



# Addressing Disparities Related to Access of Multimodality Breast Imaging Services Before and During the COVID-19 Pandemic

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Despite technological advancements focused on reducing breast cancer mortality through early detection, there have been reported disparities in the access to these imaging services with underserved patient populations (including racial minority groups and patients of low socioeconomic status) showing underutilization compared to other patient groups. These underserved populations tend to have more advanced breast cancer presentations, in part due to delays in diagnosis resulting in later stage of disease presentation. To make matters worse, the COVID-19 pandemic declared in March 2020 has resulted in significant healthcare disruptions leading to extensive delays in breast imaging services which are expected to negatively impact breast cancer mortality long-term. Given the worsening disparity in breast cancer mortality among racial/ethnic minorities and financially disadvantaged groups, it is vital to address these disparity gaps with the goal of reducing the barriers to timely breast cancer diagnosis and addressing breast cancer mortality differences among breast cancer patients. Therefore, this review aims to provide a discussion highlighting the disparities related to breast imaging access, the effects of the COVID-19 pandemic on these disparities, current targeted interventions implemented in breast imaging practices to reduce these disparities, and future directions on the journey to reducing disparity gaps for breast imaging patients. Tackling the root cause factors of the persistent breast cancer-related disparities is critical to meeting the needs of patients who are disadvantaged and can lead to continued improvement in the quality of individualized care for patients who have higher breast cancer morbidity and mortality risks.

**Key Words:** Breast imaging disparities; Health equity; COVID-19 pandemic.

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## INTRODUCTION

**B**reast cancer is the most common cause of non-cutaneous-related cancer and the second leading cause of cancer-related death in women (1). It is estimated that in 2021, over 330,000 new cases of breast cancer were diagnosed and about 44,000 deaths resulted from breast cancer (1). Since 2007, mortality related to breast cancer has been steadily decreasing due to interventions aimed towards early detection, increased awareness, and advancements in diagnosis and treatment (1). Breast cancer morbidity and mortality rates, however, are not equal in incidence and distribution across all racial and ethnic backgrounds, with negative trends skewing more towards racial minority women compared to White women (2-5). Additionally, the breast

cancer 5-year survival among Black, Hispanic, and Native American women is lower than White women (3,4,6). The cause of these disparities among distinct racial and ethnic groups is thought to be multifactorial, is due to a combination of advanced stage at the time of breast cancer detection and poorer state-specific survival rates, and is influenced by a multitude of factors related to low socioeconomic status (SES), social injustice and cultural barriers (7-10). Furthermore, prior research showed that racial minority and low SES women had less interest in knowing their breast cancer risk compared to White and higher income women (11). Therefore, these barriers to breast cancer diagnosis and access can increase the likelihood for at-risk populations to be vulnerable to more aggressive presentations and advanced stage of disease at the time of diagnosis (8-10).

Advancements in technology during the last decade such as digital breast tomosynthesis (DBT) and breast MRI have increased the likelihood of earlier detection of breast cancer, thus resulting in lower stage of disease at the time of diagnosis (12). However, it has been established that minority and low SES patients are typically the last to benefit from these advancements (13,14). This can be attributed to multifactorial

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logistical barriers including limited available appointments that can make it challenging for these patients to find an appointment time that works with their individual and family schedule logistics, limited available services in certain areas such as more rural parts of the nation, and higher co-pay and out-of-pocket costs for services without vouchers or government assistance (15).

Exacerbating the current climate, the COVID-19 pandemic declared in March 2020 has resulted in significant disruptions in the workflow for breast imaging practices nationwide (16). This resulted in extensive delays in breast imaging appointments and breast cancer treatment, which are expected to have long-term negative impacts on breast cancer mortality by 2030 (17,18). Racial minority and low SES patients were especially hit hard by the COVID-19 pandemic as preliminary data have demonstrated that these populations are not recovering from the initial delays as well as other patient groups, resulting in many patients becoming lost to follow-up which potentially increases their risk of an advanced stage breast cancer diagnosis (19,20). Thus, the COVID-19 pandemic has actually worsened disparities related to patient access of breast imaging services and breast cancer treatment.

