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Potential Overuse of Screening Mammography and Its Association With Access to Primary Care

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Abstract

Background—Cancer screening in individuals with limited life expectancy increases the risk of diagnosis and treatment of cancer that otherwise would not have become clinically apparent.

Objective—To estimate screening mammography use in women with limited life expectancy, its geographic variation, and association with access to primary care and mammographic resources.

Methods—We assessed screening mammography use in 2008–2009 in 106,737 women aged 66 years or older with an estimated life expectancy of <7 years using a 5% national sample of Medicare beneficiaries. Descriptive statistics were used to estimate the screening mammography utilization, by access to primary care.

Results—Among women with a life expectancy of <7 years, 28.5% received screening mammography during 2008–2009. The screening rates were 34.6% versus 20.5% for women with and without an identifiable primary care physician, respectively. The screening rates were higher among women who saw >1 generalist physician and who had more visits to generalist physicians. There was substantial geographic variation across the United States, with an average rate of 39.5% in the hospital referral regions (HRRs) in the top decile of screening versus 19.5% in the HRRs in the bottom decile. The screening rates were higher among HRRs with more primary care physicians ($r = 0.14$, $P = 0.02$), mammography facilities ($r = 0.12$, $P = 0.04$), and radiologists ($r = 0.22$, $P < 0.001$).

Conclusions—Substantial proportions of women with limited life expectancy receive screening mammography. Results presented sound a cautionary note that greater access to primary care and mammographic resources is also associated with higher overuse.

Keywords

access to care; elderly; medicare; overuse; screening mammography

Screening mammography allows for breast cancer diagnosis before it becomes palpable or causes clinical symptoms, when the treatment is easiest and most effective.¹ Randomized trials have found a lower breast cancer mortality after screening mammography for women aged 50–70 years.² However, such benefit is not immediate. There is approximately 4-year lag between when a cancer is diagnosed by regular screening mammography and when it would be diagnosed clinically (usually by a breast lump) for women aged 65–74 years.³ Meta-analyses of randomized mammography trials found that the survival benefits did not appear until 7–10 years after screening.^{4,5}

There is increasing awareness of potential harms of screening mammography, particularly overdiagnosis in women with limited life expectancy.^{6–8} Nevertheless, a study found that 18% women aged 70 years or older with severe cognitive impairment received screening mammography, even though these women had a median survival of 3.3 years.⁹ In such women, any screening benefit would likely not appear before women die from causes other than breast cancer. Instead, they are at increased risk for harms from the diagnosis and treatment of a condition that would have never threatened their lives.^{10,11}

To improve the quality of screening mammography services, there is a need for increased knowledge of overuse of screening mammography and factors associated with it. The present study examined screening mammography utilization in older women with limited life expectancy. On the basis of the 7-year minimal lag time to benefit after screening,^{4,5} we operationally define potential overscreening as screening mammography in women with an estimated life expectancy of <7 years. We were interested in the prevalence of such screening nationally, its geographic variation, and association with availability and provision of primary care services. We had previously found that primary care physicians (PCPs) who had high rates of mammography screening in women aged 50–70 years also tend to have higher rates of overscreening.¹² This led us to hypothesize in the current study that older women with limited life expectancy would be more likely to receive screening mammography if they had greater access to and use of primary care services.

METHODS

Data Sources

We used a 5% national sample of Medicare claims from January 1, 2006 through December 31, 2009, including the Medicare Denominator File for demographic and enrollment information, Carrier File for claims for physician services, Outpatient Statistical Analysis File (OUTSAF) for claims for outpatient services, and Medicare Provider Analysis and Review (MEDPAR) File for inpatient claims.

Study Subjects

We identified female Medicare beneficiaries aged 67–90 years as of January 1, 2008 from the 5% Medicare claims data with full coverage in Medicare Parts A (inpatient care) and B (physician and outpatient services) and without Health Maintenance Organization (HMO) coverage during 2006–2009 (n = 524,428). Women with any claims with diagnoses of breast cancer or breast mass (International Classification of Diseases, 9th revision, Clinical

Modification codes of 174.xx, 233.0, or 611.72) in 2006–2007 were excluded, leaving $n = 465,517$.

We included women with an estimated life expectancy of <7 years ($n = 106,737$, representing 2,134,740 women nationwide). A woman's life expectancy was estimated based on her age and comorbidities using a Cox proportional model we developed and validated.¹³ The model is described in detail in later section.

