

Can Regionalization of Care Reduce Socioeconomic Disparities in Breast Cancer Survival?

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Background: Breast cancer patients of low socioeconomic status (SES) have worse survival than more affluent women and are also more likely to undergo surgery in low-volume facilities. Since breast cancer patients treated in high-volume facilities have better survival, regionalizing the care of low SES patients toward high-volume facilities might reduce SES disparities in survival.

Objective: We leverage a natural experiment in New York state to examine whether a policy precluding payment for breast cancer surgery for New York Medicaid beneficiaries undergoing surgery in low-volume facilities led to reduced SES disparities in mortality.

Research Design: A multivariable difference-in-differences regression analysis compared mortality of low SES (dual enrollees, Medicare-Medicaid) breast cancer patients to that of wealthier patients exempt from the policy (Medicare only) for time periods before and after the policy implementation.

Subjects: A total of 14,183 Medicare beneficiaries with breast cancer in 2006–2008 or 2014–2015.

Measures: All-cause mortality at 3 years after diagnosis and Medicaid status, determined by Medicare administrative data.

Results: Both low SES and Medicare-only patients had better 3-year survival after the policy implementation. However, the decline in mortality was larger in magnitude among the low SES women than others, resulting in a 53% smaller SES survival disparity after the policy after adjustment for age, race, and comorbid illness.

Conclusion: Regionalization of early breast cancer care away from low-volume centers may improve outcomes and reduce SES disparities in survival.

Key Words: breast cancer, Medicare, disparities, case volume

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Breast cancer patients exhibit prominent survival disparities based on socioeconomic status (SES); these disparities have been persistent over the decades.^{1–4} Even among older women with Medicare insurance (assuring some level of access to care), poor women diagnosed with breast cancer are almost twice as likely as more affluent women to die in the first 5 years after breast cancer surgery.⁴ Although SES survival disparities were mitigated slightly after the 2006 implementation of the Medicare Part D program, which provided insurance coverage for expensive oral endocrine agents, substantial disparities persist.⁴

Data suggest that poorer women are more likely to be treated at low-volume hospitals, even when controlling for race/ethnicity, rural residence, and distance from residence to the nearest high-volume hospital.⁵ This finding is relevant because multiple observational studies have found that treatment in a high-volume hospital is associated with improved 5-year survival,^{6–8} even after control for potential selection bias.⁹ When care outcomes are better in high-volume facilities, one potential intervention is to regionalize care to such facilities. Another strategy is to export beneficial processes of care from high-volume to low-volume hospitals. Given that studies to date have not identified specific processes employed by high-volume hospitals that directly lead to better outcomes experienced by their breast cancer patients,^{10,11} the regionalization strategy seems particularly attractive for this disease.

Enrollment in Medicaid, the public program that provides health insurance to low income and disabled persons as a partnership of state and federal government, is often used as an indicator of low SES as eligibility is limited to individuals with low incomes and limited assets. In 2009, New York State implemented a public policy designed to promote regionalization of care for its Medicaid beneficiaries. The policy precludes payment for breast cancer surgery for New York Medicaid beneficiaries treated in facilities performing <30 all-payer breast cancer surgeries on average over a 3-year period.¹² By 2019, 84 facilities located in 35 counties were on the list of excluded facilities. For context, Medicare files report 165 acute care or critical access hospitals registered with Medicare in New York state in 2020.¹³ Although the stated goal of the policy was “to ensure the purchase of cost-effective, high-quality health care, and better outcomes” for New York Medicaid beneficiaries, it is plausible to expect that such a policy might also have achieved an unstated goal of reducing SES disparities in survival among

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breast cancer survivors. In this study, we aim to test this hypothesis. Specifically, we examine mortality of a cohort of Medicare beneficiaries with incident breast cancer, a group in which SES survival disparities are well documented, and contrast the outcomes of beneficiaries enrolled in both Medicare and Medicaid (indicating low SES) to that of beneficiaries enrolled only in Medicare.

