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Quality Of Breast Cancer Care In The US Territories: Insights From Medicare

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Abstract

The quality of breast cancer care among Medicare beneficiaries in the US territories—where federal spending for health care is lower than in the continental US—is unknown. We compared female Medicare beneficiaries who were residents of the US territories and had surgical treatment for breast cancer in 2008–14 to those in the continental US in terms of receipt of recommended breast cancer care (diagnostic needle biopsy and adjuvant radiation therapy [RT] following breast-conserving surgery) and the timeliness (time from needle biopsy to surgery and from surgery to adjuvant RT) of that care. Residents of the US territories were less likely to receive recommended

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care (24 percent lower odds of receiving diagnostic needle biopsy and 34 percent lower odds of receiving adjuvant RT) and to receive timely care (45 percent lower odds of receiving surgery and 82 percent lower odds of receiving adjuvant RT, both within three months). Further research is needed to identify barriers to the provision of adequate and timely breast cancer care in this unique population.

The quality of breast cancer care in the US has largely been characterized among women residing in the contiguous US, with little known about care among women residing in the US territories, which constitute a geographically isolated region with an understudied population. The US territories (which we defined as American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, the US Virgin Islands, and the Commonwealth of Puerto Rico) are under the jurisdiction of the US government and home to nearly five million people who primarily identify themselves as belonging to racial/ethnic minority groups.¹ Some US territories have limited availability of basic medical services and geographic barriers to accessing optimal care for chronic conditions.^{2,3} Thus, the US territories provide a unique geographic area and population in which to examine the quality of breast cancer care.

Access to health insurance has been shown to be a major contributor to disparities.⁴ Federal insurance reimbursement rates in the US territories are lower than those in the continental US (that is, the forty-eight contiguous states, Alaska, and the District of Columbia), and the territories are also subjected to federal spending caps for Medicaid assistance.⁵ Territories such as Puerto Rico, where over 70 percent of Medicare beneficiaries depend on subsidies,⁶ have accumulated a large debt by borrowing to pay for health care.⁷ Other US territories, such as Guam and the Northern Mariana Islands, have limited health care access and infrastructure compared to the continental US.⁸ A study of hospitalized Medicare beneficiaries found US territory hospitals to have significantly worse outcomes and performance on core process-of-care measures for acute cardiac and pulmonary-related hospitalizations, compared to hospitals in the continental US.⁹ These regional differences in care between the US territories and the continental US may also extend to differences in the quality of care provided for chronic conditions such as breast cancer.

An important domain of the quality of breast cancer care is the receipt of recommended care processes such as diagnostic needle biopsy and adjuvant radiation therapy (RT). As the “gold standard” for an initial diagnosis of breast cancer,^{10,11} needle biopsies are less invasive and allow for accurate diagnosis, compared to open biopsies.¹² As part of evidence-based quality standards, adjuvant RT is recommended following breast-conserving surgery (BCS).¹³ Prior studies have demonstrated disparities in the receipt of needle biopsy¹⁰ and adjuvant RT by race/ethnicity.¹⁴ Timeliness is another integral part of cancer care, as treatment delays can cause psychological stress¹⁵ and contribute to poor clinical outcomes,¹⁶ including local recurrence.¹⁷ To address the lack of knowledge about the quality of breast cancer care in the US territories, we used a national sample of Medicare beneficiaries to assess the receipt and timeliness of recommended breast cancer care—as indicators of quality—among residents of US territories relative to those of the continental US.

Study Data And Methods

Data Source And Study Sample

This retrospective study used data from the Chronic Conditions Data Warehouse of the Centers for Medicare and Medicaid Services. The warehouse includes 100 percent of Medicare beneficiaries' institutional and noninstitutional claims data.¹⁸ We identified female fee-for-service Medicare beneficiaries who were ages sixty-six and older; who had an *International Classification of Diseases*, Ninth Revision (ICD-9), diagnosis code for breast cancer; and who received surgical treatment (BCS or mastectomy) in the period January 2008–June 2014. We used a variation of a validated algorithm by Ann Nattinger and coauthors to identify women with incident breast cancer.¹⁹ To be included in our sample, women had to have twelve months of claims data before surgery, so that we could assess comorbidity after the women became eligible for Medicare at age sixty-five. Comorbid conditions were added to multivariate models to control for covariates associated with residence status to assess the independent association between residence and each outcome, as described in the Statistical Analysis section. These models controlled for covariates associated with residence status, such as comorbidity, as well as factors that could alter the association between residence status and the receipt and timeliness outcomes. Our eligible sample was divided into two groups based on the Medicare state code of residence in the year before breast surgery: residents of the US territories and those of the continental US.

