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Screening Mammography among Nursing Home Residents in the United States: Current Guidelines and Practice

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Abstract

Objective: United States (US) guidelines regarding when to stop routine breast cancer screening remain unclear. No national studies to-date have evaluated the use of screening mammography among US long-term care nursing home residents. This cross-sectional study was designed to identify the prevalence, predictors, and geographic variation of screening mammography among that population in the context of current US guidelines.

Materials and Methods: Screening mammography prevalence, identified with Physician/Supplier Part B claims and stratified by guideline age classification (65-74, 75 years), was estimated for all women aged 65 years residing in US Medicare- and Medicaid- certified nursing homes (1 year) with an annual Minimum Data Set (MDS) 3.0 assessment, continuous Medicare Part B enrollment, and no clinical indication for screening mammography as of 2011 (n=389,821). The associations between resident- and regional- level factors, and screening mammography, were estimated by crude and adjusted prevalence ratios (APR) from Robust Poisson regressions clustered by facility.

Results: Women on average were 85.4 (standard deviation ± 8.1) years old, 77.9% were disabled, and 76.3% cognitively impaired. Screening mammography prevalence was 7.1% among those

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aged 65-74 years (95% Confidence Interval (CI): 6.8% - 7.3%) and 1.7% among those ≥ 75 years (95% CI: 1.7% - 1.8%), with geographic variation observed. Predictors of screening in both age groups included race, cognitive impairment, frailty, hospice, and some comorbidities.

Conclusions: These results shed light on the current screening mammography practices in US nursing homes. Thoughtful consideration about individual screening recommendations and the implementation of more clear guidelines for this special population are warranted to prevent overscreening.

Keywords

nursing homes; health service utilization; screening mammography

Introduction

Preventative screening mammography reduces breast cancer-related mortality up to 20% in women 50-74 years old.¹ Yet the benefits of screening older women for breast cancer are less clear.²⁻⁴ Consequently, United States (US) recommendations regarding cessation of screening mammography conflict. As of 2016, the US Preventative Services Task Force statement on breast cancer screening states that there is not enough evidence to recommend for or against screening for women aged ≥ 75 years old.⁵ This perspective is shared by some,⁶⁻⁸ but not all organizations.⁹⁻¹¹ For women ≥ 75 years old, the American Cancer Society recommends use only among those with a ≥ 10 years of life expectancy,⁹ while the American College of Physicians recommends against screening mammography for this age group.¹⁰ Despite conflicting guidelines,¹² Medicare Part B fully covers yearly screening mammograms for women ≥ 40 years old.¹³

Although sensitivity of mammography is higher in older women, its benefits diminish with decreasing life expectancy.^{5,9} Nearly 25% of all breast cancers detected would not have presented clinically within the remainder of a diagnosed woman's life.^{2,14,15} Discontinuation of futile preventative screening is key to reducing unnecessary harms.^{1,3} Overdiagnosis and false-positives lead to emotional distress, excess health service utilization, and financial burden through superfluous diagnostic imaging and procedures.^{1,16} For older women with multiple comorbidities at baseline, the costs of screening may outweigh its prospective benefits.³

Screening mammography is common among older women in the US and abroad.^{17,18} In the US (2010-2012), 60% of Medicare beneficiary women aged 65-74 years and 30% of those aged ≥ 75 years were screened.¹⁷ However, older women in nursing homes differ from those living independently as they are often more debilitated and terminally ill with a lower life expectancy.¹⁹ We would expect less screening in this population, yet to our knowledge, no national studies have described the use of screening mammography in nursing home populations.

This study seeks to identify the prevalence, predictors, and geographic variation of screening mammography among long-stay nursing home residents in nursing home facilities across the US using the Minimum Data Set (MDS) and Medicare Physician/Supplier Part B Claims

File. We hypothesize that screening mammography does occur in nursing homes, but the prevalence will be marginal given that many residents have a limited remaining life expectancy or factors associated with it.

Materials and Methods

Study Design and Data Sources

This cross-sectional study used the 2011 Medicare Physician/Supplier Part B Claims File (Carrier File; latest data available to institutional team) linked by beneficiary identification number to the Medicare Beneficiary Summary File (MBSF) and to the Minimum Data Set (MDS) version 3.0. The University of Massachusetts Medical School Institutional Review Board approved this work.

The Carrier File, consisting of fee-for-service Medicare Part B health insurance claims for outpatient services, includes procedure/diagnosis codes: Current Procedure Terminology (CPT), Healthcare Common Procedure Coding System (HCPCS), International Classification of Diseases- Ninth Revision (ICD-9). Part B claims were linked to MBSF data to identify Medicare Part A and B enrollment.

The MDS 3.0 is a validated^{20,21} repository of standardized health status assessments of residents in all US Medicare- and Medicaid- certified nursing homes. A Comprehensive Omnibus Budget Reconciliation Act (OBRA) assessment completed by a licensed healthcare provider is required for each nursing home resident on admission and annually thereafter.²² This assessment includes enrollment/ sociodemographic characteristics, clinical conditions, and psychological functioning.

Study Sample

The sample included women residing in US nursing homes long-term, operationally defined as those with a one year nursing home stay identified by the presence of an annual MDS OBRA assessment conducted in 2011. We restricted the sample to women, continuously enrolled in fee-for-service Medicare Part A and B coverage throughout 2011 or until death (since mammography was defined with Part B claims), 65 years old (given that Medicare-eligibility starts at age 65 for most US citizens), and with complete information on all covariates (as missing data occurred infrequently). Women were excluded with clear indications for diagnostic mammography based on Medicare Part B codes for history of breast malignancies or a breast lump/mass (Appendix Table 1).²³ The final sample was 389,821 long-term stay nursing home residents (Figure 1).