Given the growing disparity in breast cancer mortality among racial, ethnic, and financially disadvantaged groups, it is vital to address these disparity gaps with the goal of reducing the barriers faced by racial minority patients, in order to improve breast cancer survival outcomes for all patients. Currently, there is a sparsity of literature on disparities related to the impact of lack of access to breast imaging resources and the compounding effect of the COVID-19 pandemic on this. This review aims to provide a discussion highlighting the disparities related to the unique workflow employed in breast imaging, the effects of the COVID-19 pandemic on these disparities, current targeted interventions implemented in breast imaging practices to reduce these disparities, and future directions on the journey of reducing disparity gaps for breast imaging patients who are underserved.

## **DISPARITIES IN BREAST IMAGING RESOURCES – SCREENING MAMMOGRAPHY**

The utilization of screening mammography has been a major contributor to the reduction in breast cancer mortality via the early detection of breast cancer, especially in women who undergo consistent annual screening mammography (21). To make screening mammography more accessible, cost-sharing for insured patients has been largely eliminated and there are typically no out-of-pocket costs for patients who have private insurance or Medicare (22–24). For patients without insurance, there are organizations such as the Susan G. Komen Breast Cancer Foundation which offer vouchers so that these patients can undergo screening mammography without out-of-pocket costs (22–24). Despite these efforts, barriers still persist which prevent patients from obtaining the care they need. Black, Hispanic, and Asian populations have been

shown to have lower likelihood of undergoing annual screening mammography when compared to White populations (25–27). For Black populations, this was present for all age groups > 40 years and for Hispanic populations from age 40–65 years (25).

The underlying etiology of the barriers to screening mammography access for underserved patients is suspected to be multifactorial (28). Among these patient populations, the most common reported barrier is psychological/knowledge-related with specific focuses for each patient population (28). Common to all groups was fear including, fear of breast cancer diagnosis, concern about side effects from the mammogram examination, and misinformation related to benefits/risks of screening mammography and national screening guidelines. For Black and Asian populations, prioritization of other responsibilities such as work and family and embarrassment/discomfort of male providers were unique barriers reported. For Black and Hispanic populations, procrastination which commonly manifested as delaying their appointment to the point of never going to it was a specific barrier reported. Cultural barriers that were specific to Asian, Muslim, and Hispanic populations included differences in primary language which prevented effective communication with providers and body modesty as the process of mammography requires exposure of the patient's breast which may be regarded as invasive in light of the cultural norms of these populations (28–30). Furthermore, logistical aspects of annual screening mammography such as facility location and access to transportation preferentially negatively affects Black and Hispanic populations more than White populations (28,31). Longer travel distance to screening mammography facilities can detract time from work, family or other responsibilities which may hinder the ability of these patients to attend their appointment and further contributes to the likelihood of procrastination of medical appointments. For example, Peipins et al. in 2011 found that the median public transportation travel time was three times longer for Black populations compared to White populations and even with private transportation travel, Blacks still experienced longer travel times compared to Whites (31). In addition, American Indian and Alaska native patients are the most disadvantaged when it comes to geographic access to screening mammography facilities as these populations tend to live in rural areas and have travel times two to three times longer compared to other racial/ethnic groups which has resulted in the lowest screening adherence rates (32,33). This is impactful as both these patient populations have higher breast cancer mortality rates similar to other minority groups compared to non-Hispanic White women and while other minority groups experienced a decline in mortality rates between 2013 and 2017, American Indian and Alaska native patients did not (33). Therefore, it isn't surprising that increased mortality and advanced stage of breast cancer diagnosis unfortunately occur in these populations as a result of multilevel factors resulting in reduction of annual screening mammography adherence (2–4).

