



The Benefits of Screening Mammography

Charles De Jesus¹ · Tanya W. Moseley¹ · Valentina Diaz² · Varnita Vishwanath³ · Shanen Jean³ ·
Ahmed Elhatw⁴ · Hanna R. Ferreira Dalla Pria¹ · Hannah L. Chung¹ · Mary S. Guirguis¹ · Miral M. Patel¹

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Abstract

Purpose of Review Breast cancer is the most commonly diagnosed cancer worldwide. Early detection through screening mammography has been proven to reduce mortality, morbidity, and years of life lost. The purpose of this review is to discuss the benefits of screening mammography and the latest recommendations from the American College of Radiology (ACR).

Recent Findings Approximately 300,000 new cases of breast cancer are diagnosed in the USA yearly. Screening mammography has allowed for early cancer detection with increasing efficacy leading to 500 prevented deaths for every 100,000 women screened and a 5-year survival rate of 91%.

Summary Mammography screening promotes the earlier detection of breast cancer, hence minimizing mortality, years of life lost, and treatment morbidity associated with advanced breast cancer at the time of diagnosis.

Keywords Screening · Mammography · Benefits · Guidelines · Reduced mortality · Years of life saved · Reduced treatment morbidity

Introduction

Breast cancer is the most common globally diagnosed cancer accounting for 13% of all new annual cancer diagnoses worldwide [1]. In the USA, 1 in 8 women will receive a diagnosis of invasive breast cancer in their lifetime [1].

Almost 290,000 new cases of invasive breast cancer and 51,000 cases of non-invasive cancers were expected to be diagnosed in women in the USA, and an estimated 43,250 women would die from breast cancer in 2022 [1].

Certain risk factors will increase a woman's chance of being diagnosed with breast cancer in her lifetime. These risk factors include a personal or family history of breast, ovarian, tubal or peritoneal cancer, known carrier or first degree relative with a pathogenic mutation with the most well-known being BRCA mutations,

Charles De Jesus and Tanya W. Moseley contributed equally to this work.

✉ Tanya W. Moseley
TStephens@mdanderson.org

Charles De Jesus
CDe8@mdanderson.org

Valentina Diaz
ValentinaDiazad@gmail.com

Varnita Vishwanath
Varnita.Vishwanath@midwestern.edu

Shanen Jean
Shanen.Jean@midwestern.edu

Ahmed Elhatw
AhmedElhatw@gmail.com

Hanna R. Ferreira Dalla Pria
HRFerreira@mdanderson.org

Hannah L. Chung
HLChung@mdanderson.org

Mary S. Guirguis
MGuirguis@mdanderson.org

Miral M. Patel
MPatel6@mdanderson.org

¹ Division of Diagnostic Imaging, University of Texas MD Anderson Cancer Center, Box 1350, 1515 Holcombe Blvd, TX 77030 Houston, USA

² Baylor College of Medicine, Houston, TX, USA

³ Arizona College of Osteopathic Medicine, Midwestern University, Glendale, AZ, USA

⁴ National Cancer Institute, Cairo University, Cairo, Egypt

increased mammographic breast density, previous breast biopsy demonstrating a high-risk lesion (e.g., atypical ductal hyperplasia or atypical lobular hyperplasia), age of menarche, age at first live birth, number of pregnancies, menopausal status, and radiotherapy to the chest between age 10 and age 30 [2]. While breast cancer is most commonly found in women, men can also be diagnosed with breast cancer. The lifetime risk of breast cancer for men is 1 in 833 [3•], and therefore due to the lower risk, routine screening mammography in men is not recommended.

Breast cancer death rates have been in a steady decline since 1989 as a result of treatment advances and early detection through screening mammography [1]. Mammography screening has been one of the most studied screening programs worldwide with large randomized clinical trials dating back to the 1970s [4, 5]. Over the years, the efficacy of screening mammography has been a tried and proven method of cancer prevention leading to approximately 500 prevented deaths for every 100,000 women screened and a 5-year survival rate of 91% [1]. These trials have led to the development of the commonly heard slogan “Screening Mammography Saves Lives” with the three major benefits of screening being reduced mortality, reduced years of life lost, and reduced treatment morbidity.

