Increasing Inclusion and Equity for Black Women in Breast Cancer Clinical Trials

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Abstract: Black women diagnosed with breast cancer experience a disproportionately high mortality rate. The disparity in outcomes between Black and White women is multifactorial, with a large portion attributed to lower participation of minorities in clinical trials. The lack of diversity in clinical trials continues to both reflect and contribute to health care inequities, limiting the generalizability of research findings. In addition, women who do not enroll in clinical trials miss out on the standard-of-care or often better patient care provided in these trials. Barriers to enrolling diverse populations encompass system-, provider-, and patient-level barriers. Identifying these barriers and providing actionable solutions are key to bolstering enrollment in clinical trials and ultimately eliminating cancer disparities. This review elucidates the barriers to clinical trial participation in Black women diagnosed with breast cancer and discusses ways to overcome these challenges.

Keywords
Barriers, breast cancer, clinical trials, diversity, equity, inclusion

Introduction

Clinical trials are considered the gold standard for evaluating safe and effective novel therapies in cancer therapeutics modalities,[1] and it has repeatedly been shown that participation in clinical trials improves patient outcomes.[2,3] However, underenrollment in cancer clinical trials remains a major issue, with less than 5% of all cancer patients participating in these trials.[4] In addition, there is documented underrepresentation of several patient populations, including racial and ethnic minorities, the elderly, residents of rural areas, and those with low socioeconomic status.[5-9] Ensuring diversity in clinical trials is important for several reasons. First, it ensures that the trial population represents the actual patient population, making the data from clinical trials generalizable. Second, diversity in clinical trials allows investigators to broaden their understanding of racial and ethnic genomic variations and discover the effects of varying drug metabolism and treatment response on subpopulations.

Despite the importance of diverse patient representation in clinical trials and the large evidence of poorer outcomes among Black

Table. Racial/Ethnic Disparities in FDA-Approved Drugs

Drug	Studies	Patient demographics by race, n			
		White	Black	Others[a]	Total
Tucatinib	HER2CLIMB	444	55	113	612
Pembrolizumab	KEYNOTE-522	No race/ethnicity data			
	KEYNOTE-355	598	38	246	882
Sacituzumab govitecan	ASCENT	418	62	49	529
Palbociclib	PALOMA-3	No race/ethnicity data			
	PALOMA-2	No race/ethnicity data			
Ribociclib	MONALEESA-2	No race/ethnicity data			
	MONALEESA-3	619	5	102	726
	MONALEESA-7	388	19	265	672
Abemaciclib	MONARCH 3	288	8	177	473
	monarchE	3925	110	1602	5637
Alpelisib	SOLAR-1	377	8	187	572
	BYLieve	81	6	40	127
Elacestrant	EMERALD	338	12	71	421
Fam-trastuzumab deruxtecan	DESTINY-Breast04	267	10	279	556
	DESTINY-Breast01	132	5	116	253
	DESTINY-Breast03	143	19	362	524
	TROPION-PanTumor01	No race/ethnicity data			
Pertuzumab/trastuzumab	PHranceSCa	129	4	27	160
Pertuzumab/trastuzumab + hyaluronidase	FeDeriCa	329	6	165	500
Trastuzumab emtansine	KATHERINE	1082	40	364	1486
	EMILIA	732	50	209	991
	TH3RESA	488	0	116	604
Pertuzumab	CLEOPATRA	480	30	298	808
Olaparib	OlympiA	1225	48	563	1836
Neratinib	ExteNET	No race/ethnicity data			

FDA, US Food and Drug Administration; NIH OMB, National Institutes of Health Office of Management and Budget.

[a]As defined by NIH OMB: American Indian or Alaska Native, Asian, Native Hawaiian, or other Pacific Islander

women with breast cancer, Black women continue to be underrepresented in breast cancer studies compared with their White counterparts.[10-12] This underenrollment of Black women is observed not only in therapeutic trials but also in surgical oncology trials, with the enrollment factor defined as the number of National Cancer Institute (NCI) trial enrollees divided by the Surveillance, Epidemiology, and End Results (SEER) estimated United States cancer cases in each demographic group.[8] Addressing these enrollment challenges will help reduce disparities in breast cancer outcomes.

