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Addressing Potential Health Disparities in the Adoption of Advanced Breast Imaging Technologies

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Abstract

With the advent of new screening technologies, including digital breast tomosynthesis, screening ultrasound, and breast MRI, there is growing concern that existing disparities among traditionally underserved populations will worsen. These newer screening modalities purport improved cancer detection over mammography alone, but are not offered at all screening facilities and often require a larger co-pay or out-of-pocket expense. Thus, the potential for worsening disparities with regards to access and appropriate utilization of supplemental screening technologies exists. Currently, there is a dearth of literature on the topic of health disparities related to access and use of supplemental breast cancer screening and their impact on outcomes. Identifying and addressing explanatory factors for persistent and potentially worsening disparities remains a central focus of efforts to improve equity in breast cancer care. Therefore, this paper provides an overview of factors that may contribute to present and future disparities in breast cancer screening and outcomes, and explores specific relevant topics requiring greater research efforts as more personalized, multi-modality breast cancer screening approaches are adopted into clinical practice.

Introduction

While breast cancer incidence in the U.S. has steadily increased over the past four decades, breast cancer mortality rates have declined with current five-year relative survival rates of 99% and 84% in women diagnosed with localized and regional disease, respectively [1][2].

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Decreased mortality has largely been attributed to both increased mammography screening resulting in early detection and improved therapies [3]. However, not all women have benefitted equally from these advances that have led to improved breast cancer survival. Racial/ethnic minorities, women from low socioeconomic backgrounds, those living in rural areas, and the elderly bear a disproportionate burden of breast cancer morbidity and mortality [4][5]. These vulnerable populations often contend with barriers to screening, experience delays in diagnosis, and present with more advanced stage of disease at time of diagnosis [6–8].

With the advent of new screening technologies, including digital breast tomosynthesis, screening ultrasound, and breast MRI, there is growing concern that existing disparities will worsen [9], since typically, vulnerable populations have been the last to benefit from new health technologies [10][11]. These newer screening modalities purport improved cancer detection over mammography alone, but are not offered at all screening facilities and often require a larger co-pay or out-of-pocket expense [12]. Thus, the potential for worsening disparities with regards to access and appropriate utilization of supplemental screening technologies exists.

Currently, there is a dearth of literature on the topic of health disparities related to access and use of supplemental breast cancer screening and their impact on outcomes. Identifying and addressing explanatory factors for persistent and potentially worsening disparities remains a central focus of efforts to improve equity in breast cancer care [13]. Therefore, this paper provides an overview of factors that may contribute to present and future disparities in breast cancer screening and outcomes, and explores specific relevant topics requiring greater research efforts as more personalized, multi-modality breast cancer screening approaches are adopted into clinical practice.

Persistent Disparities

Between 1973 and 2010, breast cancer incidence in the U.S. rose from 82.6 to 127.3 per 100,000 women, with White women having a higher incidence rate (127.3 per 100,000) compared to African-American, Hispanic, Asian/Pacific Islander, and American Indian/Alaskan Native women (rates of 118.4, 91.1, 84.7, and 90.3, respectively). Despite having a lower incidence rate, African-American and subgroups of Hispanic women demonstrate higher mortality rates [14][15]. While African-American women have the highest breast cancer-specific mortality of all ethnic groups, breast cancer represents the leading cause of cancer death in Hispanic women [16][17].

Differences in outcomes seen among vulnerable populations are linked to more advanced disease at diagnosis, worse biological features of disease, and more comorbid conditions [18]. Patient-level factors including low income, limited education, lack of health insurance, and rural residence have all been associated with worse breast cancer outcomes, potentially due to decreased screening and delays in care [19][20]. Other patient-level factors including cultural differences, acculturation, and linguistic barriers may also play a role [21]. Many of these characteristics are disproportionately seen in certain ethnic minority groups, potentially exacerbating mortality disparities observed in these populations.