Reduced Mortality (Number of Deaths)

In medicine, “mortality” refers to the number of deaths over a certain period of time [6]. Compared to no screening, studies show a 40% reduction in mortality in women aged 40 to 84, including a 2015 meta-analysis by the International Agency for Research on Cancer (IARC) [7]. The IARC meta-analysis conducted a review of 20 cohort and 20 case-controlled studies in high-income countries (Australia, Europe, and North America), from 1994 to 2014, and concluded that screening mammography is an effective tool in breast cancer mortality reduction for women aged 50–69 years with several studies extending that benefit to women aged 70–74 years. Additional studies demonstrate that annual screening contributes to a 12–29% mortality reduction in women ages 40–49 [7]. The Surveillance, Epidemiology, and End Results (SEER) cancer statistics review reports mortality rates of 19.9, 4.2, and 60.9 deaths per 100,000 women of all ages, ages < 50, and ages > 50 years, respectively: a decrease from 32.7, 8.16, and 96.91 deaths per 100,000 in 1991 [8, 9•]. The number needed to screen (NNS), or how many women need to be screened to prevent one breast cancer death, decreases with age as incidence of breast cancer increases in older women. Thus, NNS is approximately 750 for women ages

40–49 compared to 460 and 355 for women ages 50–59 and 60–69, respectively [10].

Reduction in Years of Life Lost (Measure of Premature Death)

In medicine, “years of life lost” is defined as a measure of premature death and considers the age at which death occurs, giving greater weight to deaths at younger ages [11]. It is estimated that 30% of years of life lost is from breast cancer diagnosed in women during their 40 s, and for every 20 women who undergo screening in their 40 s, one year of life is gained [12–14]. As breast cancer screening with mammography has gained popularity due to increased evidence-based medicine and outreach programs, the SEER program reported a relative 5-year survival rate of 91% for women in the USA for the period 2010–2016 which is an approximate increase from 84% reported in 1987–1989 [1]. This increased survival rate is attributed to screening mammography’s goal of detecting breast cancer early. Detection of stage 1 breast cancer has a 5-year survival rate of approximately 99 compared to 93% for stage 2 and 72% for stage 3 breast cancers. In women diagnosed early, the 10-year survival rate of 76% and 20-year survival rate of 65% have been reported [9•, 15], compared to women with distant metastasis at the time of diagnosis who have a 5-year survival rate of approximately 29% [16].

Reduced Treatment Morbidity (State of Being Symptomatic or Unhealthy Due to a Disease/Condition)

Early detection also decreases treatment morbidity. Cancers that are diagnosed by screening are usually smaller and local (no lymph node involvement or distant metastasis) [17] and can be treated with local therapy. In comparison, systemic therapy is needed for more aggressive tumors with distant metastases which have demonstrated a 5-year survival rate of approximately 29% [16]. Women ages 40–49 who do not get regular screening mammography are 3 times more likely to undergo a mastectomy, 5 times more likely to undergo axillary node dissection, and 2.5 times more likely to undergo chemotherapy compared to women who undergo routine screening mammography [18•]. Women who undergo regular screening and diagnosed with early cancers are most likely to be candidates for breast conserving therapy, i.e., lumpectomy with radiation, which has equivalent survival rates to mastectomy, preserves a cosmetically acceptable breast, and offers low rates of local recurrence in the treated breast [19]. Thus, the earlier breast cancer is detected by screening, the greater reduction in treatment morbidity.