Breast cancer is the leading cause of cancer-related morbidity and mortality among women in the United States, with an estimated incidence of 287,850 new cases of invasive disease and an expected 43,250 patient deaths from breast cancer.[131] Despite the similar breast cancer incidence rates between Black and White women in the United States (127.8 vs 133.7 per 100,000), there remains an overall 40% higher death rate in Black women (27.6 vs 19.7 deaths per 100,000 in 2016-2020), and an almost 2-fold higher death rate among those younger than 50 years of age (12.1 vs 6.5 deaths per 100,000).[143] Furthermore, Black women have the lowest 5-year relative survival rate of any racial/ethnic group for every breast cancer molecular subtype and stage of disease. The largest disparities between Black and White women in absolute

terms occur in hormone receptor–positive/human epidermal growth factor receptor 2–negative (HR+/HER2–) disease (88% vs 96%), HR–/HER2+ disease (78% vs 86%), and stage III disease (64% vs 77%).

Higher breast cancer mortality rates in Black women compared with White women have been attributed to aggressive cancer biology,[15,16] lack of screening, limited access to quality care, inadequate laws, and social determinants of health. Biologic factors certainly play a role in disease-related death, but nonbiologic factors such as low income, access to high quality care, and lack of community-based support may play an even more vital role in mortality.[17] For example, Sail and colleagues reported a retrospective study using SEER-Medicare linked data on 54,682 women aged 65 years or older with stages I, II, or IIIA breast cancer from 1991 to 2002, including 23,110 women with node-positive tumors and 31,572 women with node-negative tumors.[18] Black women diagnosed with node-positive tumors were 25% (odds ratio, 0.75; 95% CI, 0.65-0.87) less likely and those diagnosed with node-negative tumors were 17% (0.83, 0.70-0.99) less likely to undergo chemotherapy compared with White women, after adjusting for patient and tumor characteristics. Additionally, Black women with node-negative breast cancer who did not receive chemotherapy had higher mortality rates than White women (hazard ratio, 1.14; 95% CI, 1.04-1.24). Cancer Intervention and Surveillance Modeling Network (CISNET) modeling further suggests that failure to adhere to guideline-concordant treatment accounts for 21.2% to 27% of breast cancer–related deaths, which includes offering patients enrollment in clinical trials if available when discussing standard practices.[19,20] Patients enrolled in clinical trials often receive the standard of care, with the possibility of obtaining additional study drugs/interventions. Participation often includes additional diagnostic testing and clinical team oversight. Therefore, providing access to quality care that includes clinical trials is key to eliminating breast cancer disparities.

Clinical Trials Mitigate Breast Cancer Disparities

Diversity in clinical trials is important, as patients who participate in clinical trials experience better outcomes[21] that include better overall survival.[22] Studies have demonstrated parity in outcomes when standardized for social and health factors. For example, prospective data from the I-SPY network demonstrate that women with high-risk early-stage breast had improved outcomes with chemotherapy. The adaptive randomized I-SPY 2 trial evaluated 907 patients with early-stage high-risk breast cancer (81% White, 12% Black, 7% Asian).[23] Patients underwent genomic testing of the tumor by MammaPrint gene expression and were randomly assigned to either the standard of care or an investigational arm tailored to the molecular subtype of breast cancer. The primary endpoint was pathologic complete response, which correlates with an improvement in survival. After a median follow-up of 4.4 years, there was no statistical significance among the racial groups in pathologic complete response, residual cancer burden, or event-free survival. These data suggest that the biology of the tumor, rather than race, predicted outcomes to systemic therapy when all patients had equal access to quality care. In the United States, the correlation between race and limited access to high-quality care, including access to clinical trials, exacerbates disparate outcomes.

