Screening Mammography Among Older Women: A Review of United States Guidelines and Potential Harms

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Abstract

In the United States, older women (aged ≥ 65 years) continue to receive routine screening mammography surveillance, despite limited evidence supporting the benefits to this subpopulation. This article reviews screening mammography guidelines and the potential harms of such screening for older women in the United States. Published guidelines and recommendations on screening mammography for older women from professional medical societies and organizations in the United States were reviewed from the mid-20th century to present. Observational data were then synthesized to present the documented harms from screening mammography among older women. In 1976, the American Cancer Society recommended to screen all women aged ≥ 40 years with no upper age limit. With time, other major U.S. medical societies adopted their own screening guidelines without a consensus on age of screening cessation. A population-wide screening effort has largely continued without an upper age limit and with it, a growing body of literature on the harms of screening older women. Reported harms from screening mammography procedures have included physical pain, psychological distress, excessive use of health services from overdiagnoses/false positives, and undue financial expenses. These costs are particularly pronounced among special populations with limited life expectancies such as those of very advanced age ≥ 80 years, long-term nursing home residents, and the cognitively impaired. When potential harms, remaining life years, and the viability of available treatments are considered, the burdens of screening mammography often outweigh the benefits for older women. For some cases, an individualized approach to recommendations would be appropriate. National guidelines should be updated to provide clear guidance for screening women of advanced age, especially those in special populations with limited life expectancies.

Keywords: mammography, breast cancer, screening, older adults, nursing homes, guidelines

Introduction

WORLDWIDE, BREAST CANCER is the most common type of cancer among women.¹ In the United States, approximately one in every eight women will develop breast cancer during their lifetime.² In 2014, an estimated 236,968 U.S. women were diagnosed with breast cancer, while 41,211 died of breast cancer-related causes.³

Epidemiology of Breast Cancer in Older Women

As of January 2014, 4.60% of women aged 60–69 years, 6.63% of women aged 70–79 years, and 6.89% of women aged ≥ 80 years were diagnosed with invasive breast cancer.² Of all incident breast cancer cases (2010–2014), almost one in five occurred in women aged ≥ 75 years.² Among all breast cancer-related mortality (2010–2014), 36.8% of women were

at least 75 years of age at the time of their death.² However, the prognosis for breast cancer is favorable with a 5-year survival of 89.5% and 87.1% for women ≥ 65 and ≥ 75 years old, respectively.²

Development of screening mammography

Given the high incidence of breast cancer and higher rates of survival from early diagnosis, targeted breast cancer screening has been a public health strategy for decades.⁴ In the early 20th century, the mammogram was introduced in the form of X-rays, targeted to the breast, enabling visualization of breast malignancies.⁵ By the 1950s, the quality of mammographic imaging improved with the introduction of breast compression, single emulsion film, and a low voltage–high milliamperage technique.⁶ Although the improved mammogram showed promise of diagnosing nonpalpable breast

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malignancies, it was not widely accepted as a screening tool until the 1960s.^{7,8}

In 1965, a large-scale randomized-controlled clinical trial demonstrated a 30% reduction in breast cancer-related mortality among women aged 40–64 years receiving annual screening mammograms after 14 years of follow-up.^{9,10} In 1971, the American Cancer Society (ACS), an influential nonprofit organization, recommended population-wide annual mammographic surveillance.^{11,12} Although original studies did not always show mammograms with perfect sensitivity (ranging from 83% to 95%) or specificity (ranging from 94% to 99%), the screening tool was embraced as the gold standard of noninvasive diagnostic modalities.¹³

Today, the most common mammographic screens include not only standard X-ray film but also digital and 3D (tomosynthesis) imaging.¹⁴ Typically, film is still used for screening mammography unless a higher resolution image is indicated (e.g., dense breasts). Even with more advanced screening technology, sensitivity and specificity rates remain similar in the range of mammographic screening modalities.

