to receive

BCSO relative to MST or BCSRT, but only slightly less likely to receive BCSRT relative to MST. Nonwhite race could be associated with both lower education and lower rates of supplementary insurance coverage. Age, Medicare payments in the prior year, and disease stage all have highly significant effects. Women who are 80 or older, or who had very high Medicare payments in the prior year, are much more likely to receive BCSO and much less likely to receive BCSRT relative to MST. As disease stage increases, women are much less likely to receive either BCS procedure relative to MST.

DISCUSSION

Our basic finding that Medicare's fees for BCS and MST influence the surgical treatment received by elderly Medicare beneficiaries with newly-diagnosed early-stage breast cancer is consistent with and extends the results of our earlier study, which found that small-area variations in Medicare's average BCS and MST fees significantly influenced the proportion of women who received BCS in 1994 (Hadley, Mitchell, and Mandelblatt 2001). We addressed many of the potential limitations and sources of bias in the earlier analysis by using data for individual women with confirmed diagnoses of early-stage breast cancer, by isolating the effect of variations in pure fees, by distinguishing between BCSRT and BCSO, and by controlling directly for the effects of prior health condition and disease stage. Thus, the results of the current analysis reinforce the inference that variations in Medicare fees for BCS and MST may influence the treatment received in some cases.

We found that Medicare fees were significant factors in the choice between MST and BCSRT, but did not significantly influence the choice of BCSO versus MST. This may be due to both the relatively small number of women receiving BCSO, only 190 cases, and a real difference in the effect of Medicare fees on the choice between a less aggressive treatment, BCSO, and more aggressive treatments of BCSRT and MST. The results in Table 3 indicated that the oldest women (80 or older) and women with the highest medical care use (Medicare payments) in the prior year were much more likely to receive BCSO than either of the other treatments. These relationships presumably reflect differences in life expectancy and ability or willingness to tolerate the side effects associated with radiation therapy or major surgery. As such, the lack of significance of the fee variables suggests that for these women, clinical and other factors dominate the treatment choice.

If this inference is valid, then our earlier study, which could not distinguish BCSO from BCSRT, may have understated the effects of Medicare fees by combining BCSO and BCSRT cases. At the same time, however, the earlier study may have had an implicit upward bias, since it also included women who did not have cancer and for whom breast conserving surgery was a diagnostic rather than a therapeutic procedure. If the fee for BCS influences surgeons' diagnostic approach, which is a topic for future research, then the inability to exclude cancer "rule out" cases may have been another source of bias.

We also found that the treatment received may be influenced by BCS and MST intraprocedure "practice styles." Women were more likely to receive BCSRT in areas where the high-fee BCS procedure (code 19162—removal of breast lesion and axillary nodes) was a relatively high proportion of Medicare BCS procedures. Although we do not have any direct evidence that practice style is influenced by fee levels, it may be that physicians' preferences for clinically equivalent procedures follow fee differences that prevail in their areas. Another recent study found that breast surgeons' treatment propensities for BCS and MST were significantly related to Medicare fees (Mandelblatt et al. 2001).

One possible explanation for our findings is that physicians tended to charge more for the procedure that was done more often in their area. In other words, the fee variable may be endogenous. However, an indirect test of endogeneity found no correlation between any of the independent variables and the residuals in the treatment model.⁴ Moreover, even if true in the past, beginning in January 1992, the Medicare fee schedule shifted the basis of payment from physicians' own historical charges to a schedule derived from relative values based on resource costs. Thus, the difference between the average amounts paid for MST and BCS in 1994 should be relatively independent of the influence of local practice patterns.

As suggested above, our finding of a significant fee effect in the choice between BCSRT and MST may imply that physicians feel greater latitude in responding to financial incentives because BCSRT and MST have comparable survival outcomes in women with localized disease, although there is growing evidence that some quality of life outcomes are better among women treated by BCS compared to those receiving MST (Ganz et al. 1998). While our results cannot be generalized to all services, it seems plausible that fee responsiveness may be greater for services with close alternatives or for services provided in non-life threatening cases. To date, relative fees within the

Medicare fee schedule have been driven entirely by relative cost considerations, without regard to efficacy or clinical outcomes. Our findings suggest that the Medicare program could use the Medicare fee schedule to influence physicians' treatment choices in situations where the clinical outcomes of alternative treatments are similar.

Limitations

Although the analysis used data from a national sample of Medicare beneficiaries with confirmed localized breast cancer, the size of the sample was still relatively small, especially for women treated by BCSO. We were unable to measure, or may have captured incompletely, several factors, such as the distance to freestanding radiation therapy centers; providers' affiliation with teaching hospitals or medical schools; providers' costs of supplying BCS and MST; patients' incomes, education levels, and supplementary insurance coverage; and patient and provider preferences. Our sample was also limited to women in Medicare's fee-for-service program, and we did not consider any possible market-level effects of managed care penetration.