METHODS

Study Populations and Data Sources

Using a validated algorithm¹⁴ that employs Medicare administrative data (inpatient, outpatient, and carrier claims) to preferentially capture early-stage incident breast cancer, we identified cohorts of Medicare breast cancer patients with the initial diagnosis and 3 years of follow-up in the prepolicy era (2006–2008 incident disease, n = 8379) and with the initial diagnosis in the postpolicy era (2014–2015 incident disease, n = 5804). For both cohorts, inclusion criteria consisted of females aged 65–89 years, residence at the time of breast cancer diagnosis in New York state, and with information available on baseline comorbidity and Medicaid status. The Medicare Master Beneficiary Summary File provided information on demographics, Medicaid enrollment, and date of death. The cause of death was not available. Beneficiaries enrolled in Medicare Advantage or another Health Maintenance Organization plan were excluded due to insufficient encounter information to determine incident breast cancer.

Key Measures

The primary study outcome was all-cause mortality at 3 years after a breast cancer diagnosis, determined from the date of death field. Medicaid enrollment was determined as of the time of breast cancer diagnosis. In this cohort, all Medicaid enrollees also had Medicare insurance, and are referred to as “dually enrolled” beneficiaries. The comparison group, comprised of Medicare beneficiaries who were not dually enrolled in Medicaid, is referred to as “Medicare only,” although some may have been covered by market-provided Medicare supplemental

insurance plans. Age at diagnosis and race (African American/Black, White, or other) were also determined from the Medicare Master Beneficiary Summary File. Comorbidity was computed as a continuous variable based on inpatient, outpatient, and carrier Medicare claims during the 12-month period preceding the breast cancer diagnosis.¹⁵

Statistical Analysis

The prepolicy and postpolicy cohorts were each stratified by SES [low SES (dually enrolled) vs. higher SES (Medicare only)], and baseline characteristics were compared. Kaplan-Meier curves were generated to illustrate the unadjusted survival trends for the dually enrolled versus the Medicare-only cohorts. Difference-in-differences probit regressions¹⁶ were then applied to the pooled cohort of women to estimate the impact of the regionalization policy on the survival of dually enrolled breast cancer beneficiaries. By comparing the survival of the dually enrolled patients to that of the Medicare-only patients, we could identify the effect likely attributable to the regionalization policy after factoring out any temporal trend in the overall Medicare breast cancer population during the study timeframe.

The multivariable difference-in-differences regressions included an indicator variable for the time period (prepolicy vs. postpolicy), SES (low SES vs. higher SES), and an interaction term between these 2 factors. All regressions also included covariates measuring the patient’s age, race, and number of comorbid illnesses. To provide an estimate of the magnitude of potential policy effects, we used coefficients from these models to calculate predicted probabilities of death assuming all patients received treatment first in the prepolicy and then in the postpolicy timeframe, for dually enrolled and Medicare-only breast cancer survivors, while holding all other factors constant at their original levels.

RESULTS

Among the overall cohort of 14,183 women, 1811 were dually enrolled and 12,372 had only Medicare insurance. Some differences in patient characteristics were present between the prepolicy and postpolicy timeframes, as shown in Table 1.

TABLE 1. Characteristics of 14,183 Breast Cancer Patients Diagnosed Before or After Implementation of a Policy Discouraging Treatment of Medicaid Patients in Low-volume Facilities

Patient Characteristic	Dually Enrolled* [n (%)]		P	Medicare Only [n (%)]		P
	Prepolicy (N = 1065)	Postpolicy (N = 746)		Prepolicy (N = 7314)	Postpolicy (N = 5058)	
Age group (y)			0.04			<0.001
65–69	267 (25.1)	167 (22.3)		1814 (24.8)	1110 (21.9)	
70–74	287 (26.9)	213 (28.6)		1813 (24.8)	1490 (29.5)	
75–79	235 (22.1)	189 (25.3)		1756 (24.0)	1178 (23.3)	
80–84	195 (18.3)	106 (14.2)		1319 (18.0)	806 (15.9)	
85–89	81 (7.6)	71 (9.5)		612 (8.4)	474 (9.4)	
Race			0.01			<0.001
White	658 (61.8)	504 (67.6)		6662 (91.1)	4448 (87.9)	
Black	180 (16.9)	124 (16.6)		503 (6.9)	464 (9.2)	
Other	227 (21.3)	118 (15.8)		149 (2.0)	146 (2.9)	
Comorbidity			0.02			0.01
Mean (SD)	1.5 (1.5)	1.7 (1.6)		0.8 (1.1)	0.9 (1.2)	
Median (interquartile range)	1.0 (2.0)	1.0 (2.0)		0.0 (1.0)	1.0 (1.0)	

*Dual enrollment in Medicaid and Medicare, a proxy for low-income status.