Community-level factors also likely influence cancer screening outcomes. Rural communities, as well as regions demonstrating low per capita income and high unemployment rates, demonstrate diminished access to overall medical services due to limited resource allocation and proximity to medical services [13][19]. Variable geographic access likely contributes to the different screening rates seen among non-Hispanic white women compared to minority groups [3]. Differences in screening adherence strongly contributes to advanced stage at diagnosis and increased mortality seen in certain minority populations, including Black and subgroups of Hispanic women [22]. Native Americans, who have the least geographic access to screening services, demonstrate the lowest screening rates out of all ethnicity groups in the U.S, with less than one-third of Native women undergoing screening mammography [23].

Advanced Imaging Use Beyond Mammography

Over the last decade, new imaging-based breast cancer screening technologies have emerged, including tomosynthesis, screening (automated) ultrasound, and breast MRI, which are rapidly changing the landscape of breast cancer screening [9][24–26]. These modalities show promise in improving sensitivity for detecting additional cancers when added to mammography, are FDA-approved, and are increasingly available in community settings [27–30]. New state laws across the U.S. now require imaging facilities to directly inform patients about increased breast cancer risk due to dense breast tissue, further increasing demand for supplemental screening [31]. Breast density legislation, present in 60% of states as of April 2017, may further facilitate increased use of emerging imaging modalities due to variable state recommendations and modality-specific reimbursement rates for adjunct screening [32].

In contrast to digital mammography, advanced imaging services are inconsistently reimbursed by third party payers. Nevertheless, from 2013 to 2015, digital breast tomosynthesis availability increased from 0 to 50% among Breast Cancer Surveillance Consortium (BCSC) facilities [33]. Market competition and patient demand appear to act as primary drivers of rapid diffusion of this technology throughout US community practices [34]. Similar to digital breast tomosynthesis, prior studies supporting improved breast cancer detection in women with dense breast tissue with whole breast ultrasound has led to its increased use [24]. Automated breast ultrasound (ABUS) offers similar sensitivity to hand-held ultrasound, while removing intra-operator variability [35][36]. Breast MRI screening is currently recommended by the American Cancer Society for women at high lifetime (>20%) risk [37]. Additionally, potential expansion of breast MRI screening to women with dense breast tissue is currently being evaluated through the DENSE trial [38]. Widespread use of breast MRI as an efficient breast cancer screening tool may become more prevalent, as abbreviated screening protocols are now being tested [39].

Given the known financial pressures on mammography facilities, these emerging technologies offer the opportunity to increase revenue through either higher reimbursement for MRI or higher out-of-pocket payments for tomosynthesis and screening ultrasound. As a consequence, adoption of adjunct technologies may inadvertently cause decreased availability and access to imaging services for those unable to afford them. Furthermore,

vulnerable women may be displaced from routine screening if there are fixed or decreasing imaging capacity and preference for accommodating more financially sustainable exams among facilities.

Previous studies corroborate that unequal adoption of new technologies disproportionately affects vulnerable populations and can potentially exacerbate pre-existing health disparities [10][40]. This is likely to be true with new advanced breast imaging technologies, as they are geographically less accessible than routine mammography and are often associated with high out-of-pocket expenses or higher co-pay requirements. Unlike mammography screening which has benefited from the Patient Protection and Affordable Care Act (PPACA) expanding mandatory health insurance coverage for routine preventive services and prohibiting cost-sharing for screening mammography, there is no requirement for insurance coverage of supplemental screening modalities [41].

Patient-Level Enabling Factors

The health belief model (HBM) takes into account the association between perceived susceptibility to disease and benefits of breast cancer screening [42]. Patient-level factors, including patient knowledge, health literacy, and cultural beliefs, are important determinants of health behavior [43][44]. These factors have been shown to directly impact effective communication between patients and physicians, influencing health-seeking behaviors and physician recommendation adherence. Acculturated Hispanic women, specifically those demonstrating English proficiency, are more likely to recognize breast cancer risk factors and to obtain routine screening. Lack of English proficiency may prevent adequate navigation through the healthcare system and negatively influence patient-provider interactions [17][21]. Additional barriers to screening include embarrassment, denial, and inconvenience, impacting screening adherence [45][46].

