

The Relationship between Breast Cancer Incidence, Mammography and Income in New York State

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Background and Purpose

A positive association between breast cancer incidence and socioeconomic status (SES) has been well-established through hundreds of studies.¹ This relationship has been explained by differences in reproductive history, physical activity, genetic factors, and mammography rates, though taken together they insufficiently explain the observed patterns. In New York State, there is about a 50% difference in local-stage breast cancer incidence rates among white non-Hispanic women between the wealthiest and poorest communities, as defined by census tract of residence at diagnosis (Fig. 1).

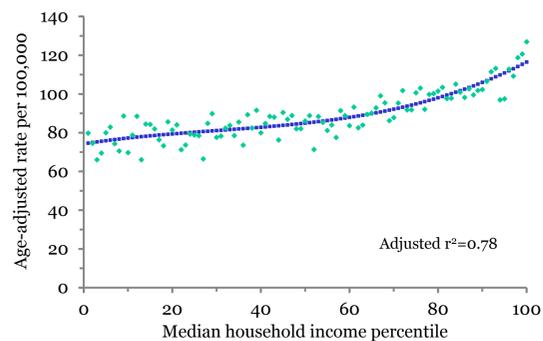


Figure 1. Local-stage female invasive breast cancer incidence by median household income, white non-Hispanic women, New York State, 2008-2012.

For in situ diagnosis, however, the difference is more than twofold, all of which occurs in the upper half of the income distribution. Rates of in situ breast cancer are actually about the same for poor and middle-income women (Fig. 2). As middle- and upper-income women share many of the same risk factors, we hypothesized that differences in mammographic technology could explain some of this disparity. Specifically, several studies have suggested that digital mammography is more sensitive at detecting breast lesions than film mammography, and like many new technologies, digital mammography was more rapidly adopted in wealthier communities.^{2,3}

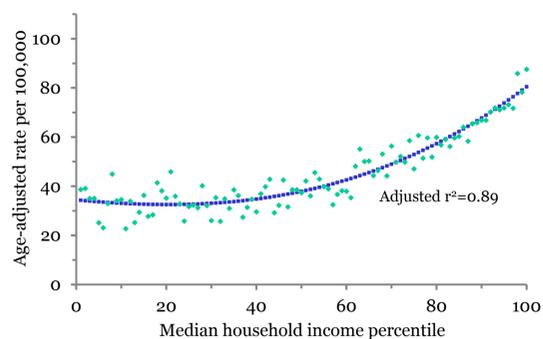


Figure 2. In situ female breast cancer incidence by median household income, white non-Hispanic women, New York State, 2008-2012.

Methods

Using Medicare claims data from a sample of women aged 65 and over from New York State without cancer for the period 2004-2012, we examined the type of screening and diagnostic mammograms that were delivered, as determined by HCPCS codes: digital mammograms, film mammograms with computer-aided analysis, and film mammograms alone. We calculated the proportion of mammograms that were digital by year and ZIP code of patient residence and related this to median household income, presenting the results in both timeline and map formats.

Results

Our study period corresponded to widespread adoption of digital mammography. In 2004, 10% of the poorest women and 24% of the wealthiest women received their mammograms digitally (Fig. 3). By 2012, the corresponding numbers were 87% and 99%. The socioeconomic disparity persisted over the entire period, peaking in 2008-2009 when the gap between poorest and wealthiest was about 30%. Similar results were found for both screening and diagnostic mammograms (only the former shown).

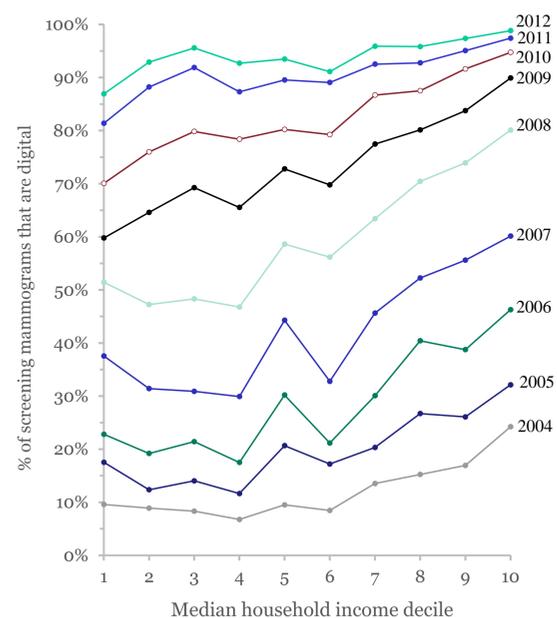


Figure 3. Relationship between digital screening mammography and median household income, 2004-2012. Mammography data from Medicare claims from a sample of New York State women at least 65 years of age without cancer. Income data from the 2007-2011 ACS 5-year estimates.