Among the dually enrolled group, the median age was 74 years during each study period. The percentage of White women was higher during the postpolicy era, while the percentage of women of another race declined. The mean number of comorbidities was also slightly higher in this group in the postpolicy era. Among the more affluent women with only Medicare insurance, the median age was 75 years during the prepolicy era, compared with 74 years in the postpolicy era. During the postpolicy timeframe, a slightly lower percentage of women were White, and a slightly higher percentage were African American. Again, the mean number of comorbid conditions was marginally higher in the postpolicy cohort.

Unadjusted mortality probabilities presented in Table 2, and documented graphically in the Kaplan-Meier curves (Fig. 1), show improvement in survival over time among both low and higher SES groups. They also suggest a greater improvement among the low SES cohort, whose mortality probability postpolicy declined to levels similar to that of the prepolicy higher SES beneficiaries.

Multivariate estimates shown in Table 3 confirm that, regardless of SES, the more recently treated breast cancer patients were less likely to die within 3 years of diagnosis ($-0.177, P < 0.001$), with the adjusted probability of death being 8.4% postpolicy versus 11.6% prepolicy, suggesting a temporal trend of improved survival that is unrelated to the regionalization policy. Regardless of the time period, low SES (dually enrolled) beneficiaries were more likely to die than their higher SES (Medicare only) counterparts ($0.193, P < 0.001$), with the adjusted probability of death being 12.4% for low SES versus 10% for higher SES. Consistent with unadjusted findings from the Kaplan-Meier curves, difference-in-difference point estimates suggest that the decline in mortality was larger in magnitude among low SES beneficiaries compared with the decrease in mortality among the higher SES women. The coefficient for the interaction term did not reach statistical significance at conventional levels ($P = 0.08$). However, the point estimates depicted in Figure 2 indicate that, while mortality declined 5.9 percentage points among dual enrollees (from 14.9% prepolicy to 9% postpolicy), mortality declined only 2.8 percentage points among Medicare-only beneficiaries (from 11.1% prepolicy to 8.3% postpolicy). These estimates suggest that 53% [calculated as $(5.9 - 2.8) / 5.9$] of the 5.9 percentage point decrease in mortality among low SES breast cancer patients can be attributed to the regionalization policy, as it captures the proportion of the dual enrollees' decline in mortality that is *above and beyond* the temporal trend reflected in the experience of the Medicare-only (control) patients. These adjusted probabilities reflect controls for differences in the

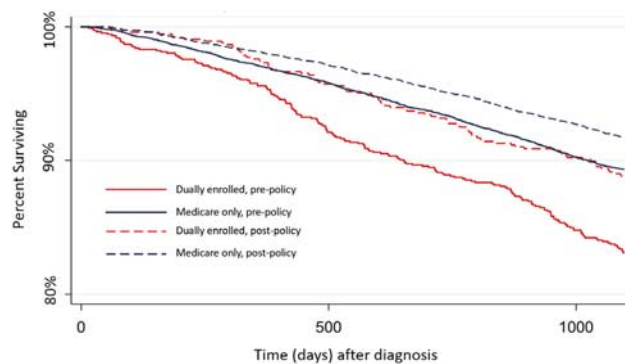


FIGURE 1. Kaplan Meier curve depicting survival of 14,183 older breast cancer patients diagnosed before or after implementation of a policy discouraging treatment of Medicaid patients in low-volume facilities. Dual enrollment refers to enrollment in Medicaid and Medicare, a proxy for low-income status.

composition of patient populations over time and across SES groups in terms of sociodemographic and health characteristics.