Interventions to close the breast cancer screening disparities gap have, thus far, primarily focused on patient-level factors largely falling into three categories: 1) health policy and/or financial support to support breast cancer screening, 2) community-based outreach programs to increase awareness, and 3) mobile mammography to remove geographic access barriers. With regards to financial support, approximately one in five African Americans do not have health insurance [47]. While Medicaid fills gaps in coverage for approximately 32% of Blacks, quality of care may not be sufficient [48]. Some uninsured women are able to access outreach programs designed to offer free or low-cost mammograms. The National Breast and Cervical Cancer Early Detection Program (NBCCEDP) and Breast and Cervical Cancer Prevention and Treatment Act was established to increase access to mammography screening and treatment with provisions for underserved groups, including uninsured and minority groups [49]. Although funding restrictions have limited services to only a small subset of women, the PPACA will expand coverage to more women 32 million individuals by 2019 [48]. Similar to prior government supplemental funding programs, however, this legislation does not clearly address funding for advanced imaging services. This is particularly important in Latina and African-American women, who report cost concerns as a barrier to screening [50].

The majority of federal funds designated for improving access to breast cancer screening are appropriated for reimbursement of medical expenses, leaving limited funds available for community outreach [17]. Programs designed to address barriers including language and acculturation limitations, deficits in knowledge and cultural beliefs, and literacy, seen disproportionately in vulnerable communities, are critical to increasing access to care [42]. Culturally competent cancer education programs have been established to more appropriately educate women from underserved communities, sometimes by outreach workers from the same community who can provide culturally sensitive breast cancer education [51]. Limited English proficiency has been shown to influence utilization of preventive screening. Hispanic patients with limited English proficiency demonstrate lower likelihood of receiving a mammogram compared to non-Hispanic white patients [21]. Programs including translators and focusing on cultural competency may help to remove misconceptions about breast cancer, which appear prevalent among minority subgroups and prevent women from obtaining screening [17].

Provider referral for newer screening technologies, as well as insurance coverage for these services, are largely dependent upon proper identification of women who may benefit from them. Evaluation for appropriateness of advanced imaging largely occurs following routine mammography screening. As a result, barriers to mammography screening may also directly impact access to advanced imaging services. Moreover, prior studies have demonstrated disparities in genetic risk assessment among traditionally underserved groups, which may also directly impact referral and insurance coverage for supplemental breast screening [52]. Policy and patient-provider education aimed at improving access to routine screening, availability of breast cancer risk assessment, and coverage for advanced imaging services in vulnerable groups are needed to prevent exacerbation of existing barriers. Legislation under the PPACA has the potential to address many of these issues with increased focus on prevention and insurance coverage to ensure a regular source of primary care.

System-Level Enabling Factors

In comparison to patient-level factors, there is markedly less understanding about how health system-level factors affect screening among vulnerable women. Health system attributes have the potential to influence availability and quality of preventive services [53–58]. With regards to mammography, screening access depends on adequate supply and appropriate distribution of mammography units and personnel. Between 2000 and 2010, however, the number of mammography facilities and machines declined by 10%, while median county mammography capacity dropped almost 20% [41]. System-level characteristics may shape patient-level opportunities and influence their access behavior [59–61]. There have only been a few reports estimating mammographic capacity both regionally and nationally. A 2002 report from the U.S. Government Accountability Office suggested that the overall national capacity for mammography was adequate to meet the population’s screening needs [42]. However, more recent reports suggest that available resources are not distributed proportionally to sufficiently meet the needs of vulnerable populations or to meet national screening targets set by Healthy People 2020 [62–64].

Declines in mammography capacity over the past few decades due to increased financial strain may be disproportionately impacting women from traditionally underserved backgrounds [65]. A negative association between screening nonadherence and low availability of mammography machines has been demonstrated in U.S. community settings [66]. Rural populations are at particular risk, as they demonstrate relatively greater travel times for all cancer care settings compared to women living in urban settings [67]. Travel inconveniences remain a commonly cited reason among women from rural backgrounds for not undergoing screening [68].

Beyond routine screening, travel time to specialized services has also been shown to influence both access and utilization [69][70]. Women from low socioeconomic backgrounds, ethnic minority groups, and rural populations experience increased delays in diagnostic follow-up after abnormal screening, which may contribute to increased breast cancer mortality. Diagnostic delays greater than 12 weeks have been associated with higher breast cancer mortality [20]. Factors leading to delayed care and loss to follow-up include increased financial costs, limited geographic access to diagnostic imaging modalities, and co-morbid conditions disproportionately associated with underserved groups [66]. Moreover, limited access to a regular source primary care, experienced by vulnerable women, may prevent care coordination which has been positively associated with follow-up [70]. Additionally, differences in geographic proximity to facilities offering advanced imaging services have also been seen among underserved groups, which may influence utilization [71][72].