Since the incorporation of digital breast tomosynthesis (DBT) in 2011, the use of DBT has led to increased cancer detection rates and overall reduction in recall rates with screening mammography (34,35). This benefit is only applicable to those who are able to undergo DBT instead of full field digital mammography (FFDM). Compared to FFDM, DBT has out-of-pocket costs with some insurance plans, thus inherently posing a barrier to access (36). Falomo et al. in 2018 showed that patients who chose DBT were significantly more likely to have insurance coverage, higher income, and higher education levels than patients who chose FFDM (36). Patients who chose FFDM compared to DBT reported difference in cost as the reason as most of these patients did not have insurance coverage (36). In fact, most patients who chose FFDM reported that if DBT was covered by insurance, they would be more likely to choose it (36). Lee et al. in 2021 showed that Black, Hispanic, and Asian populations have less access to DBT compared to White populations (37). Thus, access to advancements in screening technology appears to be lagging or absent for certain minority groups, thus diminishing the ability of these patient populations to experience the health benefits of improved screening technology (36).

### **DISPARITIES IN BREAST IMAGING RESOURCES – SCREENING ULTRASOUND**

Women with dense breast tissue face unique challenges related to their breast density as not only do these patients have an innately higher risk of developing breast cancer, but also screening mammography has a lower sensitivity of breast cancer detection in these women compared to women with non-dense breast tissue (38). As such, supplemental screening breast ultrasound has been shown to be useful for detecting additional breast cancers that are mammographically occult in this patient population, although there is the risk of false positive results (38). However, unlike with screening mammography, screening breast ultrasound has associated out-of-pocket costs (39). Ezratty et al. in 2020 found that non-Hispanic Black and Hispanic women were not only less likely to be recommended for supplemental screening breast ultrasound, but also less likely to undergo the examination even if ordered compared to non-Hispanic White women (40). This implies that just as with diagnostic mammography, racial and financial barriers exist with the use of supplemental screening breast ultrasound, which prevent this subset of women with even higher risk of breast cancer from accessing this modality for supplemental screening for mammographically occult cancers.

### **DISPARITIES IN BREAST IMAGING RESOURCES – DIAGNOSTIC MAMMOGRAPHY**

In the setting of an abnormal screening mammogram, prompt and consistent follow-up with diagnostic mammography is vital to maintaining lower breast cancer mortality (41). Delays

in diagnostic mammography appointments of at least 6 weeks are significantly associated with increased breast cancer mortality (41,42). Race/ethnicity was found to be a significant predictor in delays in diagnosis after an abnormal screening mammogram (9,41-46). Within the last decade, multiple studies have demonstrated that Black, Hispanic, and Asian populations all experienced longer delays in diagnosis compared to White Non-Hispanic patients, with Black and Hispanic patients approaching or surpassing the 6-week timeframe cut-off (41,43,44).

The out-of-pocket costs associated with diagnostic mammography may be a contributing factor to disparities in the adherence to diagnostic mammography follow-up. Depending on location, the average cost of a diagnostic mammogram is \$290 without insurance, which can be increased to a total of \$540 if a breast and/or axillary ultrasound is also performed during the diagnostic appointment (39). Given this cost, patients within the most disadvantaged 15% of neighborhoods and with Medicare/Medicaid were found to be less likely to adhere to diagnostic imaging recommendations following an abnormal screening mammogram, compared to patients not in disadvantaged neighborhoods and those with private/commercial insurance (22). Therefore, as Black patients are more likely to have lower incomes, be uninsured or have public insurance compared to White patients, the overall higher cost of diagnostic mammography poses a substantial obstacle for this patient population especially coupled with the reported barrier of prioritization of other responsibilities for this population (28,47,48). In addition, lack of insurance coverage was associated with lack of optimal diagnostic follow-up for Hispanic patients with a probably benign finding initially detected on screening mammography requiring up to 2 years of diagnostic mammography follow-up evaluation (49).