DISCUSSION

This study demonstrated that SES survival disparities among older women diagnosed with breast cancer in New York state declined considerably after the implementation of a policy promoting regionalization of initial breast cancer surgery away from low-volume providers. When controlling for patient age, race, and comorbid illnesses, there was a strong trend toward a greater improvement in survival among the dually enrolled breast cancer survivors compared with the more affluent breast cancer survivors covered only by Medicare insurance. The literature on policy evaluation suggests that a 95% confidence limit may be too restrictive a bar for the interpretation of such social experiments.^{17,18} Because policy impacts tend to be less precisely estimated and significance tests are not a measure of effect size or result importance, evaluation researchers consistently and incisively point out the limits of significance testing as an aid to interpret policy effects. Given this literature, we interpret our difference-in-difference estimate, which reached significance at the P -value < 0.08 level, as strongly suggestive of a beneficial effect of the regionalization policy for reducing disparities in breast cancer outcomes. It is possible that a longer follow-up duration and/or a

TABLE 2. All-cause Mortality of 14,183 Breast Cancer Patients at 3 Years of Follow-up

Insurance Status	Unadjusted All-cause Mortality (%)			P
	Prepolicy	Postpolicy	% Change*	
Dually enrolled†	16.9	11.4	-32.5	0.001
Medicare only	10.7	8.3	-22.4	<0.001

*Change in mortality from prepolicy to postpolicy.

†Dual enrollment in Medicaid and Medicare, a proxy for low-income status.

TABLE 3. Adjusted all-cause Mortality at 3 Years of Follow-up*

Characteristic	Adjusted All-cause Mortality	
	Coefficient	95% CI
Time period, postpolicy vs. prepolicy	-0.177	-0.24, -0.11
Dually enrolled vs. Medicare only	0.193	0.09, 0.30
Interaction of insurance status and time period	-0.149	-0.32, 0.02

*Results were adjusted for age, race, and comorbid illnesses using a probit difference-in-difference regression model. CI indicates confidence interval.

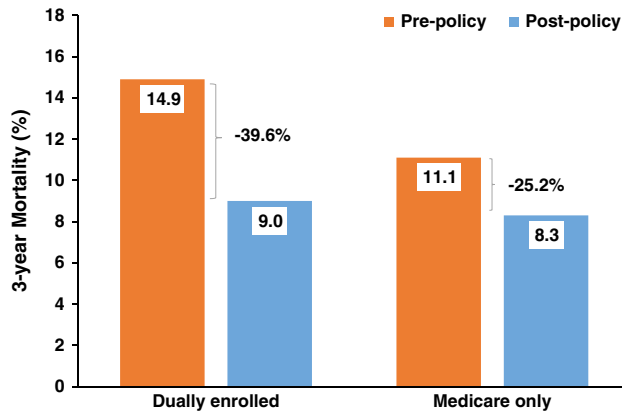


FIGURE 2. Adjusted all-cause mortality at 3 yr of follow-up among 14,183 older breast cancer patients diagnosed before or after implementation of a policy discouraging treatment of Medicaid patients in low-volume facilities.

larger sample size would demonstrate significance at the conventional 5% level.

These results, in conjunction with the relatively strong existing data supporting the better outcomes of breast cancer patients, operated on in high-volume facilities,^{6–9} suggest that regionalizing the care of such patients may represent a way to reduce the substantial survival disparities that exist by SES among breast cancer patients. Although postoperative deaths after breast cancer surgery are rare,⁶ the initial treatment plan is critical for long-term survival. Evidence also demonstrates that women with lower incomes or with Medicaid insurance are more likely than others to be treated in low-volume facilities, leaving such women potentially at risk for lower quality of care.^{10,11,19} Promoting the treatment of lower SES women in higher volume facilities could therefore represent a strategy for reducing disparities in outcomes.

This study is subject to inherent limitations. Chief among them is that disease characteristics such as stage and hormone receptor (HR) status cannot be accurately determined from claims data.²⁰ Low SES patients, who are disproportionately individuals of minority race/ethnicity, have less favorable stage distribution and non-Hispanic Blacks have higher rates of HR-negative, her2-negative (triple-negative) disease.^{21,22} While these differences are well established, they would only bias the difference-in-difference analysis if the stage or tumor characteristic patterns changed substantially during the relatively short time period between 2006–2008 and 2014–2015. This does not appear to be the case. Nationally and in New York state, incidence rates by stage were stable over this time period.^{21,23} The rate of HR-positive disease rose similarly in both White and minority races over this time, mirrored by decreases in rates of HR-negative disease. Because the changes over time were similar in White and non-White patients, these factors are unlikely to have biased the analysis.