Summary

The diffusion of advanced breast imaging services into the community may result in improved breast cancer detection, particularly in women at increased breast cancer risk. At the same time, adoption of new technologies bring with it the potential for widening breast cancer screening-related disparities. Further research is needed to understand the determinants of appropriate advanced imaging use among vulnerable populations. A special focus is needed to understand the system-level factors, and not just patient-level factors, that may be contributing to lower access and utilization of digital breast tomosynthesis, screening ultrasound, and breast MRI. Based on these investigations, policies aimed at ensuring access to emerging breast imaging technologies in traditionally underserved groups will be needed. Particular areas of need in these populations are increased access to risk-based screening and a regular source of primary care, availability of insurance coverage for advanced imaging services beyond mammography, and patient education about the potential benefits of more aggressive multi-modality screening regimens among vulnerable women at high lifetime risk for developing breast cancer.

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References:

1. Berry DA, Cronin KA, Plevritis SK, et al. Effect of screening and adjuvant therapy on mortality from breast cancer. N Engl J Med 2005;353:1784–92. [PubMed: 16251534]
2. Breast Cancer by the Numbers. Pharmacy and Therapeutics. 2014;39(3):213–214. [PubMed: 24790400]
3. Kagay CR, Quale C, Smith-Bindman R. Screening mammography in the American elderly. Am J Prev Med. 2006 8;31(2):142–9. [PubMed: 16829331]
4. Silber JH, Rosenbaum PR, Clark AS, et al. Characteristics associated with differences in survival among black and white women with breast cancer. JAMA. 2013;310(4):389–97. [PubMed: 23917289]
5. Chlebowski RT, Chen Z, Anderson GL, et al. Ethnicity and breast cancer: factors influencing differences in incidence and outcome. J Natl Cancer Inst. 2005;97(6):439–48. [PubMed: 15770008]
6. Dalton SO, During M, Ross L, et al. The relation between socioeconomic and demographic factors and tumour stage in women diagnosed with breast cancer in Denmark, 1983–1999. Br J Cancer. 2006;95(5):653–9. [PubMed: 16909141]
7. Allen JD, Shelton RC, Harden E, et al. Follow-up of abnormal screening mammograms among low-income ethnically diverse women: findings from a qualitative study. Patient Educ Couns. 2008;72(2):283–92. [PubMed: 18490127]
8. Lannin DR, Mathews HF, Mitchell J, et al. Influence of socioeconomic and cultural factors on racial differences in late-stage presentation of breast cancer. JAMA. 1998;279(22):1801–7. [PubMed: 9628711]
9. Lee CI, Bogart A, Germino JC, et al. Availability of Advanced Breast Imaging at Screening Facilities Serving Vulnerable Populations. J Med Screen. 2016 3;23(1):24–30. [PubMed: 26078275]
10. Groeneveld PW, Laufer SB, Garber AM. Technology diffusion, hospital variation, and racial disparities among elderly Medicare beneficiaries: 1989–2000. Med Care. 2005 4;43(4):320–9. [PubMed: 15778635]
11. Onega T, Duell EJ, Shi X, et al. Race versus place of service in mortality among medicare beneficiaries with cancer. Cancer. 2010 6 1;116(11):2698–706. [PubMed: 20309847]
12. Berg WA. Tailored supplemental screening for breast cancer: what now and what next? AJR Am J Roentgenol. 2009 2;192(2):390–9. [PubMed: 19155400]
13. Litaker D, Tomolo A. Association of contextual factors and breast cancer screening: finding new targets to promote early detection. J Womens Health. 2007;16(1):36–45.
14. Howe HL, Wingo PA, Thun MJ, et al. Annual report to the nation on the status of cancer (1973 through 1998), featuring cancers with recent increasing trends. J Natl Cancer Inst. 2001;93:824–842. [PubMed: 11390532]
15. DeSantis C, Ma J, Bryan L, et al. Breast cancer statistics, 2013. CA Cancer J Clin. 2014 Jan-Feb; 64(1):52–62. [PubMed: 24114568]
16. DeSantis CE, Fedewa SA, Goding Sauer A, et al. Breast cancer statistics, 2015: convergence of incidence rates between black and white women. CA Cancer J Clin. 2016 Jan-Feb;66(1):31–42. [PubMed: 26513636]
17. Bickell NA. Race, ethnicity, and disparities in breast cancer: victories and challenges. Womens Health Issues. 2002 Sep-Oct;12(5):238–51. [PubMed: 12225687]
18. Curtis E, Quale C, Haggstrom D, et al. Racial and ethnic differences in breast cancer survival: how much is explained by screening, tumor severity, biology, treatment, comorbidities, and demographics? Cancer. 2008;112(1):171–180. [PubMed: 18040998]
19. Paskett ED, Tatum C, Rushing J, et al. Racial differences in knowledge, attitudes, and cancer screening practices among a triracial rural population. Cancer. 101(11), 2650–2659.
20. Goldman LE, Walker R, Hubbard R, et al. Timeliness of Abnormal Screening and Diagnostic Mammography Follow-up at Facilities Serving Vulnerable Women. Med Care. 2013 4;51(4):307–14. [PubMed: 23358386]
21. Fiscella K, Franks P, Doescher MP, et al. Disparities in health care by race, ethnicity, and language among the insured. Med Care. 2002;40:52–9. [PubMed: 11748426]