Additionally, just as with screening mammography, barriers of transportation to mammography facilities disproportionately affect patients with lower incomes and racial minorities (10,31,32). Khang et al. in 2017 found that Black patients were more likely to live farther from diagnostic mammography facilities and were less likely to adhere to follow-up recommendations compared to White patients (50). In general, patients who live farther from diagnostic mammography facilities are less likely to adhere to follow-up recommendations compared to patients who live closer (50,51). Therefore, in the setting of an abnormal screening mammogram, recalled women must endure both direct medical and indirect time costs, which skews against racial minorities with higher incidences of lower SES leading to increased risk of delays in diagnosis.

### **DISPARITIES IN BREAST IMAGING RESOURCES – MRI**

Breast MRI is the most sensitive of all breast imaging modalities for the detection and diagnosis of breast cancer (52). Incorporation of breast MRI as an adjunct to breast cancer

screening in high-risk patients has been shown to not only improve early detection of breast cancer, but also improves overall survival when compared to screening mammography alone (53). However, Haas et al. in 2016 demonstrated that women with a high school education level or lower were reported to be less likely to obtain high-risk screening breast MRI examinations compared to women with a college degree (54). This is also true for average-risk women with less than a college degree. However, there were no significant racial or ethnic differences in the likelihood of obtaining high-risk screening breast MRI. Availability of breast MRI appointments may contribute to this disparity as variability of on-site breast MRI units at breast imaging facilities exist with only about 40% of facilities able to offer breast MRI examinations in communities that serve mostly minority and vulnerable patient populations (12). Furthermore, previous studies have shown that geographic access to breast MRI units are worse for Black and American Indian women and women in rural areas. These groups have longer median travel times to these facilities compared to White women (12,55,56). Breast MRI is the most expensive modality clinically used for breast cancer screening or diagnostic work-up with average cost of about \$1,100 (39). Although no current study has directly evaluated the relationship between cost and access of breast MRI examinations, given the fact that higher education level is overall associated with higher incomes and lower education level populations are less likely to obtain breast MRI examinations, it can be inferred that the deterrent of high cost likely plays a role in preventing access to breast MRI examinations (55,57). Furthermore, if cost is a known factor in lower diagnostic mammography follow-up adherence, it is reasonable to expect that this barrier also affects breast MRI, as breast MRI is two to five times more expensive than a diagnostic mammography/ultrasound appointment (28,47,48,58).

### DISPARITIES IN BREAST IMAGING RESOURCES – IMAGE-GUIDED BREAST BIOPSY

In breast imaging, imaging diagnosis is only half the battle as definitive diagnosis with biopsy is important for surgical and oncologic management of breast cancer. Availability of image-guided biopsy services poses a barrier with stereotactic-guided and MRI-guided biopsy reported as being available only 40% of the time at facilities which serve underserved populations (12). In fact, Selove et al. in 2016 found that Black women suffer delays between an abnormal diagnostic mammogram and diagnostic biopsy of up to 60 days and between biopsy and treatment initiation of up to 30 days compared to White women (59). This has substantial impact as Black patients are already prone to more advanced breast cancer presentations compared to other races and ethnicities and longer delays of diagnosis and treatment of breast cancer lead to increased mortality (6,41,42). As with breast

MRI, the cost of image-guided biopsies likely also poses a barrier for disadvantaged patients with costs ranging from hundreds to thousands of dollars depending on the modality and patient insurance status (58,60-62).

### THE IMPACT OF THE COVID-19 PANDEMIC ON BREAST IMAGING DISPARITIES

Starting in March 2020, significant disruptions in the health-care workflow in the United States have occurred because of the ongoing COVID-19 pandemic, with breast imaging far from being excluded (63). Due to safety concerns, the Society of Breast Imaging (SBI) released recommendations in March 2020 to delay annual screening mammography and diagnostic examinations on patients without clinically concerning symptoms and 6-month follow-up examinations until risk to patient lessened from the pandemic (16). Although this delay was short-term as most breast imaging practices began re-opening services in May 2020, the availability for these services upon re-opening was adjusted to accommodate the necessary risk-reduction strategies to mitigate COVID-19 transmission risk to breast imaging patients and staff, including limiting the number of patients in the clinic at a certain time and allowing for social distancing in the waiting rooms (64). A survey study demonstrated that the COVID-19 pandemic delayed 80% of routine and follow-up breast care appointments, 60% of breast imaging appointments, 67% of reconstruction surgeries, and 30% of breast cancer treatments including lumpectomies and chemotherapy/radiation therapy (17).