Another limitation is that the study was conducted only among elderly Medicare fee-for-service beneficiaries. While the regionalization policy applies to breast cancer patients of all ages, studying disparities in survival solely among Medicare-aged beneficiaries has several advantages in that Medicare represents a

nearly population-based cohort of women in the 65+ age group, both the Medicaid beneficiaries and the control women in the cohort had access to insurance coverage, and SES disparities in breast cancer outcomes have previously been shown to be substantial among this age group. An expansion in eligibility for Medicaid did occur in 2013 related to the Affordable Care Act, but that did not likely affect elderly women in New York state much, as that state already had relatively generous eligibility criteria for Medicaid.²⁴ That said, future work including younger age groups would provide important additional information about the extent to which this or similar regionalization policies can reduce disparities among breast cancer survivors.

We intentionally did not control for treatment factors in this analysis. Determining appropriate treatment solely from claims data is challenging. But more importantly, the administration of more appropriate treatments is one way that high-volume hospitals presumably achieve better outcomes. When conducting a volume-outcome analysis such as this, controlling for treatment would represent overcontrolling, and could mask the overall relationship of volume and outcome. A simpler “intention-to-treat” analysis is a better way of determining the overall relationship between volume and outcomes. We recognize that survival could be influenced by posthospital care for cancer or other conditions and by characteristics of the community in which the patient resides.²⁵ These unmeasured confounders, however, would tend to reduce the ability to detect group differences attributable to the regionalization policy. In addition, there is no reason to suspect that these factors would have changed systematically and differentially across the 2 groups during the time period between 2006–2008 and 2014–2015.

Regionalization is not necessarily the only strategy that could mitigate survival disparities by SES that are mediated by low case volume. Another strategy would be to export beneficial processes of care from high-volume to low-volume hospitals, but studies to date have not identified differential processes of care that are of sufficient magnitude to mitigate the rather large survival differences between low and high-volume facilities.^{10,11} A further strategy could be to incentivize high-volume surgeons to operate on a part-time basis at low-volume facilities. This might have the advantage of reducing travel times for low SES breast cancer patients, and patients might prefer it, as the patient choice of hospital for major surgery is based more upon prior health care experience at a hospital than on comparative hospital outcomes data.²⁶ However, it is less clear whether such a strategy would be as likely to accomplish the goal of diminishing SES disparities in outcomes, which are not limited to insurance differences.^{1,2,4,27}

While some studies have found that breast cancer patients of high-volume surgeons have better survival,⁶ other research casts doubt on that finding. In one study, the better overall survival experience of breast cancer patients treated by high-volume surgeons was not attributable to death from breast cancer, but rather attributable to death from other causes, primarily cardiovascular causes.²⁸ In another study employing an instrumental variable analysis to control rigorously for potential selection bias, patients of high-volume surgeons did not have lower overall or breast cancer-specific mortality.⁹ In contrast, patients of high-volume hospitals had improved overall and breast cancer-specific mortality,^{6,9} a finding which was robust in

the instrumental variable analysis.⁹ The prior findings favoring hospital volume (rather than surgeon volume) as the key driver of the volume-outcome relationship for breast cancer are consistent with the findings of this paper. It is possible that higher volume hospitals can apply more resources to breast cancer therapy, and therefore may accomplish more up-to-date or effective treatments, even when patients have few resources.¹¹ The corollary is that incentivizing high-volume surgeons to operate part-time at low-volume hospitals may not improve the outcomes to the level achieved by high-volume hospitals.

In summary, New York's policy precluding Medicaid patients with breast cancer from having initial surgery at low-volume facilities was associated with a trend toward a reduction in socioeconomic disparities in breast cancer survival at 3 years after diagnosis. This finding, which is limited at present to women aged 65 or older, provides evidence to support longer term exploration of regionalization policies on disparities, as well as further examination of outcomes among women of younger age groups. Strategies to promote greater access to high-volume facilities by women of lower SES may prove useful in reducing SES disparities in outcomes.

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