22. Jacobellis J, Cutter G. Mammography Screening and Differences in Stage of Disease by Race/Ethnicity. American Journal of Public Health. 2002 7;92(7):1144–50. [PubMed: 12084699]
23. Giuliano A, Papenfuss M, de Guernsey de Zapien J, et al. Breast cancer screening among Southwest American Indian women living on-reservation. Prev Med. 1998; 27:135–143. [PubMed: 9465364]
24. Berg WA, Blume JD, Cormack JB, et al. Combined screening with ultrasound and mammography vs mammography alone in women at elevated risk of breast cancer. JAMA. 2008;299(18):2151–63. [PubMed: 18477782]
25. Lehman CD. Role of MRI in screening women at high risk for breast cancer. J Magn Reson Imaging. 2006;24(5):964–70. [PubMed: 17036340]
26. Lehman CD, Smith RA. The role of MRI in breast cancer screening. J Natl Compr Canc Netw. 2009;7(10):1109–15. [PubMed: 19930977]
27. Kelly KM, Dean J, Comulada WS, et al. Breast cancer detection using automated whole breast ultrasound and mammography in radiographically dense breasts. Eur Radiol. 2010;20(3):734–42. [PubMed: 19727744]
28. Kelly KM, Dean J, Lee SJ, et al. Breast cancer detection: radiologists' performance using mammography with and without automated whole-breast ultrasound. Eur Radiol. 2010;20(11): 2557–64. [PubMed: 20632009]
29. Skaane P, Bandos AI, Gullien R, et al. Comparison of digital mammography alone and digital mammography plus tomosynthesis in a population-based screening program. Radiology. 2013;267(1):47–56. [PubMed: 23297332]
30. Ciatto S, Houssami N, Bernardi D, et al. Integration of 3D digital mammography with tomosynthesis for population breast-cancer screening (STORM): a prospective comparison study. Lancet Oncol. 2013;14(7):583–9. [PubMed: 23623721]
31. Lee CI, Bassett LW, Lehman CD. Breast density legislation and opportunities for patient-centered outcomes research. Radiology. 2012;264(3):632–6. [PubMed: 22919037]
32. http://densebreast-info.org/legislation.aspx. http://densebreastinfo.org/img/dbifinaldensity_tableweb_bluewlines.pdf
33. Houssami N, Miglioretti DL. Digital breast tomosynthesis: a brave new world of mammography screening. JAMA Oncol. 2016; 2(6):725–7. [PubMed: 26892954]
34. Lee CI, Lehman CD. Digital Breast Tomosynthesis and the Challenges of Implementing an Emerging Breast Cancer Screening Technology into Clinical Practice. J Am Coll Radiol. 2016 11;13(11S):R61–R66. [PubMed: 27814817]
35. Wang ZL, Xu JH, Li JL, et al. Comparison of automated breast volume scanning to hand-held ultrasound and mammography. Radiol Med. 2012 12;117(8):1287–93. [PubMed: 22744341]
36. Giuliano V, Giuliano C. Improved breast cancer detection in asymptomatic women using 3Dautomated breast ultrasound in mammographically dense breasts. Clin Imaging. 2013 May-Jun; 37(3):480–6. [PubMed: 23116728]
37. Saslow D, Boetes C, Burke W, et al. American Cancer Society guidelines for breast screening with MRI as an adjunct to mammography. CA Cancer J Clin. 2007 Mar-Apr;57(2):75–89. [PubMed: 17392385]
38. Emaus MJ, Bakker MF, Peeters PH, et al. MR Imaging as an Additional Screening Modality for the Detection of Breast Cancer in Women Aged 50–75 Years with Extremely Dense Breasts: The DENSE Trial Study Design. Radiology. 2015 11;277(2):527–37. [PubMed: 26110667]
39. Chen SQ, Huang M, Shen YY, et al. Application of Abbreviated Protocol of Magnetic Resonance Imaging for Breast Cancer Screening in Dense Breast Tissue. Acad Radiol. 2017 3;24(3):316–320. [PubMed: 27916594]
40. Rauscher GH, Allgood KL, Whitman S, et al. Disparities in screening mammography services by race/ethnicity and health insurance. J Womens Health. 2012 2;21(2):154–60.
41. Elkin EB, Paige J, Pinheiro L, et al. Changes in access to screening mammography, 2008–2011. Cancer Causes Control. 2013 5;24(5):1057–9. [PubMed: 23468282]
42. Deavenport A, Modeste N, Marshak HH, et al. Closing the gap in mammogram screening: an experimental intervention among low-income Hispanic women in community health clinics. Health Educ Behav. 2011 10;38(5):452–61. [PubMed: 21482702]