This study was approved by the Yale School of Medicine Human Investigations Committee.

Construction Of Variables

Our primary analysis included four metrics of the quality of breast cancer care: receipt of needle biopsy, receipt of adjuvant RT following BCS, time to breast surgery, and time to adjuvant RT. Use of needle biopsy was ascertained by identification of all needle biopsy claims up to twelve months before surgical treatment, using ICD-9 and Healthcare Common Procedure Coding System (HCPCS) codes (see online appendix exhibit A1).²⁰ The claim closest to the date of breast cancer surgery was used for women with multiple biopsy claims. Among women treated with BCS who did not receive adjuvant chemotherapy following surgery, we used receipt of adjuvant RT (shown by HCPCS codes for any claim within six months of BCS) to indicate the receipt of external beam RT, intensity-modulated RT, or brachytherapy. Women who received external beam or intensity-modulated RT had to receive at least four treatments to be considered adjuvant RT patients.

For timeliness of care, we calculated the time from the date of needle biopsy to definitive breast surgery (BCS or mastectomy) among women not treated with chemotherapy before surgery. We then used periods of one and three months to dichotomize the outcome as “timely care” (in other words, coded as 1 if the outcome happened within the specified time point and 0 if it did not). Among women ages 66–74 who received BCS, we determined the time between the date of BCS and that of the initial RT claim and dichotomized the outcome using two and three months as benchmarks. Clinically relevant benchmarks for treatment with breast surgery and adjuvant RT have yet to be clearly defined, although shorter intervals appear to be most beneficial,^{21,22} including one and three months after diagnosis.^{15,23}

Intervals between BCS and adjuvant RT longer than eight weeks have been suggested to increase the five-year rate of local recurrence.²⁴ A period of three months is also frequently used when assessing the timeliness of adjuvant RT, as delays beyond this may increase breast cancer–specific and overall mortality.^{25,26}

Comorbid conditions, based on the Elixhauser Comorbidity Index,²⁷ were identified using inpatient and outpatient claims billed between twelve months and one month before breast surgery. ICD-9 codes that appeared at least once on an inpatient claim or at least two times on outpatient or physician claims billed at least thirty days apart were used to identify comorbid conditions.²⁸ We also considered receipt of chemotherapy, in terms of patients who received no chemotherapy during the study period, chemotherapy one to ninety days before breast surgery (neo-adjuvant), and chemotherapy up to six months after surgery (adjuvant).

Statistical Analysis

We examined the distribution of selected demographic and clinical characteristics among residents of the US territories and those of the continental US. In a bivariate analysis, we assessed differences in the receipt and timeliness of recommended breast cancer care by place of residence using chi-square and Mann-Whitney U tests. We used logistic regression to estimate the independent association between place of residence and receipt of recommended care. Separate models were generated for receipt of needle biopsy and adjuvant RT, and for timing of breast surgery and adjuvant RT. Covariates included age at the time of surgery, having had screening mammography within the year before breast surgery, having comorbid conditions, and year of breast surgery. For the timeliness-of-care models, we also adjusted for type of breast surgery (BCS versus mastectomy) and use of neo-adjuvant chemotherapy for time to surgery, and use of adjuvant chemotherapy for time to RT.

We also examined results for residents of Puerto Rico (the territory with the most residents) alone and adjusted for race, education, and income (appendix exhibits A2 and A3).²⁰ Our final model included residents of all US territories and excluded sociodemographic factors, as they did not change the model estimates, as shown in exhibits A2 and A3.²⁰ In a subanalysis, we used a more affluent island region covered by Medicare, comparing beneficiaries in the state of Hawaii (a remote island region with a stronger economic and health care infrastructure than the US territories)⁸ to the continental US (appendix exhibits A2 and A3).²⁰

We considered *p* values less than 0.05 for results of the chi-square and Mann-Whitney U tests to be significant. Analyses were performed using SAS, version 9.2.

