

Intensity of End-of-Life Care in a Cohort of Commercially Insured Women With Metastatic Breast Cancer in the United States

Alessandra Ferrario, PhD¹; Xin Xu, MS¹; Fang Zang, PhD¹; Dennis Ross-Degnan, ScD¹; J. Frank Wharam, MB, BCh, BAO, MPH¹; and Anita K. Wagner, PharmD, MPH, DrPH¹

QUESTION ASKED: What are levels of and trends between 2000-2003 and 2010-2014 in intensity of end-of-life (EOL) care among commercially insured women with metastatic breast cancer age 25-64 years?

SUMMARY ANSWER: Between 2000-2003 and 2010-2014, there was an increase in intensive care unit (ICU) admissions from 14% to 23% and a small increase in emergency department visits (two or more visits) from 10% to 12% in the last 30 days of life, both statistically significant. In 2010-14, about 14% of women experienced two or more hospitalizations in the last 30 days of life, and about 24% of women in our cohort received antineoplastic treatment in the last 14 days of life. There was no statistically significant increase in these two measures over time.

WHAT WE DID: Using claims data for commercially insured women (< 65 years old), we identified those who died with metastatic breast cancer and estimated the proportion of women who, in the last month of their lives, had more than one hospital admission, emergency department visit, or ICU admission and/or used antineoplastic therapy in the last 14 days of life.

WHAT WE FOUND: We found a statistically significant increase in the proportion of women admitted to the ICU in the last month of their life and, to a small extent,

an increase in emergency department visits. Women with more time between diagnosis and death had less-intense EOL care; those living in predominantly non-White neighborhoods received more intense acute care in the last 30 days of life, and patients living in more deprived neighborhoods received less chemotherapy in the last 14 days of life.

BIAS, CONFOUNDING FACTORS: Our data only included year and month of death, so we used the date of the last observed claim (87% of the cohort) as the day of death within a given death month and year (Death Master File). If there was no claim in the month of death (13% of the cohort), we used the last day of enrollment. Due to changes in state level regulations in 2011, about 4.2 million historical death records were removed from the Death Master File, and since 2011 about 40% new death records are missing from the Death Master File. This means we did not capture all deaths.

REAL-LIFE IMPLICATIONS: The intensity of end-of-care indicators used in this study are part of the National Quality Forum performance measures. As such, they are considered important indicators of the quality of EOL care. Practicing oncologists will find these findings in younger women useful, as most of the available evidence has focused on older women.

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ASSOCIATED CONTENT

Appendix

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abstract

PURPOSE There is limited evidence on the intensity of end-of-life (EOL) care for women < 65 years old, who account for about 40% of breast cancer deaths in the United States. Using established indicators, we estimated the intensity of EOL care among these women.

METHODS We used 2000-2014 claims data from a large US insurer to identify women with metastatic breast cancer who, in the last month of their lives, had more than one hospital admission, emergency department visit, or an intensive care unit (ICU) admission and/or used antineoplastic therapy in the last 14 days of life. Using multivariate logistic regression, we assessed whether intensity of EOL care differed by demographic characteristics, socioeconomic factors, or regions.

RESULTS Adjusted estimates show an increase in EOL ICU admissions between 2000-2003 and 2010-2014 from 14% (95% CI, 10% to 17%) to 23% (95% CI, 20% to 26%) and a small increase in emergency department visits from 10% (95% CI, 7% to 13%) to 12% (95% CI, 9% to 15%), both statistically significant. There was no statistically significant change in the proportions of women experiencing more than one EOL hospitalization (14% in 2010-2014; 95% CI, 11% to 17%) and of those receiving EOL antineoplastic treatment (24% in 2010-2014; 95% CI, 21% to 27%). Living in predominantly mixed, Hispanic, Black, or Asian neighborhoods correlated with more intense care (odds ratio, 1.39; 95% CI, 1.10 to 1.77 for ICU).

CONCLUSION Consistent with findings in the Medicare population, our results suggest an overall increase in the number of ICU admissions at the EOL over time. They also suggest that patients from non-White neighborhoods receive more intense acute care.