A map of digital mammography adoption also captures the disparity (Fig. 4). Percentages are generally higher in the wealthier urban and suburban markets, with cities like Binghamton standing out as early adopters. Within New York City, rates are substantially higher in Manhattan, Staten Island, and the outer part of Queens than in the Bronx or Brooklyn.

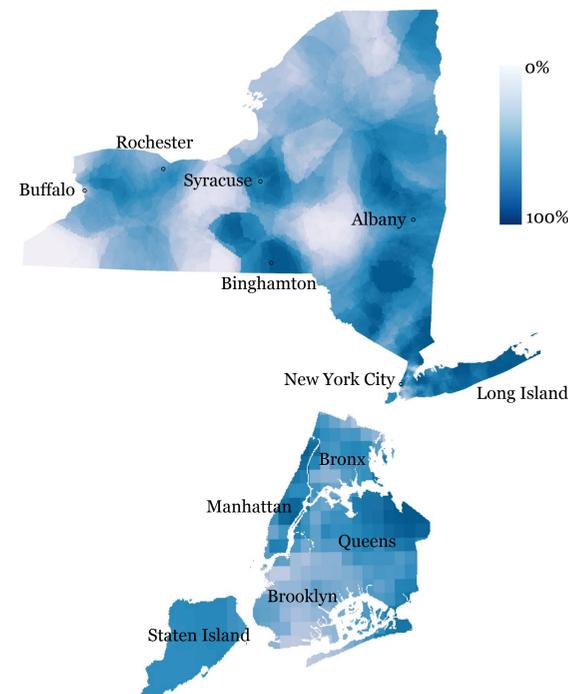


Figure 4. Smoothed maps showing the percentages of screening mammograms received that were digital in 2008 based on zip code of residence (Upper panel: NYS, lower panel: NYC)

Bluekens et al.² reported that digital mammography boosted the overall detection rate of DCIS by 18%. Applying this number to New York gives a rough idea of the magnitude of the potential effect of technology on in situ breast cancer rate disparities. Taking the in situ rate diagnosed via film mammography to be unknown, the rate diagnosed through digital mammography to be 18% higher than this, and the rate among women who did not receive mammograms to be zero yields the following table:

	Mammogram distribution (%)			In situ rate by mammogram type			Expected overall in situ rate
	Film	Digital	None	Film	Digital	None	
Wealthiest	14	56	30	x	1.18x	0	80.1x
Middle	28	39	33	x	1.18x	0	74.0x
Poorest	33	32	35	x	1.18x	0	70.8x

Table 1. Estimated in situ breast cancer rate disparities in New York State, by income, 2008, based on mammography rate and type. Data from the Behavioral Risk Factors Surveillance Survey (BRFSS) and Figure 3.

Discussion

Table 1 suggests that even at the peak of the technology disparity in 2008, the corresponding in situ rate difference would have been only about 13% between the poorest and wealthiest women, and only 8% between the wealthiest and middle-income women. Given that the observed difference in rates was more than 100%, differential access to digital mammography accounted for only a small proportion of the in situ breast cancer rate difference. This would have dwindled almost to nothing as digital mammography approached being nearly universal; as of May, 2016, over 97% of the licensed machines in the U.S. were digital.⁴ Clearly there remain additional unexplained factors driving socioeconomic disparities in localized and in situ breast cancer.

In the last few years, a new technological disparity has emerged in the form of 3-D digital tomography, which is currently available primarily in wealthy practices. Since it was recently approved for reimbursement by Medicare, it is likely poised for much wider adoption. It is still too early to know how this technology will influence breast cancer rates, but at least one study suggests there will be similar effect as was seen with digital mammography: 3-D digital tomography offers higher sensitivity and higher specificity, which can be expected to translate into higher breast cancer rates, along with a small and temporary increase in socioeconomic disparities.⁵

References

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