Current Screening Recommendations

Mammography screening for women of average risk is generally not recommended under the age of 40. The risk of developing cancer increases with age, and to date, no increased benefit of screening before the age of 40 has been demonstrated. However, once women reach the age of 40 years old, a screening mammogram is recommended. The specific recommendations for screening mammography vary among organizations. Organizations including the American College of Radiology (ACR), Society of Breast Imaging (SBI), American Cancer Society (ACS), and US Preventive Services Task Force (USPSTF) among others have specific guidelines for screening mammography. The ACR recommends breast cancer screening with mammography for the general population and additional supplemental screening for a select population of high-risk individuals [2]. For women of average risk, the ACR recommendations include annual mammography for women aged 40–74 and for ages 75+; a mammography may be offered if life expectancy is at least 10 years [2]. The ACR recommendations differ from the USPSTF guidelines which recommend beginning screening mammography at age 50.

Recommending screening mammography starting at age 40 by the ACR has been shown to save the most lives, estimated as an additional 12,200 lives per year in the USA compared to biennial screening starting age of 50 as recommended by the USPSTF [20•]. In general, the ACR includes not only more trials but also more recent data to support their recommendations compared to other entities. For example, the USPSTF considers only mortality reduction as the benefit for their guidelines [20•]. The ACR, on the other hand, considers mortality reduction and additional benefits such as less frequent and less toxic chemotherapy, less aggressive surgery, early detection and treatment of high-risk lesions, and reduction in years of life lost [21]. As such, the recommendations established by the ACR reflect maximum benefit to the patient and have been adopted/recommended by the American Society of Breast Surgeons (ASBrS), Society of Breast Imaging (SBI), the National Consortium of Breast Centers (NCBC), and the National Comprehensive Cancer Network (NCCN) [20•].

Harms and Risks of Screening Mammography

Minor risks/harms have been discussed in relation to screening mammography. These include false-positive exams and overdiagnosis of clinically insignificant breast cancer. With screening mammography, there is a concern of detecting of false-positive findings, i.e., a screening mammography call-back that turns out to be benign

upon additional diagnostic imaging work-up. A few factors contribute to false-positive reports including young age, increased breast density, family or personal history of breast cancer, prior breast biopsies, current estrogen use, increased interval between screening mammogram examinations, and a lack of comparison to prior mammograms. Another concern is that screening mammography can lead to overdiagnosis, which is a diagnosis of cancer that would not have been clinically relevant in a patient's lifetime. Overdiagnosis is very difficult to estimate due to the reduced body of evidence on the subject, and current estimates are considered inaccurate and overstated because they cannot be measured directly [20•]. A discussion of the risks/harms of mammography screening should be a regular part of the process of shared decision-making between the primary care provider and the patient regarding screening, along with screening alternatives and a woman's individual preferences [22].

Conclusion

In the USA, 1 in 8 women will be diagnosed with invasive breast cancer at some point in their lives. In 2022 alone, 290,000 new cases of breast cancer were diagnosed. Certain risk factors can increase women's likelihood of being diagnosed with breast cancer, including known genetic mutations such as BRCA 1 and BRCA 2 mutations, among others. Since 1989, breast cancer deaths have steadily decreased due not only to advances in treatment but also to mammography screening. Screening programs have been proven over the years and have been shown to have a significant impact on reducing mortality by preventing 500 deaths per 100,000 women screened, reducing years of life lost and treatment morbidity. Currently, the ACR screening mammography recommendations offer the most benefit to women because of the inclusion criteria of scientific evidence taken into consideration.

Author Contribution All authors contributed to the conception and design of this review. All authors gave final approval of the version of the review to be published, and all authors agree to be accountable for all aspects of the work.

Declarations

Conflict of Interest Drs. Chung, De Jesus, Elhatw, Ferreira Dalla Pria, Guirguis, and Patel, Ms. Diaz, Ms. Jean, and Ms. Vishwanath declare that they have no conflict of interest. Dr. Moseley is a medical imaging consultant for Merit Medical, Hologic, and Siemens Medical. Human and Animal Rights.

This article does not contain any studies with human or animal subjects performed by any of the authors.

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