Diversity in clinical trials helps us expand our knowledge of drug-related efficacy and side effects. However, clinical trial enrollment tends not to be representative of diverse populations, and underenrollment in trials among minorities is a major issue, specifically for Black women. One main rate-limiting factor in studying representation in clinical trials is that many studies do not characterize race/ethnicity demographics. Only 31% of trials completed between 2003 and 2016 on ClinicalTrials.gov reported demographics by ethnic groups.[12] Loree and colleagues conducted a study analyzing 250 trials that supported US Food and Drug Administration (FDA)-approved oncology drugs from 2008 to 2018. They found that race was reported in only 145 of these trials.[24] Among these, only 18 studies subcategorized 4 major racial groups: White (76.3%), Asian (18.3%), Hispanic (6.1%), and Black (3.1%). Upon reviewing data on ClincalTrials.gov for the most recent FDA-approved breast cancer drugs, low enrollment of AA populations was observed (Table), including multiple phase 3 studies in which less than 1% of the population was Black. Etiologies of disparities in clinical trial enrollment among Black patients diagnosed with cancer are multifactorial and include systemic, provider, and patient factors (Figure).[25-30] Further evaluation of these factors is necessary to mitigate breast cancer disparities in Black women.

Systemic Barriers to Minority Participation in Clinical Trials

Patient-level factors are often overemphasized to explain why Black women do not enroll in clinical trials, whereas system-level factors are often underemphasized (Figure). General structural barriers, such as a lack of access to off-site trial locations, limited insurance coverage for clinical trial participation, or the absence of supplemental programs that cover lodging and transportation, can affect overall trial participation. Many Black people reside

in rural or low socioeconomic status communities. Catson and colleagues reported that patients living in rural vs urban areas expressed similar interest in clinical trials; this pattern extended to patients who lived in a higher disadvantaged (40% vs 50%, respectively) or lower disadvantaged (54% vs 62%, respectively) setting.[31] Additionally, the lack of interest in trials was secondary to barriers patients faced in rural areas, such as limited transportation, financial constraints, and restricted access to the academic sites in where large phase 3 randomized trials take place (Table). Commonly, these issues disproportionately affect Black patients and contribute to their underrepresentation in cancer therapeutic studies.[19,28] Another contributor to the lack of diversity among clinical trial participants is the lack of diversity among the clinical trial staff, including nurses. Medical students, nursing staff, and faculty from diverse racial and ethnic backgrounds can teach their peers about the culture and beliefs of their communities, which contribute to the holistic care of a patient.[32,33] Underrepresented minority physicians are more likely to serve minority, poor, and Medicaid populations; therefore, diversifying the medical staff is necessary to improve trial accrual in Black women diagnosed with breast cancer.[34]

Despite the large body of research assessing barriers to enrollment of Black people in clinical trials, few corrective interventions have been implemented.[35,48] Interventions that would aid in bolstering diverse trial accrual include increasing the number of underrepresented minority staff and investigators, expanding community outreach, involving opinion leaders, and using clinical navigators to effectively recruit and retain diverse patient populations. These measures can contribute to building a higher level of trust needed for patients to feel confident in the establishment.[36,37,46,47] The above interventions may improve minority patients' perception of inclusivity and may encourage diverse enrollment in clinical trials.