Screening mammography and age

Regardless of modality, women >50 years of age appear to consistently have a slightly higher sensitivity than their young counterparts.^{13,15} Using predictive modeling with U.S. cancer surveillance data (1998–2002), the cancer detection rate *via* screening mammography was estimated to be ~2 per 1000 at age 40, ~7 per 1000 at age 50, and ~15 per 1000 at age 60 with a positive predictive value ranging from 1.3% (age 40 years) to 9.8% (age 60 years).¹⁶ Although cancer detection and screening performance appear to increase with age, the case for routine mammography screening in older women is not straightforward. The purpose of this article is to provide a review of U.S. guidelines regarding screening mammography guidelines, decision support alternatives, and the harms of such screening in older women.

Materials and Methods

For this article, we first reviewed screening mammography guidelines in the United States since the inception of the ACS in 1945 to present. We highlighted current screening mammography recommendations from leading U.S. professional societies, with particular attention paid to the upper age limit of screening. We also reviewed alternatives to national guidelines in guiding clinician decision-making regarding screening mammography.

Drawing primarily from observational studies, we then synthesized published peer-reviewed literature on the potential harms of screening mammography among older women within five broad categories: physical pain, psychological distress, overdiagnoses/false positives, financial costs, and special populations. This information was based on peer-reviewed publications searched *via* Google Scholar or PubMed databases. We define older women as ≥65 years old, remaining consistent with U.S. Medicare health insurance age of entitlement.

Results

Review of U.S. screening mammography guidelines: past to present

In the United States, the ACS (established 1945¹⁷) and the U.S. Preventative Services Task Force (USPSTF; established

1984¹⁸) have been on the forefront of population-wide screening endeavors, providing widely applied recommendations. From 1976 to 2009, routine mammography screening was recommended for all women ≥40 years old with no upper age limit by both the ACS (1976–2015)¹² and the USPSTF (2002–2009).¹⁹

In 2009, the USPSTF updated their recommendations, which now differed from those of the ACS.²⁰ At that point, the USPSTF abstained from any recommendation for those aged 40–49 and ≥75 years, and recommended biennial (instead of annual) screening for those 50–74 years old.²¹ In October 2015, the ACS updated their guidelines recommending annual screening for those aged 45–54 years and biennial screening for patients ≥55 years “as long as a woman is in good health and is expected to live at least 10 more years.”¹²

Various other organizations have since released their own guidelines on screening mammography with different strategies.²² For example, several organizations^{23–25} sided with the USPSTF and abstained from any recommendation for older women aged ≥75 years, while one organization²⁶ specifically recommended against and several^{27,28} recommended for routine mammography for older women.

A summary of the current recommendations for screening mammography among older women (aged 65–74 and ≥75 years) is presented in Table 1. Regardless of conflicting guidelines, U.S. Medicare (Part B) health insurance has covered routine screening mammography for women aged ≥40 years with no upper age limit since 1991.^{29,30}

National guideline alternatives: an individualized approach

While alternatives to national guidelines in guiding clinician decision-making about screening mammography have been developed, it is unclear if these resources are widely used. The Aging Wisely Campaign of the American Geriatrics Society has concluded that screening should be based on individual characteristics, including life expectancy—weighing the risks with the benefits of screening on a case-by-case basis.³¹

Walter and Covinsky (2001) provide a conceptual framework to help guide decision making about cancer screening for older patients taking into account remaining life expectancy, risk of cancer-related mortality, and potential harms.³² An online tool, ePrognosis, created by integrating Walter and Covinsky’s framework, was designed to provide guidance to providers and older patients when making decisions about whether to pursue preventative breast cancer screening *via* mammography or colon cancer screening *via* colonoscopy. The tool can be accessed at <http://cancerscreening.eprognosis.org/>.³³

Even with guideline updates and other resources available, population-wide mammography screening among all adult women has largely continued indiscriminately since 1976. This has allowed over three decades of observational data to accumulate on the efficacy of screening mammography for older adults. Early large trials (1963–1982)³⁴ systematically excluded those aged >50 years, and almost all subsequent large trials were for those aged 45–64 years.³⁵ Remaining testimony rests primarily on observational data—a lens that we will now use to discuss the observed costs of screening this older cohort of the population.