Measures

Screening Mammography Utilization—A screening mammogram was identified as a bilateral mammogram [Carrier files with Current Procedure Terminology (CPT) codes of 77056, 77057 or Healthcare Common Procedure Coding System (HCPCS) codes of G0202 and G0204] for a woman who received no mammogram (CPT codes 77055, 77056, 77057 or HCPCS codes of G0202, G0204, or G0206) in the previous 11 months and with no breast-related diagnosis in the prior 2 years.^{14,15} We previously validated the algorithm with mammography record review and estimated that 92% of the algorithm-identified screening mammograms were confirmed screenings.¹⁵

Life Expectancy—We developed and validated a Cox proportional model based on women's age and comorbidities.¹³ Age was obtained from the Medicare Denominator Files. The comorbidities were extracted from 2007 Medicare Carrier, OUTSAF, and MEDPAR files using Elixhauser method, which includes the presence or absence of 31 comorbid conditions (chronic heart failure, hypertension, diabetes etc.).^{16,17} For example, using the age-comorbidity-based Cox proportional model, we estimated that a 74-year-old woman with complicated diabetes and cerebral degeneration had a life expectancy of 5.5 years and her probability of living longer than 7 years was 0.39. The model had C statistics of 0.79–0.81 in predicting 1- to 10-year mortality. Of women with an estimated life expectancy of <7 years, 70.8% in the validation cohort actually died within 7 years, and 85.8% within 10 years.¹³

Access to Primary Care and Mammographic Resources—We included 3 patient-level measures of access to primary care: (1) whether a woman had an identifiable PCP, (2) the number of different generalist physicians a woman visited, and (3) total number of visits to generalist physicians in 2008–2009. We defined whether a woman had an identifiable PCP if she saw the same generalist physician (family medicine, internal medicine, general practice, geriatrics, or OB/GYN) on 3 occasions in an outpatient setting (CPT codes 99201–99205 and 99211–99215) in the year 2007.^{18,19} The physician was identified from the National Provider Identifier in the performing provider field. The physician specialty was obtained from the HCFA specialty field in the Carrier file. Using the 2008–2009 Carrier files, we extracted the number of different generalist physicians seen (0–1 vs. 2+) and number of visits to generalist physicians (0–2, 3–7, 8–12, 13+) for each woman.

We also included regional health care resources at the level of hospital referral region (HRR), including number of PCPs, number of mammography facilities, and number of radiologists per 100,000 residents. Number of mammography facilities was obtained from the US Food and Drug Administration certification file on US mammography facilities.²⁰

Number of PCPs and number of radiologists was obtained from the hospital and physician capacity file by Dartmouth Atlas of Health Care.²¹

Statistical Analysis

Descriptive statistics were used to estimate the screening mammography rates for women with limited life expectancy (< 7 y), by measures of primary care accessibility. The rates were also reported for each life expectancy stratum (< 4, 4–5, and 6 y). The stratified analyses were used to examine whether the associations between primary care accessibility and screening utilization are consistent across life expectancy strata.

A map was created to show the distribution of rates of screening mammography use in older women with limited life expectancy across the United States by HRR. The association between HRR overscreening rates and regional mammographic resources were evaluated using the Pearson correlation tests. We used ArcGIS 10.1 (Esri, Redlands, CA) for mapping and SAS version 9.2 (SAS Institute, Cary, NC) for data extraction and statistical analyses.

The study is exempted from the Institutional Review Board review at the University of Texas Medical Branch at Galveston.

RESULTS

Figure 1 shows screening mammography use in 2008–2009 by life expectancy for older women with limited life expectancy (< 7 y) in the United States. Screening mammography rates decrease with decreasing life expectancy. However, substantial proportions of women with limited life expectancy underwent mammography screening, 35.0% (95% CI, 34.4%–35.5%), 25.1% (95% CI, 24.4%–25.8%), and 17.9% (95% CI, 16.8%–18.9%) for women with an estimated life expectancy of 6, 3, and 1 year(s), respectively (Fig. 1).

Table 1 presents screening mammography utilization by primary care accessibility. Screening rates were higher among women with greater access to primary care. Women with an identifiable PCP had substantially higher rates (34.6% vs. 20.5%), as did women who saw >1 generalist physician and who had more visits to generalist physicians. These associations were consistent across all life expectancy strata. When the analyses were restricted to women with <4 years estimated life expectancy, the overall screening rate was 22.2% and increased to 28.0% in those with a PCP.

