Healthier women are more likely to follow age-based mammogram guidelines, leaving room for better-targeted testing

December 17 2020, by Peter Dizikes

Credit: National Cancer Institute/public domain

About 35 percent of women get annual mammograms from age 40 onward. But the value of those screenings has been much debated, because mammograms for people in their 40s catch relatively few cases of breast cancer, generate plenty of false positive results, and produce some cases of unnecessary treatment.

Thus, while some organizations have advocated for testing to start at age 40, in 2009 the U.S. Preventive Services Task Force recommended that women start regular mammogram screening at age 50, not age 40—a major preventative health policy change.

But a new study co-authored by MIT scholars identifies an important challenge in designing such guidelines: Women who start getting mammograms at age 40 may be healthier than the population of 40-year-old women as a whole—and they have a lower incidence of breast cancer than those who do not start getting tested at that age.

Therefore, simply changing age recommendations is not, by itself, an optimal way to make breast-cancer screening policy.

For one thing, given that women who opt in to testing in their 40s are relatively healthier, altering those age guidelines has a relatively limited impact. At the same time, if mammogram screenings reached more women from ages 40-49, those tests would likely detect more cases of breast cancer, per screening, than they currently do. This suggests that new ways of identifying at-risk women who would benefit from screening would also be useful.

"Debates over when to recommend screening are missing a key point," says MIT economist Amy Finkelstein, co-author of a new paper detailing the study's results. "There are arguments about what the costs and benefits are of screening women at a certain age, but these tend to overlook the fact that those who follow the recommendations [for early screening] differ from the rest of the population. This makes the problem more complicated. You can't just forget human behavior and human selection when designing recommended health care practices."

To picture the health disparity the researchers found, suppose all women who currently start mammogram screening at age 40 shifted their first

test to age 45. Now suppose an equal-size group of women with average health had been starting screening at age 40, and also shifted their first tests to age 45 as well. Both groups would see a rise in mortality due to breast cancer, but the first group would have only about one-quarter as many deaths.

"What we find in the paper is that compared to the women who don't follow the recommendation to get a mammogram, those who do are healthier, they are less likely to have cancer, and if they do find cancer, it's likelier to be smaller and at an earlier stage," says Abby Ostriker '16, an MIT Ph.D. candidate in economics and a co-author of the study.

"Targeting screening to higher-risk groups could be more effective than general age-based recommendations, which we find attract mostly healthy women," adds Tamar Oostrom Ph.D. '20, an assistant professor of economics at Ohio State University and another co-author of the study.

The paper, "Screening and Selection: The Case of Mammograms," appears in the December issue of the *American Economic Review*. The co-authors are Finkelstein, who is the John and Jennie S. MacDonald Professor of Economics in the MIT Department of Economics; Liran Einav, a professor of economics at Stanford University; Oostrom; Ostriker; and Heidi Williams, the Charles R. Schwab Professor of Economics at Stanford University.

Data show "compliers" are healthier

Overall, health insurance data show, about 90 percent of mammograms for middle-aged women are negative, another 9.7 percent are false positives, and just 0.7 percent are authentically positive. Previous studies have found particularly limited mammogram benefits for women ages 40 to 49. But the American Cancer Society has still advocated that

women start annual screening at age 40, and the Affordable Care Act of 2010 mandates that insurers reimburse mammograms for women starting at age 40. Therefore the percentage of women having mammograms jumps sharply from 10 percent before age 40, to 35 percent at age 40.

However, as the scholars point out in the paper, this entire debate has "primarily focused on the average impacts of mammograms," rather than considering the possibility that those who comply with screening recommendations may make up a lower-risk group than those who do not.

To investigate this issue, the scholars drew upon multiple information sources, including the Health Care Cost Institute (HCCI), which has data about screenings and diagnoses from three insurance companies (Aetna, Humana, and United Healthcare) involving 3.7 million women who got mammograms from 2009 through 2011.

The researchers also used a database from the National Cancer Institute (NCI) called Surveillance, Epidemiology, and End Results (SEER), which provides detailed data on over 200,000 breast cancer diagnoses between 2000 and 2014 for women in 13 U.S. states, as well as demographic data about the patients. To study the impact of detection at different points in time, the researchers used a clinical model of breast cancer disease progression in the absence of treatment, which had been developed by medical researchers. That clinical model also helped the researchers approximate the overall incidence of breast cancer in the entire population, including those who are not screened.

In all, they find that 10 percent of women who start having mammograms before age 40 have a relatively high positive test rate of 0.84 percent, possibly because they experience symptoms. By contrast, only 0.56 percent of the women who start getting mammograms at age

40 test positive for breast cancer, and the number of late-stage cases among them falls by 6 percentage points compared to people who get screened before age 40.

They also considered a third group—women who don't get mammograms even when they are recommended above age 40. Compared to this group, women who do start screenings in the 40s (whom the researchers call "compliers"), are also more likely to get other forms of preventative care, including flu shots and cervical cancer screenings, and have fewer emergency room visits for any reason. It is harder to assess the incidence of cancer for the women who do not get mammograms even when they are recommended at age 40. But the clinicians' model enables the researchers to estimate that the cancer risk among these unscreened women is likely higher than it is among the compliers.

"This is a great example of how health economics can build off medical research, and vice versa," Oostrom says.

Overall, Finkelstein says, "When you make age-based recommendations, it looks like the people who are most likely to follow them are the ones for whom it's least beneficial—which doesn't mean it's not beneficial, but those are not the people you most want to target."

Better ways to target?

The scholars also suggest that their findings highlight the value of recent proposals by clinical researchers to target recommended screenings to higher-risk groups—potentially based on factors like the age of mothers at first birth, or genetic markers—instead of, or together with, age-based guidance. To be sure, they recognize that such methods would still require additional medical research.

More immediately, the researchers say, they would like the findings to become part of the ongoing policy discussion.

"We want to think about choice and behavior," Finkelstein says, noting that the ways people use health care, if studied carefully, can be applied to develop robust new policies.

The researchers also hope the paper will encourage further studies of the same main issue across a range of diseases. Earlier this fall, the U.S. Preventive Services Task Force changed its recommended start age for colorectal cancer screening from 50 to 45.

"We studied mammograms, but there are other kinds of cancer screening that are also very important," Ostriker says. "This concept that the average person is not necessarily the same as the person who elects to participate is, I think, very pervasive. And getting more attention for that is hopefully going to be helpful."

More information: Liran Einav et al. Screening and Selection: The Case of Mammograms, *American Economic Review* (2020). DOI: 10.1257/aer.20191191