Mammography

Conceptually, the primary outcome was “screening” mammography (considered routine preventative screening) versus “diagnostic” mammography (considered non-routine, prompted by signs/symptoms of breast neoplasia). Operationally, screening mammography was defined using 2011 Part B claims based on CPT, HCPCS, and ICD-9 codes by the Centers for Medicare and Medicaid Services (CMS).²⁴ Part B codes may be unreliable in differentiating diagnostic from screening mammography, potentially due to differences in

provider judgment when a diagnostic screen is needed, differences in coding a pre-scheduled routine mammogram with a symptomatic patient, lack of familiarity with updated codes, or influenced by reimbursement rates.^{25,26} Because of this uncertainty and that a screening mammogram will likely not be unilateral, any Part B code for bilateral mammography (screening or diagnostic) was used to define any screening mammography as a binary (yes/no) variable. Our algorithm to define screening mammography was modeled after the results of a simulation study to identify the most reliable way to define screening mammography using Medicare claims.²³ A second operational definition of screening mammography (yes/no), excluding CPT and HCPCS diagnostic mammography codes, was used in a sensitivity analysis to ensure results did not largely change. See specific codes in Appendix Table 1.

Resident Characteristic Variables

All resident characteristic variables were extracted from 2011 annual MDS OBRA assessment data. Characteristics were selected based on evidence that suggests their association with screening mammography.^{17,27,28} Since some mammography guidelines are based on life expectancy for older women^{9,11} and guidelines do affect screening rates,^{17,29} variables associated with life expectancy were included in the analysis (e.g., six-month prognosis, hospice, frailty,³⁰ severe comorbid conditions,³¹ and organ failure³²).

Other variables evaluated included: age (65-74, 75 years old), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic/Latino, other), marital status (married, yes/no), length of stay (continuous), activities of daily living (ADL) limitations (none/mild, moderate, severe), frailty (non-frail, pre-frail, frail), cognitive impairment (none/mild, moderate, severe), active/ severe comorbid conditions as of seven days prior to annual assessment (binary variables; yes/no), organ failure (none, single, multiple), hospice use in past fourteen days (yes/no), six-month prognosis if no hospice use (yes/no), region of facility (northeast, Midwest, south, west), and geographic region type of facility (urban vs. rural).

Age categorization (65-74, 75 years old) was based on that of US screening mammography guidelines.⁵⁻¹¹ ADL limitations, based on the MDS ADL Self-Performance Hierarchy³³ (scored 0-6), were categorized as: none/mild (0-2), moderate (3-4), and severe (5-6). Cognitive impairment³⁴ consisting of the MDS Brief Interview for Mental Status (BIMS; scored 0-15) and, if residents were unable to complete the BIMS, the staff-assessed Cognitive Performance Scale (CPS; scored 0-6), categorized as: none/mild (BIMS: 13-15, CPS: 0-2), moderate (BIMS: 8-12, CPS: 3-4), severe (BIMS: 0-7, CPS: 5-6). Frailty, based on the FRAIL-NH scale^{30,35} (scored 0-14), calculated from various MDS items, was categorized as: non-frail (0-4), pre-frail (5-6), and frail (7-14). Active/ severe comorbid conditions (based on medical record documentation) included: cancer (any), dementia (or Alzheimer's disease), neurological (paralysis (hemiplegia/paraplegia/quadriplegia), traumatic brain injury, Multiple Sclerosis, Parkinson's Disease, Huntington's Disease), cardiovascular (Coronary Artery Disease, Peripheral Vascular Disease), musculoskeletal (osteoporosis, arthritis, fractures), and respiratory (asthma, pneumonia, Chronic Obstructive Lung Disease). Organ failure was based on active diagnoses of: heart failure, cirrhosis,

respiratory failure, and renal failure. Diagnoses were considered “active” if affecting a resident’s health status or care plan within the past week.

Statistical Analysis

All analyses were stratified by age group (65-74, 75 years old). Baseline characteristics were summarized for descriptive purposes. Mammography prevalence and corresponding 95% confidence intervals (CIs) were estimated overall and by resident characteristics. For resident characteristics, Poisson regressions with facility clustering, an exchangeable correlation matrix, and robust confidence intervals provided estimates of prevalence ratios (unadjusted and adjusted). Poisson models were used as they can provide more accurate estimates of prevalence ratios than other methods in cross-sectional studies.^{36,37} Predictors were determined based on adjusted estimates and 95% CIs of resident characteristic prevalence ratios. Sensitivity analysis of screening mammography defined without diagnostic mammography codes was also performed. Unadjusted state-specific prevalence estimates were calculated and mapped. Output was generated using SAS software, Version 9.4 (Copyright © 2013, SAS Institute Inc., Cary, NC, USA).