There was also considerable geographic variation in screening mammography rates among women with limited life expectancy (Fig. 2). The 306 HRRs across the United States had an average of 349 (range, 37–2274) women with a life expectancy of < 7 years in the 5% national sample of Medicare beneficiaries in 2008. Ranking the HRRs from low to high based on their overscreening rates, the HRRs in the top decile had an average screening mammography rate of 39.5% (range, 35.3%–46.4%), compared with 19.5% (range, 13.5%–22.4%) for the HRRs in the bottom decile. As shown in Table 2, higher number of PCPs ($r = 0.14$, $P = 0.02$), mammographic facilities ($r = 0.12$, $P = 0.04$), and radiologists ($r = 0.22$, $P < 0.001$) per 100,000 residents in an HRR were associated with higher screening mammography rates for women with limited life expectancy.

DISCUSSION

Greater access to primary care is associated with higher quality of preventive and chronic care.^{22,23} For example, having a PCP or living in an area with higher numbers of PCPs are both associated with increased likelihood that women receive screening mammography.^{18,23} However, our results provide a cautionary note, in that access to primary care is also associated with risk of overuse of screening mammography. For example, 22.2% of all women with an estimated life expectancy of < 4 years underwent screening mammography, and this increased to 28.0% in women with a PCP. Extrapolating from our 5% sample, approximately 137,000 women in the United States aged 66–90 years with Parts A and B Medicare and with a life expectancy of <4 years underwent screening, mammography in 2008–2009, as did 608,000 women with a life expectancy of < 7 years.

Four years is the estimated lag time between mammographic-detected versus clinically apparent breast cancer.³ Seven years is the minimal lag time between mammography screening and reduction in breast cancer mortality.^{4,5} In other words, screening would unlikely to benefit women with limited life expectancy but expose them to greater risks of physical, emotional, and economic suffering imposed by overdiagnosis and overtreatment.²⁴

There are several potential explanations both for the substantial mammography screening rates in these women and for its association with access to primary care. First, there has been little systematic attempt to distinguish appropriate use from overuse in any of the guidelines for breast cancer screening. The American Cancer Society guidelines on screening, for example, have had no upper age limit.²⁵ This is different from the case with prostate-specific antigen screening, where both the American Cancer Society and the American Urological Association have longstanding guidelines that exclude men with <10 year life expectancy.^{25,26} Furthermore, mammography screening was arguably the most widely promoted physician-level quality indicator in the 1990s and early 2000s, with multiple HMOs and other entities providing feedback to physicians on their screening rates.¹¹ The message received by PCPs was to screen. Another contributing factor is that physicians are reluctant to apply population-based life expectancy estimates to their patients, concerned about individual uncertainty.^{27,28} Another factor driving overscreening is expectations from patients. Most members of the general public overestimate the benefits and are unaware of the potential harms of cancer screening.^{29–31} Consequently, discouraging the use of a screening test may reduce patient satisfaction.^{31,32}

In agreement with prior studies,^{33,34} we found that screening mammography use decreases with decreasing life expectancy. However, this decrease could be offset by greater access to primary care. For example, the screening rate was 33.9% for women with a life expectancy of <4 years who had 13 visits to generalist physicians, compared with 19.6% for women with a life expectancy of 6 years who had 2 visits to generalists.

The results of the study should be interpreted in light of the limitations in methodology. First, we only studied women enrolled in fee-for-service Medicare. One might expect different screening practices for patients enrolled in HMOs.³⁵ Second, the life expectancy estimates are less than perfect. In a validation study, 29% of women identified as having a

life expectancy <7 years survived for at least 7 years, and 14% survived at least 10 years.¹³ Further efforts are needed to improve the life expectancy estimates, perhaps by including self-reported health and functional status. Physicians and their patients have available to them much richer information on factors that affect life expectancy compared with claims data. In addition, Medicare data do not allow us to investigate the reasons for the testing, for example, patients request versus physician recommendation. Moreover, the study focused on the measures of access to primary care and regional mammographic resources. These measures may be possible mediators between other factors (eg, race/ethnicity or rural-urban disparities) and screening utilization. Further studies are needed for other determinants under a thoroughly defined conceptual framework.

