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Estimate of the Number of Breast Cancers Undetected by Screening Mammography in Individuals with Dense Breast Tissue

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ABSTRACT

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Background: Screening mammography has limited sensitivity for detecting breast cancer in dense breast tissue. This study estimates the maximal number of breast cancers undetected by mammography in individuals with dense breast tissue participating in screening mammography in the United States.

Methods: Published data on supplemental screening incremental cancer detection rates (ICDRs), dense breast tissue prevalence, and total annual screening mammography exams in the United States are utilized for study estimates.

Results: Assuming an ICDR of 16 cancers beyond mammography per 1,000 individuals with dense breast tissue, 38.8 million mammograms in the U.S. in 2021, and a prevalence of dense breast tissue of 43%, the number of cancers undetected by mammography in individuals with dense breast tissue participating in screening in the U.S. is estimated at 267,000.

Conclusion: A large number of undiagnosed breast cancers in the population of individuals with dense breast tissue participating in screening mammography is estimated.

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INTRODUCTION

Although lifesaving, screening mammography has limited sensitivity for cancer detection in individuals with dense breast tissue.^{1,2} Supplemental screening is therefore proposed to detect mammographically-occult breast cancers.^{1,3} The total number of cancers undetected by mammography in individuals with dense breast tissue participating in screening (i.e., the reservoir of mammography-occult breast cancers) is an important topic that could inform policies for supplemental breast cancer screening. The purpose of this study is to estimate the maximal number of breast cancers undetected by mammography that exist in the population of individuals with dense breast tissue

participating in screening mammography in the United States.

METHODS

Institutional Review Board approval was waived because only published data on U.S. screening mammography participation, dense breast tissue prevalence, and incremental cancer detection rates are used.

Incremental cancer detection rates (ICDRs)—the number of additional cancers detected per 1,000 individuals with dense breast tissue by supplemental screening compared to mammography alone—provides an estimate of how many cancers are undetected by mammography per 1,000 individuals with dense breast tissue. The ICDR of the most sensitive supplemental screening examination for individuals with dense breast tissue may act as a surrogate number for the maximal number of cancers that screening mammography did not detect per 1,000

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individuals. A peer-reviewed 2021 comparative literature review by a multi-institution panel of breast imaging experts², compared ICDRs between current supplemental screening modalities for individuals with dense breast tissue and is utilized in this study to identify the most sensitive supplemental screening modality and corresponding ICDR.

Data from the U.S. Food and Drug Administration (FDA) estimates the total number of screening mammograms performed per year.⁴ Peer-reviewed data on the prevalence of dense breast tissue within the U.S. population is also available and utilized for study estimates.⁵

To estimate the maximal number of cancers undetected by mammography in individuals with dense breast tissue participating in screening mammography in the U.S., the number of undetected breast cancers per 1,000 individuals with dense breast tissue is multiplied by the number of 1,000 individuals with dense breast tissue participating in screening mammography.

RESULTS

Contrast-enhanced breast MRI has the highest ICDR among current supplemental screening options for individuals with dense breast tissue, with an ICDR of approximately 16.0 cancers beyond 2D mammography per 1,000 individuals with dense breasts based on 9,256 supplemental screening exams.²

The number of screening mammograms performed in the U.S. in 2021 was 38.8 million⁴, which equals 38,800 groups of 1,000 individuals. The prevalence of dense breast tissue in the U.S. screening mammography population is estimated at 43% based on published data from over 1.5 million mammograms.⁵

The method used to estimate the maximal number of cancers undetected by mammography in individuals with dense breast tissue participating in screening in the U.S. in 2021 is 16.0 (the number of undetected cancers per 1000 individuals with dense breast tissue) x 38,800 (the number of groups of 1,000 individuals participating in screening mammography in the U.S.) x 43% (the proportion of the screening population with dense breast tissue) which equals 267,000 cancers.

DISCUSSION

This study estimates that 267,000 undiagnosed breast cancers exist among individuals with dense breast tissue currently participating in screening mammography in the U.S. This corresponds to a rate of undiagnosed breast cancer in approximately 1.6% of the estimated 16,600,000 individuals with dense breast tissue participating in screening in the U.S. This is

roughly equivalent to the total number of breast cancers diagnosed in the U.S. in 2019, which was estimated by the U.S. Centers for Disease Control to be 264,121.6 Current and future dense breast tissue supplemental screening with additional imaging modalities such as whole breast ultrasound, breast MRI, contrast-enhanced mammography, or molecular breast imaging could theoretically reduce this reservoir of mammographically-occult breast cancers. Increased detection of mammographically-occult breast cancers may reduce the number of breast cancers that are locally advanced or metastatic at presentation, thereby lowering breast cancer mortality.

Limitations of this study include combining several published estimates, thereby lowering the accuracy of the study estimate. Additionally, some proportion of the individuals with dense breast tissue undergoing screening mammography in the U.S. may have received supplemental breast cancer screening with whole breast ultrasound, breast MRI, or other imaging modalities. If so, the total number of breast cancers that remain undetected in this population would be less than estimated. Nevertheless, the purpose of this study was to provide a maximal estimate of the number of undetected breast cancers in the study population, with the assumption that no supplemental screening has occurred. Direct measurement in a large prospective trial that accounts for any current use of supplemental screening could provide more accurate estimates.

CONCLUSION

These results suggest that a large number of undiagnosed breast cancers exist in the population of individuals with dense breast tissue participating in screening mammography.

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CONFLICTS OF INTEREST

Matthew F. Covington: Received personal payment from Applied Radiology for educational speaking pertaining to contrast enhanced digital mammography, outside of the scope of this project. Dr. Covington is a consultant for InVicro, LLC for medical imaging review, outside of the scope of this project.

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