Projected analysis models predict that the delays in breast cancer diagnosis and treatment during the first 6 months of the pandemic will result in small long-term negative impact on breast cancer mortality by 2030 (18). Amornsiripanitch et al. in 2020 demonstrated that racial/ethnic minority and Medicare patients not only had higher rates of screening mammogram cancellations during the COVID-19 pandemic, but also race and insurance status were significant predictors of having an increased relative risk of cancellation (65). This is significant as the COVID-19 pandemic resulted in loss of health insurance for some people due to unemployment and this can amplify cost barriers particularly for underserved patients (28,47,48,58,66). Furthermore, preliminary data have demonstrated that not all patients are recovering from the initial delays caused by the COVID-19 pandemic equally (19,67). Hispanic and Asian patients had lower volumes of rebound screening mammography volumes following resumption of routine breast imaging services compared to patients of other races and ethnicities, resulting in a substantial accumulation of missed mammograms (19). Lehman et al. in 2021 reported that although screening volumes improved for all races after re-opening during May 2020, all races other than White still had disproportionately lower recovery volumes (67). Additional patient characteristics such as residing in higher poverty areas, lack of health insurance, need for an interpreter, and longer travel time to breast imaging facilities

were associated with a lower likelihood of resuming routine screening mammography following COVID-19 related disruptions (20).

Currently there is a paucity of literature on the effects of the COVID-19 pandemic on the workflow and disparities related to other areas of breast imaging such as diagnostic mammography or breast MRI. However, it is reported that the COVID-19 pandemic has resulted in delayed patient presentations of prior early presenting diagnoses before the pandemic in other medical subspecialties which has affected the disease-specific mortality. Gerall et al. in 2021 reports pediatric patients presented later to the emergency department and with more severe symptoms of acute appendicitis during the COVID-19 pandemic peak in Spring of 2020 compared to before the pandemic (68). This led to an increase in the number of complicated acute appendicitis cases on radiologic imaging compared to uncomplicated cases before with worsening patient outcomes (68). Primessnig et al. in 2021 found a significant delay in time from symptom onset to medical contact of ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction (NSTEMI) patients during the COVID-19 pandemic peak in Spring of 2020 compared to before which also negatively affected patient mortality (69). Therefore, patients with a new palpable lump (the most common presenting symptom of breast cancer) during a COVID-19 pandemic surge theoretically may also have been reluctant to be evaluated, thus delaying the diagnosis of a breast cancer (70). Moving forward, more research is required to investigate if deficiencies exist in other areas of breast imaging outside of screening mammography due to the COVID-19 pandemic.

Thus, the COVID-19 pandemic has exacerbated the overwhelming disparities which permeate through breast imaging services and highlights the important need to address these barriers to ensure adequate access to breast imaging services for all patients.

## TARGETED INTERVENTIONS TO REDUCE BREAST IMAGING DISPARITY GAPS

Over the past decade, attempts at alleviating specific factors to improve access and accessibility of breast imaging services to decrease known racial/ethnic and socioeconomic disparities have been made.

### Targeted Interventions – Screening Mammography

To increase awareness of and adherence to annual screening mammography recommendations, the implementation of patient navigators has been shown to positively impact screening rates among racial minority patient populations; increasing the odds of adherence to almost triple compared to no intervention (71-73). Patient navigation's effectiveness is derived from the fact that these programs are culturally tailored to the specific patient population they serve with the sole purpose of decreasing cancer health disparities (70).