Screening mammography for older women with limited life expectancy results in the diagnosis and treatment of cancers that would otherwise not become clinically apparent in the women's lifetime. Prior studies have documented substantial rates of cancer screening and particularly mammography, in populations with limited life expectancy, such as older women with dementia, those with advanced cancer, and those undergoing dialysis.^{9,12,36–40} The real harms produced by such practices are only recently receiving more widespread attention in the medical and lay press.

Quality measures are effective tools by which to monitor and change provider practices. Current screening mammography quality measures encourage more screening rather than more appropriate screening.⁴¹ To encourage appropriate use while discouraging overuse, Walter and colleagues^{41,42} have called for the refinement of quality measures to incorporate indicators of appropriate use and overuse.

In conclusion, substantial proportions of women with limited life expectancy received screening mammography. The study sounds a cautionary note that greater access to health care resources not only promotes appropriate use of screening mammography, but also is associated with higher overuse. Continuing efforts are needed to reduce overuse, including improving awareness of screening harms, incorporating life expectancy in screening decision making, and refining quality measures to include overuse indicators.

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FIGURE 1. Screening mammography rate (%) in 2008–2009 in women aged 66–90 years with limited life expectancy in the United States. The circles are the data points and error bars represent the 95% confidence intervals estimated from 5% Medicare claims data.

FIGURE 2.

Percent of women with an estimated life expectancy of <7 years who underwent screening mammography in 2008–2009, by hospital referral region (HRR). The 306 HRRs across the United States had an average of 349 (range, 37–2274) women with a life expectancy of <7 years using the 5% Medicare claims data.

TABLE 1

Screening Mammography Use in 2008–2009 for Women With Limited (< 7 y) Life Expectancy, by Access to Primary Care

Patient-level Measures	Life Expectancy [n (%)]			
	All (< 7 y)	< 4 y	4–5 y	6 y
Overall	106,737 (28.5)	30,926 (22.2)	47,867 (28.9)	27,944 (34.7)
Having an identifiable primary care physician *				
No	46,004 (20.5)	12,620 (13.8)	20,518 (20.8)	12,866 (26.5)
Yes	60,733 (34.6)	18,306 (28.0)	27,349 (35.0)	15,078 (41.7)
No. different generalist physicians seen *				
0–1	65,582 (22.3)	19,540 (16.3)	29,212 (22.8)	16,830 (28.3)
2+	41,155 (38.3)	11,386 (32.2)	18,655 (38.4)	11,114 (44.4)
No. visits to generalist physicians *				
0–2	30,836 (14.0)	10,455 (9.4)	13,085 (14.5)	7296 (19.6)
3–7	26,890 (27.7)	6155 (21.5)	12,649 (27.0)	8086 (33.5)
8–12	24,691 (35.7)	6478 (29.3)	11,390 (35.2)	6823 (42.4)
13+	24,320 (40.5)	7838 (33.9)	10,743 (42.1)	5739 (46.4)

* All measures of access to primary care are significantly associated with screening mammography use at $P < 0.001$. The patient-level analyses were overpowered because of large sample sizes. The actual estimates are reported here with an emphasis on the public health importance rather than statistical significance.

TABLE 2

Characteristics of the US Hospital Referral Regions (HRRs) in the Lowest Versus Highest Deciles of Screening Mammography for Women With a Life Expectancy of <7 years

HRR-level Measures	Screening Mammography Rate for Women With Limited Life Expectancy		
	Mean		Correlation Coefficient [‡] (P)
	Lowest Decile [*]	Highest Decile [†]	
Screening mammography rate (%)	19.5	39.5	—
Accessibility to primary care and mammographic resources			
No. primary care physicians per 100,000 residents	64.5	69.9	0.14 (0.02)
No. radiologists per 100,000 residents	7.6	9.1	0.22 (<0.001)
No. mammography facilities per 100,000 residents	2.1	2.3	0.12 (0.04)

* HRRs (n = 31) in the lowest decile in the ranking of screening mammography rate for older women with a life expectancy of <7 years.

† HRRs (n = 31) in the highest decile in the ranking of screening mammography rate for older women with a life expectancy of <7 years.

‡ The Pearson correlation coefficient was the association between the HRR-level characteristics and their rate of screening mammography for older women with a life expectancy of <7 years. The analysis included all HRRs (n = 306).