Study Results

We identified 568 US territory and 259,015 continental US beneficiaries who received breast cancer surgery. More than 60 percent of the territory residents were in the lowest quintile of median household income, compared to approximately 20 percent of continental US residents (exhibit 1). Just over a third of the territory residents had received screening

mammography in the year before breast surgery, compared to two-thirds of women residing in the continental US. Overall, 62.4 percent of women in our sample were treated with BCS. Of these women, 2.9 percent received chemotherapy before breast surgery, while 17.2 percent received chemotherapy in the six months following surgery (also known as adjuvant chemotherapy). Nearly three-quarters of the women from the US territories resided in Puerto Rico, although exhibit 1 does not identify residents by territory.

Receipt Of Recommended Care

Compared to residents of the continental US, a smaller proportion of territory residents received needle biopsy (84.5 percent and 77.6 percent, respectively) (exhibit 2). And among women ages 66–74 who had BCS, a higher proportion of factors, as they did not change the model estimates, as shown in ef continental US residents received adjuvant RT, compared to those in the US territories (84.5 percent and 73.5 percent, respectively).

In an adjusted analysis, we found that territory residents had lower odds of receiving a needle biopsy (odds ratio: 0.76; 95% confidence interval: 0.62, 0.93) or adjuvant RT (OR: 0.66; 95% CI: 0.45, 0.98) after BCS, compared to continental US residents (exhibit 3).

Delays In Care

Territory residents had longer median intervals between needle biopsy and breast surgery (35 days; interquartile range [IQR]: 22–51), compared to residents of the continental US (25 days; IQR: 16–37; $p < 0.001$) (data not shown). A smaller proportion of territory residents had breast surgery within one month or three months following diagnosis by needle biopsy, compared to continental US residents (exhibit 2). In adjusted models, territory residence was significantly associated with lower odds of receiving breast surgery within one month (OR: 0.42; 95% CI: 0.35, 0.51) or three months (OR: 0.55; 95% CI: 0.37, 0.82) of a needle biopsy, compared to continental US residents (exhibit 4).

Among women who had BCS, the wait time for adjuvant RT was longer for territory residents, compared to continental US residents (median: 68 days [IQR: 41–92] versus 44 days [IQR: 33–59]; $p < 0.001$) (data not shown). In adjusted models, territory residents maintained lower odds of receiving adjuvant RT within two months (OR: 0.24; 95% CI: 0.16, 0.36) or three months (OR: 0.18; 95% CI: 0.11, 0.28) of BCS (exhibit 4).

Compared to the continental US, we found no disparity in the receipt and timeliness of care in our subanalysis of residents of Hawaii (appendix exhibits A2 and A3).²⁰

Discussion

In this analysis of Medicare data, the single largest payer for cancer care in the US,²⁹ we found that the quality of breast cancer care—as measured by receipt and timeliness of care—for beneficiaries residing in the US territories was inferior to that of the care received by women in the continental US. Specifically, territory residents were less likely to receive both needle biopsy and adjuvant radiation therapy following breast-conserving surgery and experienced significant delays in both surgical and radiation treatment. Studies of the quality of breast cancer care have largely characterized differences by racial/ethnic and

socioeconomic factors. For instance, forgoing adjuvant RT has been correlated with lower income and black race, even after adjustment for socioeconomic factors.^{14,30–33} Disparities in the timeliness of breast cancer care among black and Hispanic women^{30,34} have been shown to contribute to poor survival relative to their white counterparts,³⁴ with similar findings observed in the Medicare population.²¹ Although we cannot rule out the impact of these factors, our analysis provides novel insights and extends the assessment of disparities in the quality of breast cancer care to older women in the US territories.

Our study builds upon recent work suggesting that residence in a territory is associated with worse overall health care quality. Prior work has shown that Medicare Advantage beneficiaries in Puerto Rico experienced worse quality of care related to diabetes mellitus, cardiovascular disease, and appropriate medication use compared to both their non-Hispanic white and Hispanic counterparts living in the continental US.⁶

In the US territories, geographic isolation is likely not the sole driver of disparities in breast cancer care. Our analysis of residents of Hawaii—a remote island region similar to the territories yet markedly different from them in terms of socioeconomic status and health care infrastructure—did not identify disparities compared to residents of the continental US. Territory residents may face specific challenges that arise from differences in the availability of treatment facilities,² specialists, or primary care providers.³³ National data indicate that Puerto Rico has fewer registered nurses and emergency medicine specialists compared to the remainder of the United States.³⁵ In Puerto Rico, even before the devastating storms of 2017, a declining economy and low reimbursement rates had led to a mass exodus of health care providers to the continental US.^{7,36,37} In the current study, evidence of these challenges may be seen in the stark differences in screening mammography rates between the continental US (66 percent) and the territories (34 percent).