The passage of the Patient Protection and Affordable Care Act (also known as the Affordable Care Act or Obamacare) in March 2010, and the subsequent provisions of the legislation, have expanded health care access to millions by providing easy-to-understand language, tax credits, and cost-sharing reductions to make health care coverage more affordable. This law also expanded the Medicaid program to cover more people with low incomes. Additionally, protected programs like the Breast and Cervical Cancer Mortality Prevention Act of 1990 authorized the Centers for Disease Control to establish the National Breast and Cervical Cancer Early Detection Program, which provides free or low-cost mammograms, offers Pap tests to eligible women, and covers diagnostic testing and follow-up care for low-income, uninsured women with abnormal results.[38] To drive equitable inclusion in cancer research, several agencies have instituted initiatives to fund cancer research. The NCI has supported cancer research within community settings that serve a large and diverse patient population through the NCI Community Oncology Research Program (NCORP),[39] which is an umbrella of existing community-based programs: the Community Clinical Oncology Program, the Minority-Based Community Clinical Oncology Program, and the NCI Community Cancer Centers Program. NCORP and its networks aim to enhance diversity in patient age, race/ethnicity, and geographic location by providing community oncologists with access to cutting-edge cancer clinical trials, with the goal of accelerating the accrual of diverse populations. The NCI established the Specialized Programs of Research Excellence in 1992 to promote interdisciplinary research and to help basic research findings move quickly from the laboratory to the patient. In addition, the NCI's Center to Reduce Cancer Health Disparities has several programs that aim to reduce cancer health disparities, including the Community Networks Program and the Partnerships to Advance Cancer Health Equity program. These programs support research, training, and community engagement activities to improve cancer outcomes for underserved populations. Because of the high rates of racial and socioeconomic breast cancer disparities, the National Comprehensive Cancer Network has published guidelines for the management of cancer in underserved populations. These guidelines provide recommendations for addressing the unique challenges faced by underserved populations, such as limited access to health care and cultural barriers. Increasing access to cancer screenings, avoiding treatment delays, supporting research that focuses on diverse populations, and addressing social determinants of health can help reduce cancer disparities and improve outcomes for all patients.

Health Care Provider Barriers to Minority Participation in Clinical Trials

Provider-level barriers may contribute to disparities in clinical trial enrollment (Figure). For example, a lack of awareness of clinical trial opportunities among providers may result in a failure to refer eligible Black women to breast cancer trials. Additionally, cultural competency and sensitivity are not formal courses that are taught during clinicians' extensive medical training. Therefore, the skill set for approaching patients of diverse backgrounds to discuss clinical trials is not present. In addition, unconscious biases among providers may influence treatment recommendations and contribute to disparities in clinical trial enrollment. This can be attributed to concerns about perceived assumptions of patients mistrusting the provider, beliefs that more time is required to explain the trial process to minority patients, opinions that Black patients

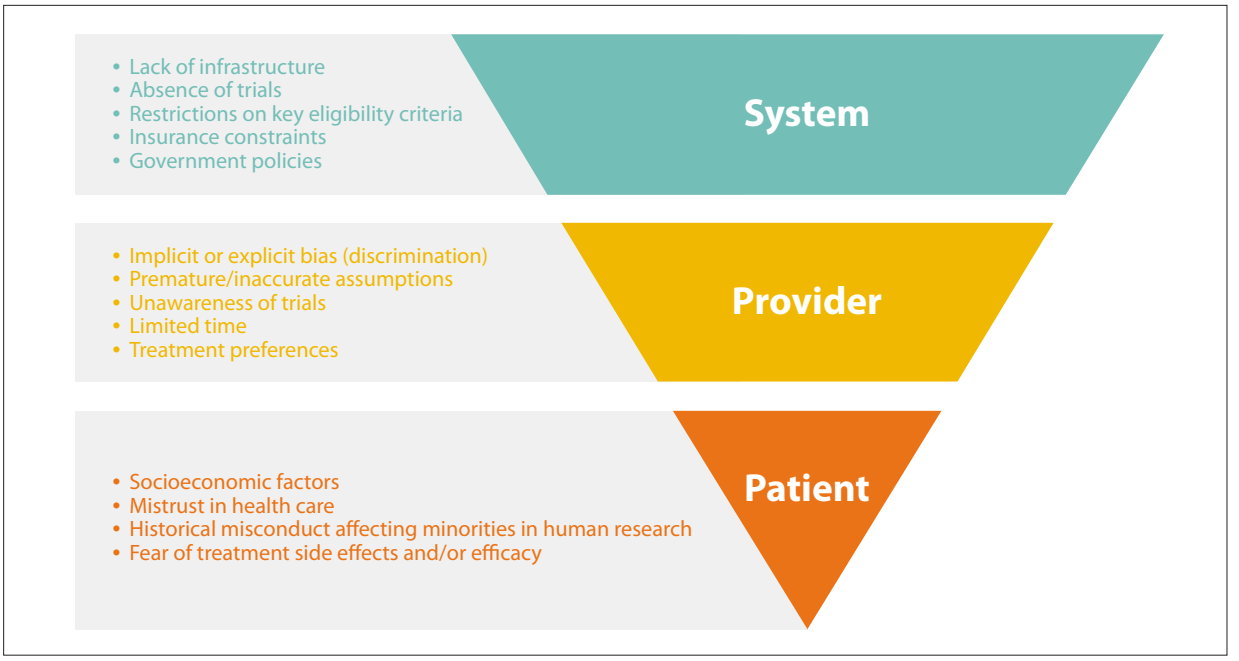

Figure. Barriers to cancer care in clinical trials.