These patient navigators are usually hired based on their experience serving diverse, inner-city patients and have connections and knowledge of existing community programs to better advise and educate their patients (71). Furthermore, most are fluent in languages other than English such as Spanish, which is essential to aiding underserved populations where language barriers could prevent access to health care. Providing education, instructions, and mammography services all in Spanish can significantly increase the adherence to annual screening mammograms in low-income Hispanic populations (74). Patient navigators also facilitate community outreach programs that provide education on the important relationship between the early detection of breast cancer and lower mortality which have proven to be equally as effective at increasing annual screening mammography adherence rates (72).

In addition to the culturally tailored strategies above using patient navigators, individualized in-person or telephone counseling, individualized letters and reminders, vouchers and coupons for free mammograms, bus passes to allow for transportation to screening mammogram appointments, and bilingual program materials have all been shown to target specific socioeconomic barriers which are common to Black and Hispanic populations to increase annual screening mammography adherence (75-78).

Alternative interventions which appeal to specific cultural activities of communities have also been proven effective to promote annual screening mammography awareness. For instance, radio stations that target Black audiences have been viewed as a trusted source of information for this population, of which a majority report using radio stations specifically programmed with Black audiences in mind to obtain information to make informed life decisions (79,80). Hall et al. in 2012 demonstrated that by using Black radio to disseminate information to promote awareness and knowledge about the importance of early detection of breast cancer, this significantly increased women's awareness of breast cancer screening services among Black populations in Georgia (81). Church is reported as one of the most important social institutions in the Black and Hispanic communities and thus, is an ideal setting to offer health care promotion activities for these populations (82,83). Multiple studies have demonstrated that utilizing the church location to provide outreach educational awareness programs or church-based telephone counseling mammography services are just a few examples of how church-related interventions significantly increased annual screening mammography adherence in these populations (84-88).

Since 2012, the mobile mammography unit (MMU) has been implemented which provides screening mammography services directly to patient neighborhoods as an alternative option to the standard breast imaging facility (89). This is a community health resource with no out-of-pocket costs for patients which can help to improve access to health care for women and to encourage these women to receive regular annual screening mammograms (89). This is especially

important as the common patient demographics that the MMUs serve are Black and Hispanic patients, rural patients, and uninsured patients, all of whom have higher risk of delayed breast cancer diagnosis and breast cancer mortality (90,91). Spak et al. in 2021 demonstrated that the MMU was effective in detecting 14 additional breast cancers in an underserved metropolitan community, all of which were in asymptomatic minority patients (92). While MMU offers an opportunity to help bridge screening disparity gaps, its impact is not equal among all minority groups (93). Roubidoux et al. in 2021 demonstrated that while the MMU offered American Indian patients the ability to obtain their screening mammograms at a location more geographically accessible, majority of these patients were still not adhering to annual screening despite this intervention to combat geographical barriers (93). Overall, the MMU has been an effective outreach strategy for many communities to overcome both racial/ethnic and socioeconomic barriers given the lack of cost to patients and location flexibility to reach both rural patients and other patients with limited access to care (89,90,94). Continued efforts to improve the ability of MMU to promote annual adherence is still required especially for rural populations such as American Indian and Alaska natives in order to maximize the screening mammography benefits for reducing breast cancer mortality (93).

#### Targeted Interventions – Diagnostic Mammography

To reduce the number of patients lost to follow-up in the setting of an abnormal screening mammogram, targeted communication interventions were implemented with successful results (22,95). Revising the language of the mandated Mammography Quality Standards Act (MQSA) recall lay letter which communicates to patients their abnormal screening mammogram results to FDA recommended readability standards resulted in increased adherence to diagnostic mammography follow-up for all racial/ethnic minority patient populations (22). Additionally, implementation of multiple telephone reminder communications in conjunction with this letter also resulted in increased adherence to diagnostic mammography follow-up for all racial/ethnic minority patient populations (95). Specifically, Nguyen et al. in 2020 demonstrated that improved readability of the recall lay letter significantly improved patient adherence rates of an imaging site whose predominant service population is racial minorities and patients with low SES (22). As with annual screening mammogram adherence, implementation of patient navigation programs, especially ones with bilingual services, has also been shown to reduce the number of patients lost to follow-up and delays experienced by racial minority patients between an abnormal screening mammogram and definitive diagnosis (96-99).