Differential implementation of Medicare and Medicaid in the territories relative to the continental US could also contribute to differences in quality between the two regions.³⁵ Compared to US states, the territories receive much lower per capita funding for Medicaid³⁸ and less than half of what an average state receives for Medicare.³⁵ Only residents of one territory—the Northern Mariana Islands—are eligible for Supplemental Security Income, a federal aid program designed to help people with disabilities, low incomes, or both.³⁹ This is relevant given the economic burden of breast cancer and its impact on treatment approach and timeliness. Policies directed at the federal funding caps that limit health care spending in the territories² and subsidies for health services there may be integral to improving the quality of care for this unique US population. These challenges have been exacerbated in the aftermath of recent hurricanes in the US Virgin Islands and Puerto Rico and amid the contentious debate about federal aid, which could push economically unstable territories, particularly Puerto Rico, further into debt.⁴⁰

This analysis had limitations. First, we were unable to adjust for differences in tumor characteristics, such as disease stage, because of the unavailability of this information in the Chronic Conditions Data Warehouse. However, we included only women who had had surgery and therefore received curative intent treatment, and we adjusted for use of mammography and receipt of chemotherapy—which are associated with disease stage.⁴¹

Second, some residents of US territories may have obtained care in the continental US. However, without accounting for this, our results likely underestimated the disparities between the territories and the continental US in breast cancer care.

Third, Puerto Rico, the largest territory in our analysis, had the highest proportion of Medicare beneficiaries enrolled in Medicare Advantage of any US territory or state (74 percent of beneficiaries).⁶ Therefore, our findings might not apply to fee-for-service Medicare beneficiaries, who are likely more numerous elsewhere.

Fourth, the small numbers of breast cancer cases within each territory limited our ability to examine variability in the quality of breast cancer care within and across territories.

Despite these limitations, our analysis of this understudied population provides a novel and broad framework for evaluating national disparities in the receipt and timeliness of breast cancer care. An evaluation of how these disparities affect breast cancer outcomes in the US territories relative to the continental US is warranted.

Conclusion

We found that Medicare beneficiaries in the US territories were notably different from beneficiaries in the continental US in their receipt and timeliness of recommended breast cancer care. Given the impact of suboptimal breast cancer care on disease recurrence and patient outcomes, further research and policy interventions are needed to identify barriers to the receipt of appropriate and timely care among this unique population of territory residents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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NOTES

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EXHIBIT 2. Receipt and timeliness of recommended breast cancer care among women in the continental US and the US territories

SOURCE Authors’ analysis of data from the Chronic Conditions Data Warehouse of the Centers for Medicare and Medicaid Services.

NOTES Adjuvant RT is radiation therapy within six months after breast surgery. BCS is breast-conserving surgery. ^aDifference between the continental US (explained in the notes to exhibit 1) and the US territories (listed in the notes to exhibit 1) is significant ($p < 0.001$). ^bAmong women ages 66–74. ^cExcluding women who received neo-adjuvant chemotherapy (explained in the notes to exhibit 1). ^dExcluding women who received adjuvant chemotherapy (explained in the notes to exhibit 1).

EXHIBIT 3. Multivariate odds ratios for receipt of recommended breast cancer care among women in the US territories compared to those in the continental US

SOURCE Authors' analysis of data from the Chronic Conditions Data Warehouse of the Centers for Medicare and Medicaid Services.

NOTES The whiskers show 95% confidence intervals. Needle biopsy logistic regression models include all women who had breast surgery and were adjusted for age range at surgery (ages 70–74, 75–79, 80–84, and 85–94; ref: 65–69), individual binary indicators for a primary care visit and screening mammography in the year before surgery, and comorbidities (1–2 conditions and 3 or more conditions; ref: 0 conditions). Adjuvant radiation therapy (RT; explained in the notes to exhibit 2) logistic regression models include women younger than 75 who had BCS and did not receive adjuvant chemotherapy (explained in the notes to exhibit 1) and were adjusted for the factors listed above and an indicator for the use of neo-adjuvant chemotherapy (explained in the notes to exhibit 1): yes versus no chemotherapy used. The continental US and US territories are explained in the notes to exhibit 1.