43. Peek ME, Han JH. Disparities in screening mammography. Current status, interventions and implications. J Gen Intern Med. 2004 2;19(2):184–94. [PubMed: 15009798]
44. Loehrer PJ, Sr, Greger HA, Weinberger M, et al. Knowledge and beliefs about cancer in a socioeconomically disadvantaged population. Cancer. 1991 10 1;68(7):1665–71. [PubMed: 1893368]
45. Hyndman JC, Holman CD, Dawes VP. Effect of distance and social disadvantage on the response to invitations to attend mammography screening. J Med Screen. 2000;7(3):141–5. [PubMed: 11126163]
46. Lee CI, Naeim A. Health disparities from future genetic research efforts: breast cancer as a case study. J Natl Med Assoc. 2012 Jul-Aug;104(7–8):390–1. [PubMed: 23092055]
47. State Health Access Data Assistance Center. 2013 “State Estimates of the Low-income Uninsured Not Eligible for the ACA Medicaid Expansion” Issue Brief #35. Minneapolis, MN: University of Minnesota Available at: http://www.rwjf.org/content/dam/farm/reports/issue_briefs/2013/rwjf404825.
48. Garfield R 10 2015 New Estimates of Eligibility for ACA Coverage among the Uninsured. (Washington, DC: Kaiser Family Foundation) Available at: http://kff.org/uninsured/issue-brief/new-estimates-of-eligibility-for-aca-coverage-among-the-uninsured.
49. DeGroff A, Carter A, Kenney K, et al. Using Evidence-Based Interventions to Improve Cancer Screening in the National Breast and Cervical Cancer Early Detection Program. J Public Health Manag Pract. 2016 Sep-Oct;22(5):442–9. [PubMed: 26672405]
50. Schueler KM, Chu PW, Smith-Bindman R. Factors associated with mammography utilization: a systematic quantitative review of the literature. J Womens Health (Larchmt). 2008 11;17(9):1477–98. [PubMed: 18954237]
51. Navarro AM, Senn KL, McNicholas LJ, et al. Por La Vida model intervention enhances use of cancer screening tests among Latinas. Am J Prev Med. 1998 7;15(1):32–41. [PubMed: 9651636]
52. Kaplan CP, Haas JS, Perez-Stable EJ, et al. Breast cancer risk reduction options: awareness, discussion, and use among women from four ethnic groups. Cancer Epidemiol Biomarkers Prev. 2006;15:162–166. [PubMed: 16434605]
53. Baker LC, Wheeler SK. Managed care and technology diffusion: the case of MRI. Health Aff (Millwood). 1998;17(5):195–207. [PubMed: 9769583]
54. Andersen RM, Yu H, Wyn R, et al. Access to medical care for low-income persons: how do communities make a difference? Med Care Res Rev. 2002;59(4):384–411. [PubMed: 12508702]
55. Ferrante JM, Gonzalez EC, Pal N, et al. Effects of physician supply on early detection of breast cancer. J Am Board Fam Pract. 2000;13(6):408–14. [PubMed: 11117337]
56. Reisch LM, Barton MB, Fletcher SW, et al. Breast cancer screening use by African Americans and Whites in an HMO. J Gen Intern Med. 2000;15(4):229–34. [PubMed: 10759997]
57. Baker LC. Managed care spillover effects. Annu Rev Public Health. 2003;24:435–56. [PubMed: 12471276]
58. DeLaet DE, Shea S, Carrasquillo O. Receipt of preventive services among privately insured minorities in managed care versus fee-for-service insurance plans. J Gen Intern Med. 2002;17(6):451–7. [PubMed: 12133160]
59. Berkman LF. Tracking social and biological experiences: the social etiology of cardiovascular disease. Circulation. 2005;111(23):3022–4. [PubMed: 15956147]
60. Link BG, Northridge ME, Phelan JC, et al. Social epidemiology and the fundamental cause concept: on the structuring of effective cancer screens by socioeconomic status. Milbank Q. 1998;76(3):375–402, 304–5. [PubMed: 9738168]
61. Link BG, Phelan J. Social conditions as fundamental causes of disease. J Health Soc Behav. 1995; Spec No:80–94. [PubMed: 7560851]
62. US General Accounting Office. Mammography: Capacity Generally Exists to Deliver Services. Washington, DC; 2002.
63. Breen N, K AC, Meissner HI, et al. Reported drop in mammography: is this cause for concern? Cancer. 2007;109(12):2405–9. [PubMed: 17503429]
64. US General Accounting Office. Mammography: Current Nationwide Capacity is Adequate, But Access Problems May Exist in Certain Locations. Washington, DC; 2006.