Results

Characteristics of the Sample

To describe the sample, characteristics of the 389,821 long-term nursing home women are presented in Table 1. Women were on average 85.4 (standard deviation (SD) ± 8.1) years old with a mean length of stay of 2.4 (SD ± 1.6) years. Most women were non-Hispanic white (84.0%), unmarried or separated (88.2%), and frail (74.4%). Many women also had severe medical conditions and substantial impairments. Specifically, single or multi-organ failure was present in 26.8%. Nearly half (45.1%) had musculoskeletal impairment. About 20% had at least one severe cardiovascular (23.5%), neurological (19.6%), or respiratory (19.2%) condition. Severe cognitive impairment was common (overall: 47.8%, 65-74 years: 31.0%; 75 years: 49.9%). Overall, 6.0% of the sample had a six-month life expectancy (hospice + six-month prognosis). A total of 12.2% of the sample (65-74 years: 7.1%, 75 years: 12.9%) died during the study period.

Screening Mammography

See Table 2, stratified by age group (65-74 years, 75 years), for overall screening mammography rates, a breakdown of screening by resident characteristics, and predictors of screening. Appendix Table 2 presents a brief literature review of US guidelines for screening mammography among older women.

i. Overall—Among long-term residents in US nursing homes, 7.1% (95% CI: 6.8–7.3%; $n=3,085$) of women aged 65-74 and 1.7% (95% CI: 1.7-1.8%; $n=5,924$) of women aged 75 years received screening mammography in 2011.

i. By Resident Characteristics—Of note, within both age cohorts, the highest percent screened among any one resident characteristic group was that among the non-frail (65-74 years: 12.8%, 75 years: 4.2%). Women with life-limiting conditions were also screened in

both age cohorts. For example, women aged 65-74 years had the following screening rates: 2.2% of those on hospice, 3.1% of those with severe cognitive impairment, 4.9% of the frail, and 5.2% of those with dementia. Moreover, those with various types of severe comorbid condition(s) were also screened (neurological: 6.4%, cardiovascular: 6.4%, respiratory: 7.7%, musculoskeletal: 8.2%). On the other hand, women aged >75 years had the following screening rates: 0.1% of those on hospice, 0.2% of those with a six-month prognosis, 0.8% of those with severe cognitive impairment, and 1.2% of those with dementia. Those with severe comorbidities were also screened in this age group (neurological: 1.5%, cardiovascular: 1.8%, respiratory: 2.1%, single or multi- organ failure: 3.5%).

ii. Predictors—Predictors of screening based on adjusted prevalence ratios (APR) varied for each age cohort. Positive predictors among women aged 65-74 years included: any active cancer diagnosis (vs. no active cancer; APR: 1.6, 95% CI: 1.3-1.8) and musculoskeletal impairment (vs. none; APR: 1.2, 95% CI: 1.1-1.3). Positive predictors among those aged 75 years included: non-Hispanic black race (vs. non-Hispanic white race; APR: 1.6, 95% CI: 1.4-1.7), any active cancer diagnosis (vs. no active cancer; APR: 2.1, 95% CI: 1.9-2.3), musculoskeletal impairment (vs. none; APR: 1.2, 95% CI: 1.1-1.2), and respiratory impairment (vs. none; APR: 1.2, 95% CI: 1.1-1.2). Negative predictors among those aged 65-74 years included: other racial group (vs. non-Hispanic white; APR: 0.7, 95% CI: 0.5-0.9), cognitive impairment (e.g., severe vs. none/mild; APR: 0.4, 95% CI: 0.3-0.4), frailty (e.g., frail vs. non-frail; APR: 0.4, 95% CI: 0.4-0.5), dementia diagnosis (vs. none; APR: 0.8, 95% CI: 0.7-0.9), cardiovascular disease (vs. none; APR: 0.9, 95% CI: 0.8-0.9), receipt of hospice (vs. none; APR: 0.1, 95% CI: 0.0-0.4), six-month prognosis (vs. no such prognosis; APR: 0.4, 95% CI: 0.2-0.9), and US directional region of nursing facility (e.g., south vs. northeast; APR: 0.7, 95% CI: 0.7-0.8). Negative predictors of screening among those aged 75 years included: not married/separated (vs. married; APR: 0.7, 95% CI: 0.7-0.8), cognitive impairment (e.g., severe vs. none/mild; APR: 0.3, 95% CI: 0.3-0.3), frailty (e.g., frail vs. non-frail; APR: 0.4, 95% CI: 0.4-0.5), dementia diagnosis (vs. none; APR: 0.8, 95% CI: 0.8-0.9), single organ failure (vs. no organ failure; APR: 0.9, 95% CI: 0.8-0.9), and urban nursing facility (vs. rural; APR: 0.8, 95% CI: 0.8-0.9).

Geographic Variation

Geographic predictors of screening mammography included directional regions (Northeast, Midwest, South, West) among women aged 65-74 and geographic region type (urban vs. rural) among those 75 years (Table 2). Regarding mammography prevalence on the state-level (Figure 2), for women aged 65-74 (Figure 2 - A), screening ranged from 1.4% in Nevada and 3.5% in Tennessee to 15.7% in Minnesota and 14.2% in South Dakota. States in the lowest quintile of screening rates for this age group (ranging from 1.4 - 4.8% screened) included: Alabama, Arizona, Florida, Georgia, Hawaii, Michigan, Nevada, Rhode Island, South Carolina, and Tennessee. States in the highest quintile of screening rates for this age group (ranging from 10.0 - 15.7% screened) included: Alaska, Delaware, Kansas, Louisiana, Massachusetts, Minnesota, Nebraska, North Dakota, Oregon, and South Dakota. For women aged 75 years (Figure 2 - B), the prevalence of screening on the state-level ranged from 0.6% in Nevada and 1% in Michigan/ Maine to 4.9% in Alaska and 4.5% in Louisiana. States in the lowest quintile of screening for this age group (ranging from 0.6 - 1.3%

screened) included: Alabama, California, Maine, Michigan, Nevada, South Carolina, Tennessee, and Vermont. States in the highest quintile of screening for this age group (ranging from 2.1 - 4.9% screened) included Alaska, Kansas, Louisiana, Mississippi, Missouri, Nebraska, North Dakota, Ohio, Oregon, and South Dakota.