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INTRODUCTION

Female breast cancer is the fourth leading cause (by number) of cancer death in the United States, and 40% of women dying from breast cancer are < 65 years old.¹ However, most end-of-life (EOL) cancer care research has examined ≥ 65-year-old Medicare-insured patients. Far less is known about the intensity and quality of care of < 65-year-old commercially insured patients. Differences in insurance coverage, life expectancy, life circumstances, and overall health could lead to different intensity of treatment at the EOL for younger compared with older patients.

Over the past two decades, on the basis of mounting evidence of benefits and risks, multiple stakeholders have advocated less-intense EOL care and greater access to palliative care and hospice.²⁻⁷ Yet, it is

unclear if care intensity has changed over time. Most studies are cross-sectional,⁸⁻¹² and few recent studies analyzed the intensity of EOL cancer care over time.^{13,14}

EOL care research has measured intensity using indicators such as hospitalization, potentially life-prolonging interventions, and potentially life-supporting interventions.^{2,15} US studies about EOL cancer care have focused on Medicare patients ≥ 65 years old.^{10,16-25} Some studies have used commercial insurance claims to investigate end-of-life care among US cancer patients younger than age 65 years,^{14,26} but only few with national coverage.⁸ Some nationally representative claims data studies have focused on costs.^{27,28} Other EOL care studies among patients < 65 years old have used data from the Cancer Care Outcomes Research and Surveillance study,²⁹ the Coping

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with Cancer study,³⁰ Medicaid data,^{31,32} or medical records at individual hospitals.^{33,34} There is therefore limited evidence on whether EOL care patterns among cancer patients \geq 65 years old generalize to younger patients.

In this study, we used data from a large cohort of commercially insured women with metastatic breast cancer age 25-64 years who died between 2000 and 2014 to analyze intensity of EOL care over time using established measures.

METHODS

Data Source

This study used enrollment information and administrative claims data from Optum's de-identified Clinformatics Data Mart Database (Eden Prairie, MN) between May 1, 2000 and December 31, 2014. These data are sourced from a large national health insurer with 48 million commercially insured members across all 50 US states. The claims data include de-identified enrollment information and all medical, pharmacy, and hospitalization claims. We linked sociodemographic variables derived from the annual American Community survey 2008-2012³⁵ using census tract. The data vendor linked month and year of death in the Death Master File to members in our cohort; we used the date of the last observed claim as the day of death within a given death month and year (Death Master File; 87%). If there was no claim in the month of death, we used the last day of enrollment (13%). Because of changes in state-level regulations in 2011, about 4.2 million historical death records were removed from the Death Master File, and since 2011 about 40% new death records are missing from the Death Master File.^{36,37}

Study Population

We used a claims-based algorithm³⁸⁻⁴⁰ and relevant International Classification of Diseases, 9th Revision (ICD-9) codes to identify women with metastatic breast cancer who died between May 2000 and December 2014.

We first identified women age 25-64 years at the time of diagnosis of metastatic cancer. The date of diagnosis of metastatic cancer was determined based on the time of the first of two secondary malignant neoplasm diagnoses (ICD-9 codes 197.x, 198.xx, and 199.0) on separate days up to 90 days apart. We defined the first diagnosis date as the disease index date.

To identify women with metastatic breast cancer, we then limited this cohort of women with secondary metastatic diagnosis to women with at least two claims for breast cancer (ICD-9 codes 174-174.9, 233.0) during the 365 days before the disease index date (first inclusion rule) or at least one breast cancer diagnosis within 365 days before and one breast cancer diagnosis up to 90 days after the disease index date (second inclusion rule).

We excluded patients with a diagnosis of cancer other than breast cancer before the index date (ICD-9 codes 140.xx-165.xx, 170.xx-172.xx, 175.xx, 176.xx, 179.xx-195.xx, 199.1, 199.2, and 200.xx-209.xx) to avoid including patients whose primary cancer diagnosis was not breast cancer. Finally, we limited the cohort to women with a death recorded in the Death Master File and who were enrolled in the commercial insurance plan in the month of and in the month before death.