EXHIBIT 4. Multivariate odds ratios for timeliness of recommended breast cancer care among women in the US territories compared to those in the continental US

SOURCE Authors' analysis of data from the Chronic Conditions Data Warehouse of the Centers for Medicare and Medicaid Services.

NOTES The whiskers show 95% confidence intervals. Breast surgery logistic regression models include all women who had breast surgery and did not receive neo-adjuvant chemotherapy (explained in the notes to exhibit 1) before and were adjusted for age range at surgery, individual binary indicators for a primary care visit and screening mammography in the year before surgery; comorbidities, and type of surgery (breast-conserving surgery [BCS] or mastectomy). Adjuvant radiation therapy (RT; explained in the notes to exhibit 2) logistic regression models include women described in the notes to exhibit 2 and were adjusted for the factors described above except for type of breast surgery, as well as an indicator for use of neo-adjuvant chemotherapy. The continental US and US territories are explained in the notes to exhibit 1.

EXHIBIT 1

Characteristics of breast cancer patients by residence in the continental US or US territories

Characteristic	Patients in:		
	All patients (N = 259,583)	Continental US (n = 259,015)	US territories (n = 568)
Race ****			
White	89.1%	89.2%	62.3%
Black	7.4	7.4	14.6
Other	3.5	3.5	23.1
Age range at time of surgery (years) **			
66–69	24.6	24.6	21.7
70–74	27.2	27.2	28.0
75–79	21.7	21.7	26.8
80–84	15.8	15.8	13.4
85–94	10.7	10.7	10.2
Adults ages 25 and older with high school education or less (quintiles) ****			
Q1 (<32%)	19.6	19.6	7.2
Q2 (32–< 44%)	19.4	19.5	6.2
Q3 (44–< 53%)	19.3	19.3	6.5
Q4 (53–< 62%)	19.0	19.0	17.1
Q5 (62% or more)	18.9	18.9	30.1
Unknown	3.8	3.8	32.9
Median patient household income (quintiles) ****			
Q1 (less than \$32,143)	19.5	19.4	62.9
Q2 (\$32,145–< \$38,299)	19.1	19.2	2.8
Q3 (\$38,302–< \$45,930)	19.0	19.0	0.0
Q4 (\$45,938–< \$58,033)	19.2	19.2	<2.0
Q5 (\$58,036 or more)	19.5	19.5	<2.0
Unknown	3.8	3.8	32.9
Had:			
Primary care provider visit within 12 months of diagnosis	96.4	96.5	96.0

Characteristic	Patients in:		
	All patients (N = 259,583)	Continental US (n = 259,015)	US territories (n = 568)
Screening mammography in the year before surgery	66.3	66.4	34.0
3 or more comorbid conditions	11.4	11.4	13.0
Type of breast surgery			
Mastectomy	37.6	37.6	38.9
Breast-conservative surgery	62.4	62.4	61.1
Chemotherapy status			
All women: had some type of chemotherapy	19.7	19.7	23.6
Women with needle biopsy			
No chemotherapy	80.0	80.0	77.0
Neo-adjuvant chemotherapy	3.0	3.0	4.0
Adjuvant chemotherapy	17.0	17.0	19.0
Radiation therapy status			
All women: had therapy	49.6	49.6	40.9

SOURCE Authors' analysis of data from the Chronic Conditions Data Warehouse of the Centers for Medicare and Medicaid Services.

NOTES The continental US refers to the forty-eight contiguous states, Alaska, and the District of Columbia. Significance refers to differences across residence, estimated using the chi-square and Mann-Whitney U tests. Sample sizes for the territories were as follows: American Samoa and Northern Marianas, both fewer than 11; Guam, 36; Virgin Islands, 97, and Puerto Rico, 425.

^a219,417 women.

^bChemotherapy 1–90 days before surgery.

^cChemotherapy up to six months after surgery.

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 $p < 0.05$

 $p < 0.001$