Sensitivity Analysis

When excluding the bilateral diagnostic screens from the definition of screening mammography (Appendix Table 1), overall screening mammography rates (and factors associated with screening) were similar (65-74 years: 6.2% (95% CI: 6.0-6.5%; n=2,719); 75 years: 1.4% (95% CI: 1.4-1.5%; n=4,909); Appendix Table 3).

Discussion

Among long-term stay nursing home resident women, screening mammography occurred in both age cohorts (aged 65-74 and 75 years) over a one-year period (2011). Overall screening rates varied by region and state. The prevalence was less in the older and more debilitated.

The prevalence of mammography in nursing home women was lower (as expected) than estimates of older women from the general US population. In the US (2013), the majority of non-institutionalized women aged 65 years had mammography biennial screening in the past two years.³⁸ This is consistent with screening mammography rates in European countries, but only for women up to age 70.¹⁸ While the European Commission (as of 2003) recommends population-based screening for all women aged 50-69 years, screening after age 70 is rare in Europe. In England, over a two-year period (2011-2012), 3.3% of 71-74 year-olds and 1.5% of 75 year-olds were screened.^{18,39} Given the global deficiency of mammography prevalence data in *nursing homes*, we cannot ascertain how our results would compare internationally. Similar to studies conducted with the general US population,^{28,40} we found regional variation in screening mammography rates. This indicates that some states or facilities are screening less than others. Lower regional screening rates may be secondary to resource constraints, statewide policies/practices, or other regional patterns. For example, higher odds of mammography use has been observed in counties with high Hispanic and black residential segregation than those with low segregation.⁴⁰

Consistent with other studies,^{17,27,28} sociodemographic characteristics were associated with screening mammography among older Medicare-beneficiary women (aged 65 years). Yet, contrary to the literature,^{27,28,40} we found black older adults (> 75 years) were more likely to receive mammography screens than their white counterparts. Because other studies were not nursing home-based, *our* trend may be less about access and more about other contributing factors such as health literacy. On average, older African American patients had lower adequate health literacy scores compared to white ($\beta=-0.58$) and health literacy was shown to be negatively correlated with health utilization among older patients (e.g., hospital use: $r=-0.24$).⁴¹

Unexpectedly, we found potential indicators of reduced life expectancy (e.g., six-month prognosis, multiple organ failure, severe cardiovascular condition etc.) were *not* associated

with lower screening prevalence in one or both age groups. Although these potential indicators were not statistically significant, they were suggestive of less screening among these groups. Regardless, these were not as strong indicators of screening as would be expected since life expectancy has been shown to be important when considering whether a mammography screen would be beneficial.^{42,43} While some US-based guidelines recommend consideration of life expectancy for women ≥ 65 years,^{9,11} many do not.^{5–8} One potential explanation is that without clear guidelines, life expectancy plays less of a role in the decision-making process. This could be tested in future longitudinal studies.

The inverse association between level of cognitive impairment and screening mammography is consistent with existing data.²⁷ Although we observed lower screening rates among those with dementia and the severely cognitively impaired than those in the general population, any screening in this group is notable considering the minimal benefits.^{27,44} Median survival among those with dementia is reported as <3.5 years,⁴⁵ and presumably even less among those with severe cognitive impairment. Because benefits of screening wane with decreasing life expectancy and there are special concerns among those cognitively impaired, screening within these populations should be carefully considered.^{4,43,44}

Mammography procedures are not without harm.⁴² Physical pain during the mammogram process often stems from compression of the breast, pressure of the plate pressing against ribs or sternum, and stretched skin.⁴⁶ There is a 30% cumulative lifetime risk of receiving at least one false positive result with at least ten mammography screens.⁴⁷ False-positives have been shown to produce psychological distress in addition to unnecessary procedures.¹⁶ The potential for over-diagnosis increases with decreasing survival with an estimated over-diagnosis rate ~30% for those ≥ 70 years-old.⁴² Beyond the physical and psychological burden of screening, there are economic costs. Although the prevalence of mammography in our study was relatively low, the fee-for-service cost to Medicare for all breast cancer-related screening is >\$1 billion annually.⁴⁸ In 2017, the average Medicare reimbursement rate for bilateral screening mammography (HCPCS G0202) was \$138.17.⁴⁹ Given the 9,009 Medicare long-term nursing home residents screened in our study, today, this would cost ~\$1.24 million for one year of screening alone, assuming the use of this less expensive type of “screening” mammogram.