Outcomes

We constructed some of the measures of EOL care intensity developed by Earle et al¹⁵ that are part of the National Voluntary Consensus Standards for Quality of Cancer Care (National Quality Forum).⁷ Specifically, we defined the proportions of patients, who in the last 30 days of life: (1) had more than one hospital admission, (2) had more than one emergency department (ED) visit, or (3) were admitted to the intensive care unit (ICU); and (4) in the last 14 days of life received anticancer therapy. In the following sections, we refer to these measures as EOL hospitalizations, ED visits, ICU admissions, and antineoplastic treatment. Appendix Table A1 (online only) includes billing codes used to define these outcomes that we identified based on published literature.^{8,10,14,41-43} We define antineoplastic treatment in last 14 days of life on the basis of receipt of traditional chemotherapy and/or targeted therapies. For oral drugs, we used the date of last supply (ie, dispensing date + number of days supplied) and for injectable products the date of administration. For antineoplastic treatments, Healthcare Common Procedure Code System (HCPCS) and National Drug Code (NDC) code lists as well as National Comprehensive Cancer Network guidelines were used. Our list of antineoplastic billing codes includes drug administration codes (diagnosis [ICD-9], diagnostic-related groups, procedure [Current Procedural Terminology (CPT), revenue], and HCPCS codes) and substance codes (HCPCS and NDC codes) for traditional chemotherapy (eg, cytotoxic chemotherapy) and targeted therapy (including small molecule targeted and immunotherapies). It does not include endocrine therapy (eg, aromatase inhibitors).

Covariates

We used version 10 of The Johns Hopkins Adjusted Clinical Groups (ACG) System version 11.1 to calculate participants' morbidity scores over the 6-month period before the month of death (ie, excluding the month of death).⁴⁴ We used 2015 Area Deprivation Index deciles calculated by the University of Wisconsin based on the 2011-2015 American Community Survey 5-year estimates at the Census Block level.⁴⁵ We used geocoding, at census tract level, to classify women residing in predominantly non-Hispanic White neighborhoods versus predominately mixed, Hispanic, Black, or Asian neighborhoods using the 2008-2012 American Community Survey (for more details on how race/

ethnicity was defined, see Wharam et al⁴⁶). We then applied a superseding ethnicity assignment (at the individual level) using flags created by the E-Tech system (Ethnic Technologies), which analyzes full names and geographic locations of individuals.^{47,48} In the following sections, we call the different neighborhoods predominantly White versus non-White. Other covariates include age at death, months between first observed secondary metastatic diagnosis and death (categories were selected based on tercile), US region, and time period of death (2000-2003, 2004-2006, 2007-2009, 2010-2014). Similar to previous cross-sectional⁸ and longitudinal trend studies,¹⁴ we grouped patients into the following categories on the basis of their year of death (2000-2003, 2004-2006, 2007-2009, 2010-2014) to achieve similar numbers of deaths and larger samples to estimate proportions in a given period.

Statistical Analysis

We used multivariate logistic regression to analyze the correlation between covariates and outcomes and estimated adjusted rates of outcome variables using the Stata margins postestimation command. We used separate models for each outcome measure. We tested for changes over time (by year) using the first-order ARIMA autoregressive model.⁴⁹ This study was approved by the Harvard Pilgrim Health Care Institute Institutional Review Board.

RESULTS

Descriptive Analysis

Between November 2000 and December 2014, 2,126 women were identified as having died with metastatic breast cancer. Most women (89%) were > 40 years of age when they were diagnosed (Table 1) and resided in predominantly non-Hispanic White neighborhoods (64%). Almost half (47%) lived in the South and 30% in the Midwest.

Statistical Analysis

Multivariable analysis. Longer time intervals (10-21 and > 22 months compared with < 10 months) between the first observed secondary metastatic diagnosis and death correlated with between 53% and 72% lower likelihood of intense EOL care (Table 2).

Women living in predominantly mixed, Hispanic, Black, or Asian neighborhoods were more likely to be hospitalized (odds ratio [OR], 1.38; $P = .03$) and be admitted to the ICU (OR, 1.39; $P = .01$) at the EOL. Women living in more deprived neighborhoods were less likely to receive EOL antineoplastic treatment (OR, 0.71; $P < .01$). Patients living in the South were less likely than patients living in the Midwest to experience EOL ED visits (OR, 0.70; $P = .04$).