Harms of screening mammography

Decades of population-wide screening mammography has led to an accumulation of data, which leads one to question

TABLE 1. SUMMARY OF SCREENING MAMMOGRAPHY GUIDELINES FOR OLDER WOMEN FROM MAJOR PROFESSIONAL SOCIETIES AND MEDICAL ORGANIZATIONS IN THE UNITED STATES BASED ON A REPORT BY THE CENTERS FOR DISEASE CONTROL AND PREVENTION.²²

Woman's age	65–74 years	≥75 years
Screening mammography frequency recommendations	Annual ^{23,28} Biennial ^{21,25–27} Not recommended ^{24,c} No recommendation	Annual ^{28,a} Biennial ^{27,b} Not recommended ²⁶ No recommendation ^{21,23–25}

The most common recommendation is highlighted in bold for each age group. See citations for organization references.

^aAnnual screening recommended only for those with ≥5-year life expectancy.²⁸

^bBiennial screening recommended only for those with ≥10-year life expectancy.²⁷

^cNot recommended for those aged 70–74 years.²⁴

not only the age of initiation but also the age of cessation.³⁶ Although “when to stop” routine mammography screening may have received less attention from research and lay press,³⁷ its importance should not be minimized considering the potential harms.

A recent review of the benefits and harms of screening mammography revealed that (1): there is limited evidence for older women and the oldest and most clinically impaired women may not derive any benefits with respect to increased life expectancy.³⁸ While a mortality benefit from breast cancer screening may take 5–10 years depending on the use and availability of effective treatment, the burdens from screening are often immediate and could persist.³⁸ These burdens are not trivial, and can include physical pain, psychological distress, overuse of health services from overdiagnoses/false positives, and financial waste.^{35,38–40}

Physical pain. There is physical pain that has been reported in the process of screening mammography induced by stretching the skin, raising arms, the plate pressing against one's chest (including ribs and sternum), and pressure from breast compression.⁴¹ One study found that ~80% of women undergoing mammography experienced pain from the examination—among those 60% reported pain that was moderate or severe.⁴² An early study (1998) noted that almost half of women invited to a second round of mammography screening declined—citing pain from the first mammogram as the primary reason.⁴³

To the best of our knowledge, no studies to date have specifically evaluated the level of pain experienced during mammography among older women. However, among frail older women who often have multiple comorbidities and musculoskeletal impairments, one could expect increased pain in response to the physical processes involved in the procedure due to a heightened sensitivity from related ailments.

Psychological distress. Psychological distress is also not uncommon during the screening mammography experience. Women have reported fear and anxiety from screening, not only about the prospect of pain from the process, but also about the potential of being diagnosed with breast cancer.^{44,45} One study found that ~60% of those receiving a mammography screen experienced some form of anxiety about the procedure and ~90% experienced some form of anxiety about the results.⁴⁴ Although this distress is notable, unclear results and subsequent testing can elicit longer term and more severe stressors.^{46,47} Distress from subsequent diagnostic

testing after an initial mammogram has been shown to persist up to 1 year post initial recall,^{46,47} and could potentially last even longer if evaluated for a lengthier period of time.

Psychological distress from mammography among those of very advanced age (≥80 years) is unclear. However, it is not unreasonable to extrapolate emotional trends to this older population. Those older may face even greater psychological stressors during the screening process than younger cohorts. This is because older women are at increased risk of breast malignancies, yet most of the currently available treatments are so physically taxing that the frail may not survive their course. Consequently, many screened older women will be burdened with the decision about their pursuit of a therapeutic strategy that has questionable benefit, but major implications.

Overdiagnoses and false positives. Psychological distress from screening mammography extends to overdiagnoses and false positives. The proportion of breast cancer-related overdiagnoses and false positives across the United States are surprisingly high after the implementation of population-wide screening efforts.

Many breast cancers that have been detected and possibly even treated may not have manifested clinically within the remainder of a woman's lifetime, especially among those of advanced age.³⁸ It is estimated that ~30% of all breast cancers diagnosed among women aged ≥40 years in the United States were overdiagnosed, or unlikely to have progressed clinically.³⁶ This rate is likely higher among older women with less remaining life years and an increased likelihood of slow-growing cancers.⁴⁸