Overall, guidelines affect screening mammography rates.^{17,28,29} While there are no specific guidelines for screening mammography among the US nursing home population as of 2017, an American Geriatrics Society working group, as part of the Choosing Wisely initiative, only recommended screening if life expectancy and risks are first considered.⁵⁰ Nonetheless, a review on screening nursing home residents for cancer concluded that long-term residents, typically frail with shortened life expectancy, should not receive screening for asymptomatic cancer given the minimal benefit and significant risk of harm.¹⁹

Limitations of this study should be noted. First, useful information not available from the 2011 data included: biennial screening rates, the granularity of conditions such as dementia, mastectomy procedures completed prior to the study period, life expectancy beyond six-month prognosis, and facility-level characteristics. Since this study only captured one year of screening, and biennial screening is frequently recommended for those ≥ 65 years-old,

screening mammography rates reported here are likely underestimates. Moreover, future research should evaluate the impact of facility-level practices as these could be important predictors of screening mammography, especially on the state-level. Risk factors for increased breast cancer surveillance available as diagnosis codes in Part B claims (e.g., family history of breast cancer) were not included due to issues of coding reliability and validity. To account for uncertainty in screening versus diagnostic mammography claims codes,^{25,26} screening mammography was defined broadly using previous research.²³ A sensitivity analysis of a more conservative definition of screening mammography, defined without diagnostic codes, showed similar results (Appendix Table 3). Lastly, the population was limited to those continuously enrolled in fee-for-service Medicare with nursing home stays one year, so the prevalence of screening other populations (e.g., those with other insurances (Medicare Advantage or uninsured) or nursing home stays <one year) was not measured. Defining long-stay residents as those in the nursing home one year is an approach that misses many of the “long-stay” residents by the CMS definition (>100 day stay). Excluding these residents likely leads to further screening underestimation, but was necessary in order to better ensure that the 2011 mammography claims matched those in the nursing home at the time of the screen.

Despite these limitations, this study is important as it is the first to address screening mammography among a large national nursing home population. These results can help shed light on current practices in screening long-term stay nursing home residents and raise awareness about potential overscreening. Given this data, there are two major next steps that could be pursued: (1) more research and (2) addressing underlying concerns. Regarding future research, more thorough evaluations should be performed using longitudinal data in order to evaluate biennial mammography rates and the potential drivers of screening in nursing homes. To address underlying concerns, one must first recognize that nursing home residents are a vulnerable population. As such, action should be taken to minimize potential harm. Specifically, national US medical organizations could clarify population-specific screening guidelines, patient-provider communication should be encouraged, and there should be greater public awareness about cost-benefits of screening. We hope these results can prompt thoughtful consideration about screening and potential action.

Conclusion

The US long-term nursing home population mostly consists of frail and medically complex residents. Many are receiving mammography screens even with a high potential for net-harm. Thoughtful consideration of screening this population is warranted.

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Declaration of Interest

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Appendix

Appendix Table 1.

Current Procedural Terminology (CPT), Healthcare Common Procedure Coding System (HCPCS), and International Classification of Diseases (ICD-9) Medicare insurance claims codes used to identify mammography events and to classify screening and diagnostic codes for this study

Codes	CPT	HCPCS	ICD-9
Mammography event			
Screening	77052 (analog film, computer-aided detection), 77057 (analog film, bilateral)	G0202 (digital screen, bilateral)	V7610 (breast screening unspecified), V7611 (breast screening high risk - family history of breast cancer), V7612 (other screening mammogram), and V7619 (other screening breast examination)
Diagnostic	77051 (computer-aided detection), 77056 (computer-aided detection, bilateral)	G204 (digital screen, bilateral, diagnostic)	None
Excluded women from sample			
			V103 (history of breast malignancies), 61172 (breast lump/mass)

Appendix Table 2.

Brief review of screening mammography guideline recommendations for older women (aged 65 years) from major United States medical organizations/societies based on the Centers for Disease Control and Prevention (CDC) 2017 summary¹²

Age	65-74 years	75 years
Screening mammography guideline recommendations	Biennial, ^{5,8-10} annual ^{6,11} not recommended [*]	no recommendations, ⁵⁻⁸ not recommended, ¹⁰ biennial ⁹ annual ¹¹

* only those 70-74 years old;

** only for those with 10 year life expectancy;

*** only for those with 5 year life expectancy

Appendix Table 3.

Excluding all bilateral diagnostic screens, prevalence of screening mammography and associated resident characteristics among Medicare beneficiary women in nursing homes long-term in the United States within a one-year period (2011)

Age	65-74 years				75 years			
	No. *	% **	Prevalence Ratio (PR) (95% CI ***)	Adjusted PR (95% CI ***)	No. *	% **	Prevalence Ratio (PR) (95% CI ***)	Adjusted PR (95% CI ***)
Overall	43,683	6.2 [†]	-	-	346,138	1.4 [‡]	-	-
Race/Ethnicity								
Non-Hispanic white	33,684	6.5	1.0	1.0	293,633	1.4	1.0	1.0