A higher percentage of women experienced EOL ICU admissions during 2007-2009 (OR, 1.79; $P < .001$) and 2010-2014 (OR, 1.93; $P < .001$) compared with 2000-2003.

Intensity of EOL care by time period. The proportion of women experiencing EOL hospitalizations was 11% (95% CI, 8% to 14%) in 2000-2003 and 14% (95% CI, 11% to 17%) in 2010-2014; the annual increase was not statistically significant (ARIMA model: $P = .086$). EOL ED visits increased from 10% (95% CI, 7% to 13%) to 12% (95% CI, 9% to 15%); EOL ICU admissions increased from 14% (95% CI, 10% to 17%) to 23% (95% CI, 20% to 26%). Changes in EOL ED visits and ICU admissions over time were statistically significant (ARIMA model: ED, $P = .018$; ICU, $P < .01$). The proportion of women on EOL antineoplastic therapy was 23% (95% CI, 19% to 27%) in 2000-2003, 20% (95% CI, 16% to 24%) in 2004-2006, 27% (95% CI, 24% to 31%) in 2007-2009, and 24% (95% CI, 21% to 27%) in 2010-2014; there was no statistically significant change over time (ARIMA: $P = .56$; Fig 1).

DISCUSSION

This study contributes longitudinal evidence on EOL care intensity in a population of younger commercially insured patients. We find that commercially insured women who died with metastatic breast cancer between 2000 and 2014 received more intense EOL care when they were living in predominantly mixed, Hispanic, Black, or Asian neighborhoods or (with respect to antineoplastic treatment) when living in less-deprived neighborhoods; when time between diagnosis of secondary metastatic cancer and death was shorter; and when they died in more recent years (with respect to ICU and, to a smaller extent, ED visits).

Previous studies showed an effect of race/ethnicity on EOL in the Medicare population. We provide evidence for this in younger commercially insured patients. A study of patients with breast cancer using SEER-Medicare (2007-2012) data found that Black patients were more likely to experience EOL hospitalizations, ED visits, or ICU admission than White patients (risk ratio, 1.30; 95% CI, 1.02 to 1.65).¹¹ Additional studies in SEER-Medicare have found more intense care for Black patients with cancer.^{10,21,22,50}

There may be several reasons that patients living in predominantly mixed and/or non-White neighborhoods experience more hospital and ICU admissions. In addition to availability of palliative and hospice services, trust in the health care system, prognostic understanding, knowledge of risk and benefits of treatment, religious beliefs, and provider communication skills influence patient and family preferences toward EOL care.⁵¹

Few studies assessed the association between time since diagnosis and intensity of EOL. A study of women with stage IV breast cancer on Medicare found that patients surviving > 6 months after diagnosis were less likely to receive aggressive EOL care in comparison with patients surviving ≤ 6 months (OR, 0.47; 95% CI, 0.39 to 0.58 among patients who lived 6-12 months, and OR, 0.44; 95% CI, 0.38 to 0.52 among patients who lived > 12 months).⁵⁰