Another limitation is that our data are now ten years old. Full implementation of the Medicare fee schedule, administrative changes in payments made by Medicare, and the rapid development of a variety of financial incentive mechanisms by managed care may all have affected the extent to which our estimates can be applied to current practice. Nor can we estimate the extent to which changes in fees over time may have contributed to the substantial increase in the rate of BCS in older women. Replicating this analysis with more recent or time-series data would be useful.

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NOTES

1. For details on methodology, see Hadley et al. (2001).
2. For example, the benchmark BCS procedure has 8.43 relative value units compared to 24.21 for procedure 19162 (removal of breast tissue and nodes). Dividing one by the other converts procedure 19162 into the equivalent of 2.9 units of procedure 19120.
3. We defined these variables in this way because practice style may itself be related to the fees for the specific procedures within the BCS and MST procedure sets.
4. We regressed the residuals from the treatment model against the full set of independent variables. None of the independent variables was statistically significant. The highest t-value was 0.25 and the R^2 from the regression was only 0.0002.

REFERENCES

- Albain, K. S., S. R. Green, A. S. Lichter, L. F. Hutchins, W. C. Wood, I. C. Henderon, J. N. Ingle, J. O'Sullivan, C. K. Osborne, and S. Martino. 1996. "Influence of Patient Characteristics, Socioeconomic Factors, Geography, and Systemic Risk on the Use of Breast-Sparing Treatment in Women Enrolled in Adjuvant Breast Cancer Studies: An Analysis of Two Intergroup Trials." *Journal of Clinical Oncology* 14 (11): 3009–17.
- American Medical Association. 1994. *Medicare RBRVS: The Physicians' Guide*, 64–5. Chicago: American Medical Association.
- Ballard-Barbash, R., A. L. Potosky, L. C. Harlan, S. G. Nayfield, and L. G. Kessler. 1996. "Factors Associated with Surgical and Radiation Therapy for Early Stage

- Breast Cancer in Older Women." *Journal of the National Cancer Institute* 88 (11): 716–26.
- Bierman, A., T. A. Bulboz, E. Fisher, and J. Wasson. 1999. "How Well Does a Single Question about Health Predict the Financial Health of Managed Care Organizations?" *Effective Clinical Practice* 2 (2): 56–62.
- Busch, E., K. Kemeny, A. Fremgen, R. T. Osteen, D. P. Winchester, and R. E. Clive. 1996. "Patterns of Breast Cancer Care in the Elderly." *Cancer* 78 (1): 101–11.
- Chu, J., P. Diehr, P. Feigle, G. Glaefke, C. Begg, A. Ghcksmann, and L. Ford, 1987. "The Effect of Age and Race on the Care of Women with Breast Cancer in Community Hospitals." *Journal of Gerontology* 42 (2): 185–90.
- Diehr, P., J. Yergen, H. Chu, P. Feigle, G. Glaefke, R. Moe, and M. Bergner. 1989. "Treatment Modality and Quality Differences for Black and White Breast Cancer Patients Treated in Community Hospitals." *Medical Care* 27 (10): 942–8.
- Farrow, D. C., W. C. Hunt, and J. M. Samet. 1992. "Geographic Variation in the Treatment of Localized Breast Cancer." *New England Journal of Medicine* 326 (17): 1097–101.
- Ganz, P. A., J. H. Rowland, K. Desmond, B. E. Meyerowitz, and G. E. Wyatt. 1998. "Life after Breast Cancer: Understanding Women's Health-Related Quality of Life and Sexual Functioning." *Journal of Clinical Oncology* 16 (2): 501–14.
- Guadagnoli, E., J. C. Weeks, C. Shapiro, J. H. Gurwitz, C. Barbas, and S. B. Soumerai. 1998. "The Use of Breast Conserving Surgery for Treatment of Early Stage Breast Cancer." *Journal of Clinical Oncology* 16 (1): 101–6.
- Hadley, J., J. M. Mitchell, and J. S. Mandelblatt. 2001. "Medicare Fees and Small Area Variations in Breast Conserving Surgery among Elderly Women." *Medical Care Research and Review* 58 (3): 334–60.
- Hadley J., J. M. Mitchell, J. S. Mandelblatt, T. C. Weeks, E. Grundagnoli, and Y. T. Hwang. 2001. "Do Medicare Breast Surgery Fees Affect Treatment Received by Older Women with Localized Breast Cancer." Working paper, Institute for Health Care Research and Policy, Georgetown University, Washington, DC.
- Hand, R., S. Sener, J. Imperato, J. S. Chmiel, J. Sylvester, and A. Fremgen. 1991. "Hospital Variables Associated with Quality of Care for Breast Cancer Patients." *Journal of the American Medical Association* 226 (24): 3429–32.
- Health Care Financing Administration. 2000. "Medicare Program; Revisions to Payment Policies under the Physician Fee Schedule for Calendar Year 2001; Final Rule." *Federal Register* 65 (212): 65,404.
- Kotwall, C. A., D. L. Covington, R. Rutledge, M. P. Churchill, and A. A. Meyer. 1996. "Patient, Hospital, and Surgeon Factors Associated with Breast Conservation Surgery." *Annals of Surgery* 224 (4): 419–26.
- Lazovich, D., E. White, D. B. Thomas, and R. E. Moe. 1991. "Underutilization of Breast Conserving Surgery and Radiation Therapy among Women with Stage I or II Breast Cancer." *Journal of the American Medical Association* 266 (24): 3433–8.
- Liberati, A., G. Apolone, A. Nicolucci, C. Confalonieri, R. Fossati, R. Grilli, V. Torri, P. Mosconi, and A. Alexanian. 1991. "The Role of Attitudes, Beliefs, and