Age	65-74 years				75 years			
	No. *	% **	Prevalence Ratio (PR) (95% CI ***)	Adjusted PR (95% CI ***)	No. *	% **	Prevalence Ratio (PR) (95% CI ***)	Adjusted PR (95% CI ***)
Non-Hispanic black	7,260	5.6	0.9 (0.8 – 1.0)	1.1 (1.0 – 1.2)	34,544	1.8	1.3 (1.1 – 1.4)	1.6 (1.5 – 1.8)
Hispanic/Latino	1,910	4.6	0.7 (0.6 – 0.9)	0.9 (0.8 – 1.2)	12,018	1.2	0.9 (0.7 – 1.0)	1.1 (0.9 – 1.3)
Other	829	3.9	0.6 (0.4 – 0.9)	0.7 (0.5 – 1.0)	5,943	0.9	0.7 (0.5 – 0.9)	0.7 (0.6 – 1.0)
Marital Status								
Married	7,855	4.7	1.0	1.0	38,018	1.7	1.0	1.0
Not married/separated	35,828		1.4 (1.2 – 1.5)	1.1 (1.0 – 1.2)	308,120	1.4	0.8 (0.7 – 0.9)	0.7 (0.6 – 0.7)
Cognitive Impairment								
None/mild	18,129	9.3	1.0	1.0	74,147	3.4	1.0	1.0
Moderate	11,989	5.5	0.6 (0.5 – 0.6)	0.7 (0.6 – 0.8)	99,332	1.3	0.4 (0.4 – 0.4)	0.5 (0.5 – 0.5)
Severe	13,565	2.7	0.3 (0.3 – 0.3)	0.4 (0.4 – 0.5)	172,659	0.6	0.2 (0.2 – 0.2)	0.3 (0.3 – 0.3)
Frailty								
Non-frail	8,651	11.6	1.0	1.0	46,607	3.7	1.0	1.0
Pre-frail	5,229	8.7	0.8 (0.7 – 0.9)	0.8 (0.7 – 0.9)	39,430	2.3	0.6 (0.6 – 0.7)	0.7 (0.6 – 0.7)
Frail	29,803	4.2	0.4 (0.3 – 0.4)	0.5 (0.4 – 0.5)	260,101	0.9	0.2 (0.2 – 0.3)	0.4 (0.3 – 0.4)
Comorbidities								
Cancer	1,215	8.4	1.4 (1.1 – 1.7)	1.4 (1.1 – 1.7)	9,738	2.5	1.8 (1.6 – 2.0)	1.7 (1.5 – 1.9)
Dementia	19,901	33.6	0.6 (0.6 – 0.7)	0.8 (0.8 – 0.9)	239,027	1.0	0.5 (0.4 – 0.5)	0.8 (0.8 – 0.9)
Neurological	14,500	5.6	0.9 (0.8 – 1.0)	1.1 (1.0 – 1.2)	61,817	1.3	0.9 (0.8 – 0.9)	1.1 (1.0 – 1.2)
Cardiovascular	8,933	5.6	0.9 (0.8 – 1.0)	0.8 (0.7 – 0.9)	82,813	1.5	0.9 (0.8 – 0.9)	1.0 (0.9 – 1.0)
Musculoskeletal	15,079	7.4	1.3 (1.2 – 1.4)	1.3 (1.2 – 1.4)	160,690	1.6	1.2 (1.2 – 1.3)	1.2 (1.1 – 1.3)
Respiratory	11,029	6.8	1.1 (1.0 – 1.2)	1.0 (0.9 – 1.1)	63,663	1.8	1.3 (1.2 – 1.4)	1.2 (1.1 – 1.3)
Organ Failure								
None	33,089	6.4	1.0	1.0	252,385	1.4	1.0	1.0
Single organ failure	8,973	5.9	0.9 (0.9 – 1.0)	0.9 (0.8 – 1.0)	83,214	1.4	1.0 (0.9 – 1.0)	0.9 (0.8 – 0.9)
Multiple organ failure	1,621	5.5	0.9 (0.7 – 1.1)	0.8 (0.6 – 1.0)	10,539	1.5	1.0 (0.9 – 1.2)	0.8 (0.7 – 1.0)
End-of-life Care/Status								
Hospice	893	0.5	0.1 (0.0 – 0.2)	0.2 (0.1 – 0.5)	12,954	0.1	0.1 (0.0 – 0.1)	0.1 (0.1 – 0.3)
Six-month prognosis	680	0.9	0.1 (0.1 – 0.3)	0.5 (0.2 – 1.1)	8,723	0.2	0.1 (0.1 – 0.2)	0.7 (0.4 – 1.1)
Region								
Northeast	8,614	7.3	1.0	1.0	82,608	1.4	1.0	1.0

	Age	65-74 years				75 years			
		No. *	% **	Prevalence Ratio (PR) (95% CI ***)	Adjusted PR (95% CI ***)	No. *	% **	Prevalence Ratio (PR) (95% CI ***)	Adjusted PR (95% CI ***)
	Midwest	11,603	7.8	1.1 (1.0 – 1.2)	1.0 (0.9 – 1.1)	101,685	1.6	1.2 (1.1 – 1.3)	1.0 (0.9 – 1.1)
	South	18,897	4.9	0.7 (0.6 – 0.8)	0.7 (0.6 – 0.8)	129,398	1.4	1.0 (0.9 – 1.1)	0.9 (0.9 – 1.0)
	West	4,569	5.7	0.8 (0.7 – 0.9)	0.8 (0.7 – 0.9)	32,447	1.3	0.9 (0.8 – 1.1)	1.0 (0.8 – 1.1)
Region Type									
	Rural	11,955	6.6	1.0	1.0	98,460	1.3	1.0	1.0
	Urban	31,728	6.1	0.9 (0.8 – 1.0)	0.9 (0.8 – 1.0)	247,678	1.8	0.7 (0.7 – 0.8)	0.8 (0.7 – 0.9)

* No.= total number of nursing home residents;

** % = percent of nursing home residents that received screening mammography ;

*** CI = confidence interval;

[†] 6.2% = 6.2% with a 95% confidence interval of 6.0 – 6.5%;