Furthermore, shortly after the resumption of breast imaging services initially delayed at the beginning of the COVID-19 pandemic, Dontchos et al. in 2021 implemented an immediate-read screening mammography program with the

possibility of same-day diagnostic mammography appointments for patients in May 2020 (100). Dontchos et al. showed that after implementation, this program significantly decreased racial and ethnic disparities associated with same-day diagnostic imaging in the setting of an abnormal screening mammogram (100). Therefore, immediate-read screening mammography programs could be another effective way to decrease the delays in diagnosis experienced by underserved populations.

#### Targeted Interventions – Breast Biopsy

Same-day interventions have also been utilized to reduce disparities related to biopsy appointments as typically breast biopsies may be performed days or even weeks after diagnostic evaluation due to lack of appointment availability, staffing or service availability (12,101). Dontchos et al. in 2019 implemented a same-day biopsy program which resulted in the elimination of all racial/ethnic or insurance-related disparities associated with delays in biopsy appointments prior to implementation (101).

#### FUTURE DIRECTIONS

There are still multiple known barriers which have not been addressed including high out-of-pocket service costs for breast services other than screening mammography as well as geographical limitations in appointment availability, especially for breast MRI examinations. Furthermore, there are disadvantages of some interventions that need to be addressed to maximize their impact. For example, although both same-day screening programs and MMU have reduced barriers in accessing screening mammography for underserved populations, they do not address the same barriers for the subset of patients who then require diagnostic mammography evaluation (94,100,102,103). In fact, it has been recommended that for either of these interventions to be effective, adequate logistical protocols need to be established to ensure the opportunity for same-day diagnostic evaluation or the capability of tracking patients who require follow-up to ensure that these patients are not lost to follow-up (102,103).

Moving forward, specific areas for improvement include creation of institutional programs to help reduce out-of-pocket costs for underserved and low SES populations for all breast imaging services, outreach to large philanthropic foundations to sponsor vouchers to help alleviate diagnostic and biopsy costs just like with screening mammography in uninsured patients, increasing the availability of diagnostic services provided with the goal of reducing delays in the time to diagnostic evaluation and biopsies, and increasing the availability of breast MRI appointments in facilities serving predominantly racial/ethnic minority and rural populations.

Therefore, the crusade for achieving optimal and equal access of care for all populations is far from complete. It is important to continue innovating and improving the

interventions that are currently in place especially as we progress through the COVID-19 pandemic where at-risk populations are shown to be disproportionately affected negatively impacting their breast cancer mortality risk.

## CONCLUSION

The interventions which have the greatest impact on health-care disparities address the structural and logistical aspects of breast imaging services as well as the cultural and interpersonal factors which appeal specifically to these communities promoting consistent adherence. Tackling these disparities by addressing the root causes of disadvantaged patients' psychological barriers (through direct personal communication from telephone protocols to patient navigators) and logistical barriers (from vouchers and mobile mammography units to same-day screening and biopsy programs) demonstrates the persistent attempts of our healthcare system to make progressive strides at closing disparities gap. However, based on the findings discussed in this review, more targeted interventions aimed at ensuring access to all breast imaging services in underserved and low SES populations are still needed. Development and implementation of suggested interventions can help to chip away at the disparity iceberg which separates these underserved populations from the equitable access to health care services that they deserve. Tackling the root cause factors of the ever-widening breast cancer-related disparity gap is critical to meeting the needs of patient populations that are underserved and can lead to continual improvement in the quality of individualized care for patients who have higher breast cancer morbidity and mortality risks.

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