65. Elkin EB, Ishill NM, Snow JG, et al. Geographic access and the use of screening mammography. Med Care. 2010 4;48(4):349–56. [PubMed: 20195174]

66. Elkin EB, Snow JG, Leoce NM, et al. Mammography capacity and appointment wait times: barriers to breast cancer screening. Cancer Causes Control. 2012 1;23(1):45–50.

67. Onega T, Duell EJ, Shi X, et al. Geographic access to cancer care in the U.S. Cancer. 2008 2 15;112(4):909–18. [PubMed: 18189295]

68. Engelman KK, Hawley DB, Gazaway R, et al. Impact of Geographic Barriers on the Utilization of Mammograms by Older Rural Women. J Am Geriatr Soc. 2002 1;50(1):62–8. [PubMed: 12028248]

69. Onega T, Cook A, Kirlin B, et al. The influence of travel time on breast cancer characteristics, receipt of primary therapy, and surveillance mammography. Breast Cancer Res Treat. 2011 8;129(1):269–75. [PubMed: 21553117]

70. Onega T, Duell EJ, Shi X, et al. Influence of NCI cancer center attendance on mortality in lung, breast, colorectal, and prostate cancer patients. Med Care Res Rev. 2009 10;66(5):542–60. [PubMed: 19454624]

71. Alford-Teaster J, Lange JM, Hubbard RA, et al. Is the closest facility the one actually used? An assessment of travel time estimation based on mammography facilities. Int J Health Geogr. 2016 2 18;15:8. [PubMed: 26892310]

72. Onega T, Lee CI, Benkeser D, et al. Travel Burden to Breast MRI and Utilization: Are Risk and Sociodemographics Related? J Am Coll Radiol. 2016 6;13(6):611–9. [PubMed: 27026577]