[‡] 1.4% = 1.4% with a 95% confidence interval of 1.4 – 1.5%

Notes: Prevalence Ratio (PR) = crude prevalence ratio via Poisson regression with each characteristic individually;
Adjusted PR (APR) = adjusted prevalence ratio via multivariable Poisson regression with clustering by facility adjusted for characteristics listed in this table + length of stay; APR reference categories for comorbidity and end-of-life care/status variables are those without that condition or service

Comorbidities defined: cancer = any active cancer diagnosis; dementia = dementia or Alzheimer's Disease; neurological = paralysis, traumatic brain injury, Multiple Sclerosis, Parkinson's Disease, Huntington's Disease; cardiovascular = Coronary Artery Disease, Peripheral Vascular Disease; musculoskeletal = osteoporosis, arthritis, recent fracture; respiratory = asthma, Chronic Obstructive Lung Disease, pneumonia

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Figure 1.
Construction of the sample

Figure 2.

Unadjusted prevalence of screening mammography by state in the United States among Medicare beneficiary women residing in nursing homes long-term (2011), stratified by age. A. Women aged 65-74 years, B. Women aged ≥ 75 years

Table 1.

Characteristics of fee-for-service Medicare beneficiary women residing in nursing homes long-term (2011) in the United States, by age group (n=389, 821)

	65-74 years (n=43,683)	75 years (n=346,138)
	<i>Percentage</i>	
Overall	100.0	100.0
Race/Ethnicity		
Non-Hispanic white	84.0	84.8
Non-Hispanic black	10.7	10.0
Hispanic/Latino	3.6	3.5
Other	1.7	1.7
Marital Status		
Married	11.8	11.0
Cognitive Impairment		
None/mild	22.1	21.4
Moderate	46.9	28.7
Severe	31.0	49.9
Activities of Daily Living (ADL) Limitations		
None/Mild	22.1	21.5
Moderate	46.9	47.5
Severe	31.0	31.1
Frailty		
Non-frail	14.2	13.5
Pre-frail	11.5	11.4
Frail	74.4	75.1
Comorbidities		
Cancer	2.8	2.8
Dementia	45.6	69.1
Neurological	19.6	17.9
Cardiovascular	23.5	23.9
Musculoskeletal	45.1	46.4
Respiratory	19.2	18.4
Organ Failure		
None	73.2	72.9
Single organ failure	23.7	24.0
Multiple organ failure	3.1	3.0
End-of-life Care/ Status		
Hospice	3.6	3.7
Six-month prognosis	2.4	2.5
Length of stay in years (mean $\pm$ standard deviation)	2.3 $\pm$ 3.2	2.4 $\pm$ 2.5
Directional Region		
Northeast	23.4	23.9

	65-74 years (n=43,683)	75 years (n=346,138)
	<i>Percentage</i>	
Midwest	29.1	29.4
South	38.0	37.4
West	9.5	9.4
Geographic Region Type		
Urban	71.7	71.6

Comorbidities defined: cancer = any active cancer diagnosis; dementia = dementia or Alzheimer's Disease; neurological = paralysis, traumatic brain injury, Multiple Sclerosis, Parkinson's Disease, Huntington's Disease; cardiovascular = Coronary Artery Disease, Peripheral Vascular Disease; musculoskeletal = osteoporosis, arthritis, recent fracture; respiratory = asthma, Chronic Obstructive Lung Disease, pneumonia

Table 2.

Prevalence of screening mammography and associated resident characteristics among Medicare beneficiary women in nursing homes long-term in the United States within a one-year period (2011)