Moreover, overdiagnosis is not an isolated issue. Unfortunately, with overdiagnoses comes the potential for greater use of unnecessary health services from subsequent testing and overtreatment. Tests after a positive result often include diagnostic mammograms and additional imaging, ultrasounds, and biopsies—tests that come with their own psychological and physical risks ranging from emotional distress to potential scarring and infections.^{38,47,49} Furthermore, with increasing age comes a higher likelihood of false-positive mammogram results. After >10 years of annual screening, ~60% of all participants will receive at least one false-positive result in their lifetimes.^{39,50} From 2012 to 2013, data from a major U.S. insurance plan indicated a false-positive rate from mammography screening between 10% and 15%.⁵¹ Overall, false positives are not uncommon and often leads to undue emotional distress and excessive testing.⁴⁷

Financial costs. Older adults in the United States are classified, based on the Centers for Medicaid and Medicare Services (CMS), as ≥ 65 years of age, coinciding with Medicare coverage.²⁹ Therefore, Medicare bears the brunt of the costs of screening mammography among the older adult population in the United States. With Medicare costs rising at unsustainable rates, attention should be given to areas at which potential waste can be identified.

For the Medicare fee-for-service program in the United States from 2006 to 2007, the total expenditure for breast cancer screenings and related testing was \$1.08 billion, while the payment for treatment was \$1.36 billion.⁵² For women aged 75–84 years, total expenditure for screening and subsequent testing was \$350 million, with treatment costs estimated at $\geq$ \$700 million. For women aged 85–100 years, total expenditure for screening and subsequent testing was \$60.3 million, with treatment costs estimated at \$182 million.⁵² These costs are substantial, but they underestimate screening-related costs for the entire older adult population in the United States by excluding those not on Medicare fee-for-service health insurance (e.g., those on Medicare Advantage, on another HMO health insurance, or uninsured).

National U.S. expenditures (2011–2013)⁵¹ for false-positive mammography screenings and subsequent testing 1-year postdiagnosis have been estimated at \$852 per false-positive result, with the cost for 1 year of invasive breast cancer screening and treatment estimated at \$51,837 per individual and that of noninvasive breast cancer (ductal carcinoma *in situ*) estimated at \$12,369 per individual. This study estimated the overall costs to the nation from false positives and overdiagnoses to be $\sim$ \$4 billion per year at minimum.⁵¹ In all, economic costs from breast cancer screening-related expenditures are substantial and exert economic pressure on the health care system nationally.

Special populations. Screening mammography in special populations of older adults are likely to experience even fewer benefits from screening than those of the general population. This specifically applies to groups that have such a limited life expectancy (< 5 years) that they will not have enough time to benefit from preventative screening, even with the availability of viable treatments.⁵³ For example, those with dementia have a mean survival of < 4 years after diagnosis, and those with severe cognitive impairment likely have even less.^{54,55} In addition, long-term nursing home residents have an average remaining life expectancy of < 3 years, and are largely impaired either physically and/or cognitively.^{54,56} Screening these individuals is unlikely to result in a change in management that would improve their quality of life given the limited amount of time they have left.

Moreover, the very old (aged ≥ 80 years) are a special population because, even among the healthiest of this population, screening may have little benefit for three primary reasons. First, their remaining life years are limited (likely < 5 years) since the average human life expectancy is 81 years for women and 76 years for men in the United States.⁵⁷ Second, most cancers detected at this advanced age are ductal carcinomas *in situ*, which are noninvasive, slow-growing malignancies.⁵⁸ Therefore, most cancers diagnosed among the very old *via* screening mammography would never present clinically during their lifetime, reducing the potential for any benefit from screening this group. Third, the burden of comorbid illness

and frailty severely limits therapeutic options, given a diminished functional status for surgery, systemic chemotherapy, or radiation-based approaches. Treatment complications have also been shown to increase with advanced age.^{53,59,60}

An observational study that compared women aged ≥ 80 years who received a mammography screen with those who did not found no significant difference in breast cancer-related mortality and stage at diagnosis between the two groups. However, differences were apparent in evaluating the harms of screening, where 12.5% of the women who received a mammogram experienced harm as defined by follow-up testing, false positives, and refusal of care.⁵⁸ Although the majority of this very old population may not benefit from preventative screening mammography, the population is heterogeneous, and unique cases warrant clinical judgment to identify individuals who may benefit.