TABLE 1. Characteristics of Women With Metastatic Breast Cancer by Year of Death

Characteristic	2000 ^a -2003		2004-2006		2007-2009		2010-2014		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Deaths	390	100	482	100	637	100	617	100	2,126	100
> 40 years old at index date ^b	345	88.5	431	89.4	559	87.8	548	88.8	1,883	88.6
Months survival since index date										
< 10	195	50.0	163	33.8	203	31.9	183	29.7	744	35.0
10-21	150	38.5	165	34.2	192	30.1	198	32.1	705	33.2
> 22	45	11.5	154	32.0	242	38.0	236	38.2	677	31.8
Morbidity ACG score										
< 3	197	50.5	232	48.1	265	41.6	244	39.5	938	44.1
≥ 3 and < 10	128	32.8	175	36.3	233	36.6	237	38.4	773	36.4
≥ 10	65	16.7	75	15.6	139	21.8	136	22.0	415	19.5
Age at death, years										
25-39	38	9.7	35	7.3	51	8.0	41	6.6	165	7.8
40-54	190	48.7	249	51.7	276	43.3	279	45.2	994	46.8
55-64	162	41.5	198	41.1	310	48.7	297	48.1	967	45.5
Race/ethnicity										
Non-Hispanic White ("White")	272	69.7	310	64.3	394	61.9	385	62.4	1,361	64.0
Mixed, Hispanic, Black, or Asian ("non-White")	115	29.5	170	35.3	243	38.1	232	37.6	760	35.7
Missing	3	0.8	2	0.4	0	0	0	0	5	0.2
ADI decile										
Low deprivation area (≤ 3)	172	44.1	244	50.6	313	49.1	297	48.1	1,026	48.3
High deprivation area (> 3)	218	55.9	238	49.4	324	50.9	320	51.9	1,100	51.7
Education										
High-education neighborhood (< 15% residents with less than high school education)	287	73.6	355	73.7	472	74.1	469	76.0	1,583	74.5
Low-education neighborhood (≥ 15 of residents with less than high school education)	100	25.6	125	25.9	165	25.9	148	24.0	538	25.3
Missing	3	0.8	2	0.4	0	0.0	0	0.0	5	0.2
Geographic region										
Midwest	152	39.0	174	36.1	178	27.9	136	22.0	640	30.1
Northeast	36	9.2	39	8.1	51	8.0	65	10.5	191	9.0
South	158	40.5	210	43.6	311	48.8	321	52.0	1,000	47.0
West	41	10.5	58	12.0	97	15.2	95	15.4	291	13.7
Missing	3	0.8	1	0.2	0	0.0	0	0.0	4	0.2
Total	390	100	482	100	637	100	617	100	2,126	100

NOTE. An ACG score of 1.0 represents the mean score of the reference population. ADI deciles: group 1 is the lowest ADI (least disadvantaged), and 10 is the highest ADI (most disadvantaged).

Abbreviations: ACG, Adjusted Clinical Groups; ADI, Area Deprivation Index.

^aData for 2000 start in May.

^bIndex date is the date of the first observed diagnosis of secondary metastatic cancer.

In our study, about 11% of women were hospitalized at the EOL in 2000-2003 and 14% in 2010-2014, but this increase was not statistically significant. In an analysis of MarketScan MEDSTAT data, 9.7% of commercially insured patients with cancer had more than one hospital admission

in the last month of life during 1991-2003.¹⁶ Among patients with cancer (colorectal, breast, lung, prostate, and hematologic) on Medicare, < 10% experienced more than one EOL hospitalization during 1993-2000.¹⁶ Among 482 patients with breast cancer age ≥ 18 years from west

TABLE 2. Predictors of Intensity of End-of-Life Care Among Commercially Insured Women With Metastatic Breast Cancer

Predictor	Proportion With More Than One Hospitalization in Last 30 Days		Proportion With More Than One ED Visit in Last 30 Days		Proportion Admitted to ICU in Last 30 Days		Proportion Receiving Antineoplastic Therapy in Last 14 Days	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Months survival since index date (reference: < 10 months)								
10-21	0.66 ^a	0.48 to 0.89	0.68 ^a	0.49 to 0.95	0.68 ^a	0.52 to 0.89	0.81	0.64 to 1.04
> 22	0.53 ^a	0.38 to 0.74	0.58 ^a	0.41 to 0.82	0.64 ^a	0.49 to 0.84	0.72 ^a	0.56 to 0.93
Age at death, years (reference: 55-65)								
40-54	1.23	0.94 to 1.62	1.16	0.87 to 1.56	1.16	0.93 to 1.46	1.11	0.90 to 1.37
25-39	1.29	0.80 to 2.08	1.45	0.89 to 2.37	0.66	0.41 to 1.08	1.29	0.88 to 1.88
Morbidity (ACG score ^b)								
≥ 3 and < 10	0.96	0.72 to 1.29	0.97	0.71 to 1.32	1.05	0.81 to 1.35	1.06	0.84 to 1.33
≥ 10	0.98	0.69 to 1.40	1.04	0.71 to 1.50	1.32	0.99 to 1.77	1.15	0.87 to 1.50
ADI (reference: ≤ 3)								
> 3	1.12	0.86 to 1.47	1.08	0.81 to 1.44	0.92	0.73 to 1.16	0.71 ^a	0.58 to 0.88
Race/ethnicity (reference: White)								
Mixed, Hispanic, Black, or Asian	1.38 ^a	1.04 to 1.83	1.29	0.95 to 1.75	1.39 ^a	1.10 to 1.77	1.02	0.82 to 1.28
Geographic region (reference: Midwest)								
Northeast	1.19	0.75 to 1.90	0.77	0.45 to 1.30	0.67	0.41 to 1.08	1.10	0.75 to 1.61
South	0.91	0.66 to 1.25	0.70 ^a	0.50 to 0.98	1.22	0.93 to 1.60	1.20	0.94 to 1.53
West	0.72	0.46 to 1.14	0.72	0.46 to 1.14	0.91	0.63 to 1.33	0.79	0.56 to 1.13
Year of death (reference: 2000-2003)								
2004-2006	1.19	0.78 to 1.81	0.96	0.62 to 1.51	1.16	0.79 to 1.71	0.83	0.60 to 1.15
2007-2009	1.19	0.79 to 1.78	1.19	0.78 to 1.80	1.79 ^a	1.26 to 2.56	1.24	0.92 to 1.68
2010-2014	1.41	0.94 to 2.10	1.26	0.83 to 1.92	1.93 ^a	1.35 to 2.76	1.05	0.77 to 1.44