Age	65-74 years				75 years			
	No. *	% **	Prevalence Ratio (PR) (95% CI ***)	Adjusted PR (95% CI ***)	No. *	% **	Prevalence Ratio (PR) (95% CI ***)	Adjusted PR (95% CI ***)
Overall	43,683	7.1[†]	-	-	346,138	1.7[†]	-	-
Race/Ethnicity								
Non-Hispanic white	33,684	7.4	1.0	1.0	293,633	1.7	1.0	1.0
Non-Hispanic black	7,260	6.5	0.9 (0.8 – 1.0)	1.1 (1.0 – 1.2)	34,544	2.1	1.2 (1.1 – 1.3)	1.6 (1.4 – 1.7)
Hispanic/Latino	1,910	5.2	0.7 (0.6 – 0.9)	0.9 (0.8 – 1.1)	12,018	1.5	0.9 (0.8 – 1.1)	1.2 (1.0 – 1.4)
Other	829	4.3	0.6 (0.4 – 0.8)	0.7 (0.5 – 0.9)	5,943	1.1	0.7 (0.6 – 0.9)	0.8 (0.6 – 1.0)
Marital Status								
Married	7,855	5.5	1.0	1.0	38,018	2.1	1.0	1.0
Not married/separated	35,828	7.4	1.3 (1.2 – 1.5)	1.1 (1.0 – 1.2)	308,120	1.7	0.8 (0.7 – 0.9)	0.7 (0.7 – 0.8)
Cognitive Impairment								
None/mild	18,129	10.6	1.0	1.0	74,147	4.0	1.0	1.0
Moderate	11,989	6.2	0.6 (0.5 – 0.6)	0.7 (0.6 – 0.7)	99,332	1.6	0.4 (0.4 – 0.4)	0.5 (0.5 – 0.6)
Severe	13,565	3.1	0.3 (0.3 – 0.3)	0.4 (0.3 – 0.4)	172,659	0.8	0.2 (0.2 – 0.2)	0.3 (0.3 – 0.3)
Frailty								
Non-frail	8,651	12.8	1.0	1.0	46,607	4.2	1.0	1.0
Pre-frail	5,229	9.9	0.8 (0.7 – 0.9)	0.8 (0.7 – 0.9)	39,430	2.8	0.7 (0.6 – 0.7)	0.7 (0.7 – 0.8)
Frail	29,803	4.9	0.4 (0.4 – 0.4)	0.4 (0.4 – 0.5)	260,101	1.1	0.3 (0.2 – 0.3)	0.4 (0.4 – 0.4)
Comorbidities								
Cancer	1,215	11.2	1.6 (1.4 – 1.9)	1.6 (1.3 – 1.8)	9,738	3.7	2.2 (2.0 – 2.5)	2.1 (1.9 – 2.3)
Dementia	19,901	5.2	0.6 (0.6 – 0.6)	0.8 (0.7 – 0.9)	239,027	1.2	0.5 (0.4 – 0.5)	0.8 (0.8 – 0.9)
Neurological	14,500	6.4	0.9 (0.8 – 1.0)	1.1 (1.0 – 1.2)	61,817	1.5	0.9 (0.8 – 0.9)	1.1 (1.0 – 1.2)
Cardiovascular	8,933	6.4	0.9 (0.8 – 1.0)	0.9 (0.8 – 0.9)	82,813	1.8	1.0 (1.0 – 1.1)	1.0 (0.9 – 1.0)
Musculoskeletal	15,079	8.2	1.2 (1.2 – 1.3)	1.2 (1.1 – 1.3)	160,690	1.9	1.2 (1.2 – 1.3)	1.2 (1.1 – 1.2)
Respiratory	11,029	7.7	1.1 (1.0 – 1.2)	1.0 (0.9 – 1.1)	63,663	2.1	1.3 (1.2 – 1.4)	1.2 (1.1 – 1.2)
Organ Failure								
None	33,089	7.2	1.0	1.0	252,385	1.7	1.0	1.0
Single organ failure	8,973	6.8	1.0 (0.9 – 1.0)	0.9 (0.8 – 1.0)	83,214	1.7	1.0 (1.0 – 1.1)	0.9 (0.8 – 0.9)
Multiple organ failure	1,621	6.7	1.0 (0.8 – 1.2)	0.9 (0.8 – 1.1)	10,539	1.8	1.1 (0.9 – 1.2)	0.8 (0.7 – 1.0)
End-of-life Care/Status								
Hospice	893	2.2	0.1 (0.0 – 0.2)	0.1 (0.0 – 0.4)	12,954	0.1	0.1 (0.0 – 0.1)	0.1 (0.1 – 0.2)
Six-month prognosis	680	0.9	0.1 (0.1 – 0.3)	0.4 (0.2 – 0.9)	8,723	0.2	0.1 (0.1 – 0.2)	0.6 (0.4 – 1.0)
Directional Region								
Northeast	8,614	8.3	1.0	1.0	82,608	1.7	1.0	1.0

Age	65-74 years				75 years			
	No. *	% **	Prevalence Ratio (PR)	Adjusted PR	No. *	% **	Prevalence Ratio (PR)	Adjusted PR
			(95% CI ***)	(95% CI ***)			(95% CI ***)	(95% CI ***)
Midwest	11,603	8.6	1.0 (0.9 – 1.1)	1.0 (0.9 – 1.1)	101,685	1.9	1.1 (1.0 – 1.2)	1.0 (0.9 – 1.0)
South	18,897	5.8	0.7 (0.6 – 0.8)	0.7 (0.7 – 0.8)	129,398	1.7	1.0 (0.9 – 1.1)	1.0 (0.9 – 1.0)
West	4,569	9.3	0.8 (0.7 – 0.9)	0.8 (0.7 – 0.9)	32,447	1.5	0.9 (0.8 – 1.0)	0.9 (0.8 – 1.0)
Region Type								
Rural	11,955	7.3	1.0	1.0	98,460	2.1	1.0	1.0
Urban	31,728	7.0	0.9 (0.9 – 1.0)	0.9 (0.9 – 1.0)	247,678	1.6	0.7 (0.7 – 0.8)	0.8 (0.8 – 0.9)

* No.= total number of nursing home residents;

** % = percent of nursing home residents that received screening mammography;

*** CI = confidence interval;

[†] 7.1% = 7.1% with a 95% confidence interval of 6.8 - 7.3%;

[†] 1.7% = 1.7% with a 95% confidence interval of 1.7 - 1.8%

Notes: Prevalence Ratio (PR) = crude prevalence ratio via Poisson regression with each characteristic individually; Adjusted PR (APR) = adjusted prevalence ratio via multivariable Poisson regression with clustering by facility adjusted for characteristics listed in this table + length of stay; APR reference categories for comorbidity and end-of-life care/status variables are those without that condition or service

Comorbidities defined: cancer = any active cancer diagnosis; dementia = dementia or Alzheimer's Disease; neurological = paralysis, traumatic brain injury, Multiple Sclerosis, Parkinson's Disease, Huntington's Disease; cardiovascular = Coronary Artery Disease, Peripheral Vascular Disease; musculoskeletal = osteoporosis, arthritis, recent fracture; respiratory = asthma, Chronic Obstructive Lung Disease, pneumonia