- Personal Characteristics of Italian Physicians in the Surgical Treatment of Early Breast Cancer." *American Journal of Public Health* 81 (2): 38–42.
- Liberati, A., W. B. Patterson, L. Biener, and B. J. McNeil. 1987. "Determinants of Physicians Preferences for Alternative Treatments in Women with Early Breast Cancer." *Tumori* 73 (6): 601–9.
- Mandelblatt, J. S., H. Andrews, R. Kao, R. Wallace, and J. F. Kerner. 1995. "Impact of Access and Social Context on Breast Stage at Diagnosis." *Journal of Health Care for Poor and Underserved* 6 (3): 342–51.
- Mandelblatt, J. S., C. D. Berg, N. J. Meropol, S. B. Edge, K. Gold, Y. T. Hwang, and J. Hadley. 2001. "Measuring and Predicting Surgeons' Practice Styles for Breast Cancer Treatment." *Medical Care* 39 (3): 228–42.
- Mandelblatt, J. S., J. Hadley, J. F. Kerner, K. A. Schulman, K. Gold, J. Dunmore-Griffith, S. Edge, E. Guadagnoli, J. J. Lynch, N. J. Meropol, J. C. Weeks, and R. Winn. 2000. "Patterns of Breast Carcinoma Treatment in Older Women: Patient Preference and Clinical and Physical Influences." *Cancer* 89 (3): 561–73.
- Michalski, T. A., and A. B. Nattinger. 1997. "The Influence of Black Race and Socioeconomic Status on the Use of Breast-Conserving Surgery for Medicare Beneficiaries." *Cancer* 79 (2): 314–9.
- Nattinger, A. B., M. S. Gottlieb, R. G. Hoffman, A. P. Walker, and J. S. Goodwin. 1996. "Minimal Increase in the Use of Breast-Conserving Surgery from 1986–1990." *Medical Care* 34 (5): 479–89.
- Nattinger, A. B., M. S. Gottlieb, J. Veum, D. Yahnke, and J. S. Goodwin. 1992. "Geographic Variation in the Use of Breast-Conserving Treatment for Breast Cancer." *New England Journal of Medicine* 326 (17): 1102–7.
- National Institutes of Health Consensus Conference. 1991. "Treatment of Early Breast Cancer." *Journal of the American Medical Association* 265 (3): 391–5.
- Osteen, R. T., D. P. Winchester, D. H. Hussey, R.E. Clive, M. A. Friedman, B. Cady, J. S. Chmiel, W. G. Kragbill, M. M. Unist, and R. L. Doggett. 1994. "Insurance Coverage of Patients with Breast Cancer in the 1991 Commission on Cancer Patient Care Evaluation Study." *Annals of Surgical Oncology* 1 (6): 462–7.
- Physician Payment Review Commission. "Physician Payment under the Medicare Fee Schedule." In *Annual Report to Congress*, pp. 29–56. Washington, DC: Physician Payment Review Commission.
- Potosky, A. L., R. M. Merrill, G. F. Riley, S. H. Taplin, W. Barlow, B. H. Fireman, and R. Ballard-Barbash. 1997. "Breast Cancer Survival and Treatments in Health Maintenance Organizations and Fee-for-Service Settings." *Journal of the National Cancer Institute* 89 (22): 1683–91.
- Riley, G. F., A. L. Potosky, C. N. Klabunde, J. L. Warren, and R. Ballard-Barbash. 1999. "Stage at Diagnosis and Treatment Patterns among Older Women with Breast Cancer: An HMO and Fee-for-Service Comparison." *Journal of the American Medical Association* 281 (8): 720–6.
- Silliman, R. A., E. Guadagnoli, A. B. Weitberg, and V. Mor. 1989. "Age as a Predictor of Diagnostic and Initial Treatment Intensity in Newly Diagnosed Breast Cancer Patients." *Journal of Gerontology* 44 (2): M46–50.

- Silliman, R. A., S. L. Troyan, E. Guadagnoli, S. H. Kaplan, and S. Greenfield. 1997. "The Impact of Age, Marital Status, and Physician–Patient Interactions on the Care of Older Women with Breast Carcinoma." *Cancer* 80 (7): 1326–34.
- U. S. House of Representatives, Committee on Ways and Means. 1993. "Medicare Reimbursement to Physicians in 1993." In *The Green Book*, p. 407. Washington, DC: U. S. Government Printing Office.
- Wennberg, J. E., and M. M. Cooper. 1996. *Dartmouth Atlas of Health Care Use in the United States*. Chicago, IL: American Hospital Association Publishing.