Abbreviations: ACG, Adjusted Clinical Groups; ADI, Area Deprivation Index; ED, emergency department; ICU, intensive care unit; OR: odds ratio, adjusted for all covariates listed.

^aP < .05.

^bA score of 1.0 represents the mean of the population in which the score was developed.

Washington state (53% of whom were ≥ 65 years old), 4.4% were hospitalized more than once at the EOL during 2007-2015.¹⁴ Differences between our results and those of previous studies are likely due to different types of cancers included in the earlier studies (not only breast cancer), patient ages, the time period of analysis, and the geographical coverage of the studies.

We found a small but statistically significant increase in the percentage of patients with metastatic breast cancer who visited the ED at the EOL: 10% in 2000-2003 and 12% in 2010-2014. These results are consistent with earlier findings (1993-1999) from Medicare patients (7.8%-10.4%)¹⁶ and more recent findings (2007-2013) from SEER-Medicare (11.1%).¹³ Results from a study in western Washington State found that only 1.5% patients with breast cancer visited the ED more than once in the last month of life.¹⁴ This is similar to results from another study of commercially insured patients < 65 years old with breast

cancer from across the four US regions (1.7%).⁸ Differences in how ED visits were identified may explain some of these differences. We used HCPCs, revenue codes, and CPT codes, whereas the national study on commercially insured patients used place of service revenue codes on facility claims.⁸

In line with findings from studies using Medicare data, we find an increasing percentage of patients admitted to the ICU in the last month of life, from 14% during 2000-2003 to 23% during 2010-2014. This increase was statistically significant. Goodman et al⁵² found that the percentage of Medicare patients admitted to the ICU in the last month of life increased from 23.7% in 2003-2007 to 28.8% in 2010. Similar increases were found in other studies of patients with cancer and patients with other conditions like COPD and dementia on Medicare.^{53,54} Findings for women with breast cancer > 18 years of age in western Washington State found that 34% of the women were admitted to the

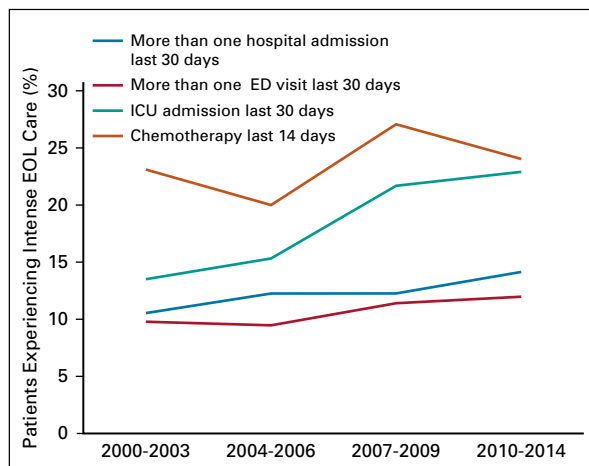


FIG 1. Intensity of end-of-life (EOL) care over different time periods (adjusted rates). ED, emergency department; ICU, intensive care unit.