Discussion

As evidenced by conflicting organization guidelines,²² there is a contentious debate in the United States about mammography screening—when to initiate and when to cease screening, if at all. If not resolved, the burdens of screening mammography will continue to grow with the older population. Currently, 14% of the population is aged ≥ 65 years,⁶¹ and this is projected to increase to 25% by 2050.⁶² From 2015 to 2050, the number of those aged ≥ 85 years will nearly triple, reaching 17.9 million (4.5% of the total population).⁶³ After three decades of population-wide mammography screening in the US, we can draw on longitudinal observational data to evaluate effectiveness. One study³⁶ did exactly that and found two effects from the widespread screening effort. They found that on one hand, the rate of women presenting with late-stage breast cancer dropped by 8%, but on the other hand, diagnoses of early stages nearly doubled. Although both effects appear beneficial, the authors also estimated that in one year (2008), $\sim 31\%$ of all breast cancers diagnosed were overdiagnosed cases. The authors concluded that the benefits from this breast cancer screening were marginal at best.³⁶ Passionate responses to this article ensued with arguments on both sides. The original authors responded to critics, rebutting claims.⁶⁴

Although much of the debate on both the national and international stage has been about breast cancer screening in general, several papers have come out to discuss when to stop screening, especially among older populations.^{31,38,65–68} These articles have generally advocated that screening among the elderly poses minimal benefits with notable harms. Despite the growing consensus, older women with limited life expectancies continue to undergo mammograms.^{69,70} In 2010–2012, 30% of women aged 75 years received at least one mammogram.⁷⁰

Recommendations to help improve decision-making:

When considering screening mammography in older adults, one must be cognizant of the goal of secondary prevention efforts and screening programs—to detect asymptomatic breast cancer and consequently improve prognosis through early treatment. The underlying rationale is to intervene early to reduce suffering and ultimately enhance well-being. There needs to be adequate benefit from a mammography screen to justify the patient burden that will follow.³⁹ To reduce harm and unnecessary screening to this older

cohort of the population, we should first improve decision-making. Two potential mechanisms to improve decision-making in this context include: (1) enhancing patient-provider communication and (2) updating guidelines.

i. Enhancing patient-provider communication. While frameworks³² and online tools³³ are available to both clinicians and older patients to enable decision support for breast cancer screening, the use of these tools is unclear. Moreover, due in part to the aggressiveness and relative success of the public health campaign to promote population-wide mammography screening,^{71,72} evidence suggests that many older patients do not view screening as a decision, but a task that they do automatically.⁷³ Furthermore, many older adult patients have reported to never discuss the continuation or discontinuation of routine screening with their provider.⁷³ To the patients, discontinuing routine mammography may be considered more consequential than continuation of screening, which many view as a given.^{71,73} A discussion on this topic could be further complicated by common misconceptions of elevated benefits and minimized harms.^{38,71,74} With this in mind, clinicians should explain the limitations of mammography and the potential cost-benefit given their patient's health status. The framework and online tools available could be used to guide this discussion. Clinicians should also engage in a dialog about a patient's willingness to accept available treatments if diagnosed with breast cancer and their personal standards for quality of life. This additional information could help promote active patient-provider engagement in deciding if the harms of screening mammography outweigh any potential benefits for an older individual.³⁸

ii. Updating guidelines. Changing U.S. guidelines for screening mammography has been shown to affect screening practices.^{70,75} Given this understanding, it is possible that inconsistent and vague guidelines may have helped promote the continuation of mammography screens among older women who experience net harm from the procedure. Guidelines should be updated, so that there is more guidance regarding when to stop screening, especially among special populations of older women. A consensus among major medical organizations regarding the guidelines would be ideal, but may not be realistic in the present time without new information or prospective long-term studies on screening for breast cancer in the older population.

Future directions

To further inform the screening mammography debate, researchers should ensure that older women are adequately represented in their sample and analysis. Other studies should be conducted to estimate the extent to which potential over-screening is occurring in older age groups and the root causes for over-screening. Whether continued screening for breast cancer in older women occurs because of system issues or poor patient-provider communication needs to be better understood.

Author Disclosure Statement

D.M. has no conflicts of interest to disclose. Dr. Kate Lapane serves as a consultant to TherapeuticsMD on work unrelated to this article.

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