ICU in the last month of life.¹⁴ The percentage was lower for Medicare patients, 18.5% among patients with various cancers during 2007-2013,¹³ and, in another study of commercially insured patients, 17.5% for patients with breast cancer during 2007-2014.⁸ Both these studies used CPT codes for critical care (99291, 99292) to identify ICU admissions. We used revenue codes validated by Weissman et al,⁵⁵ which may explain why the results of the former studies differ from ours.

EOL antineoplastic therapy in the last 14 days of life remained stable at 23%-24% between 2000-2003 and 2010-2014, with some variation in years 2004-2006 (20%) and 2007-2009 (27%) but no statistically significant change over time. Overall, the percentage of patients receiving EOL antineoplastic therapy was similar to results from western Washington State in patients > 18 years old (21.8%).¹⁴ Antineoplastic therapy use in our study was higher than reported by Falchook et al⁸ for a national sample of commercially insured patients with breast cancer (14.1%). This study did not include NDC codes to identify antineoplastic use, which may explain the lower value.

Our data included month but not day of death. It is possible that by assigning last claims or last enrolled date as death date, our EOL intensity measures covered slightly more or fewer than 30 or 14 days before death. This is likely to affect more the receipt of antineoplastic treatment during the last

14 days, given the shorter time span it covers. We therefore estimated the proportion of patients on antineoplastic treatment if the date of death was 5 days after our estimated one. The proportion of patients receiving antineoplastic treatment then would be reduced (2000-2003: 12%; 2004-2006: 12%; 2007-2009: 16%; 2010-2014: 15%). These results still indicate that antineoplastic treatment is used very close to death. Due to changes in state legislation affecting reporting of deaths to the Death Master File, death information after 2011 is partially complete,³⁶ leading to undercounting of deaths. Because outcome measures are based on proportions of deaths, declining numbers of deaths would only confound the results if unreported deaths were systematically related to intensity of EOL care, which is unlikely given the dropout is at the state level and not at individual level. To affect the results, states that dropped would need to include patients with characteristics that both differed from patients in states that did not drop and were associated with intensity of EOL care.

This is a retrospective study of care received at the EOL by women who died with metastatic breast cancer. The study design does not allow us to assess the care received by severely ill women who survived. Because of lack of information on cause of death, this study reports the experience of patients who died with metastatic breast cancer. We did not have information from cancer registry or electronic health records to confirm stage at diagnosis or metastatic status. Instead, we used a claims-based algorithm, based on the literature,³⁸⁻⁴⁰ to identify patients with metastatic breast cancer. These limitations affect most national studies using claims data of commercially insured patients.

In this study, we find that, despite broadening consensus on less intense EOL care for patients with cancer, frequency of ICU admissions and, to a smaller extent, EOL ED visits in a cohort of commercially insured women who died with metastatic breast cancer has increased over time. Patients living in predominantly mixed, Hispanic, Black, or Asian neighborhoods experienced more intense EOL care, and shorter time intervals between first observed diagnosis of secondary metastatic cancer and death were correlated with more intense EOL care. These findings provide new evidence on EOL care in an understudied group, < 65-year-old commercially insured patients, and longitudinal data on the intensity of EOL care over time.

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DISCLAIMER

Xin Xu conducted the analyses prior to changing employer. At the time the analyses were conducted, he was employed at the Harvard Pilgrim Health Care Institute.

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

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Open Payments is a public database containing information reported by companies about payments made to US-licensed physicians ([Open Payments](#)).

Xin Xu

Employment: Takeda

Stock and Other Ownership Interests: Takeda

No other potential conflicts of interest were reported.

APPENDIX

TABLE A1. List of Codes

Code
Emergency Department Codes
Current Procedural Terminology Codes
99281-99285
Revenue codes
0450-0459
0981
Healthcare Common Procedure Code System
G0380-G0384
Intensive care unit codes
Revenue codes
0200-0204
0207-0212
0219