may not want to participate in trials, or provider-directed apprehension about the patient's adherence.[40,41] As a result, providers might be more likely to offer clinical trial options to their more educated or wealthier patients, or those who they perceive as more adherent or motivated to participate.[28]

The disparities in cancer clinical trial enrollment remain multifactorial, but one underlying issue that contributes to provider bias is the lack of diversity among trial investigators. The 2022 National Residency Matching Program data reported that Black physicians accounted for 5% to 11% of all residency positions, whereas those of Hispanic/Latino/Spanish ethnicity accounted for 9.2% to 13.5%.[42] Data from 2019 on oncology fellows showed that only 3.8% were Black and only 6.1% were Hispanic. Additionally, most practice-changing large-scale trials take place primarily at academic institutions, further limiting the minority investigator pool. Most patients diagnosed with cancer seek care in community practices. Training minority community oncologists and practitioners in safety net hospitals to oversee trials as well as would enhance diversity among trial participants.[42] Diversifying supportive staff members, such as certified medical assistants and nurses, would also bridge the physician-patient gap to strengthen trust and communication. Furthermore, verbal and nonverbal communication and education have been shown to improve provider-patient relationships.[43,44] Therefore, enhancing communication models and broadening education by utilizing clinical trial workshops and retreats to train minority investigators would help diversify oncology trials. Intentional tools to train minority health care providers at every stage in their careers would expand the diverse workforce. Ideally, this introduction to the health care field should begin as early as secondary school, to improve awareness of the health care field and provide a roadmap to success.

Critical Patient Barriers to Minority Participation in Clinical Trials

Awareness

Historically, it was believed that disparate access to trials was mostly patient-driven (Figure). Key issues of concern included a lack of awareness or understanding of clinical trials, disinterest in participation, and logistic constraints (eg, lack of transportation to centers offering clinical trials, difficulty in getting time off work, and difficulty finding childcare). In a study that involved 66 interviews with inner-city and rural cancer patients, there was a lack of awareness and understanding about clinical trials, and misconceptions about what clinical trials entail. Notably, the study also revealed that commercials and television shows play a prominent role in forming inner-city and rural patients' attitudes and misconceptions about clinical trials.[45] Lack of trust in health care providers and fear of being a "guinea pig" can dissuade patients from enrolling in clinical trials. A focus group of Black patients with breast cancer found that many were unaware of clinical trial opportunities.[46]

Interestingly, despite these personal barriers, many studies have found no differences in Black and White patients' enrollments or refusal rates when offered clinical trials.[47-51] A recent survey from the BECOME initiative was presented at the 2022 American Society of Clinical Oncology Annual Meeting and included 424 patients with metastatic breast cancer, with 102 self-identifying as Black. Although 83% of Black participants expressed interest in clinical trials, 40% reported that their treatment team did not discuss trials with them. In addition, Black participants were more concerned than non-Black participants that experimental treatments might be harmful (57% vs 31%, respectively) and fewer said that they trusted the treatment (73% vs 91%, respectively). Black participants said they were more likely to participate in a clinical trial if there was assurance that people of their race would benefit (83%). Black participants were also more likely than White participants to say they would be more willing to participate if they were given information on clinical trials by someone who was of the same race/ethnicity (67% vs 10%, respectively).[52]

Comorbidities

Black patients are more likely to have multiple comorbidities at the time of cancer diagnosis, which can delay or impair optimal treatment and render them ineligible for clinical trials. In a single-institution retrospective study of 548 breast cancer patients (26% of them Black), the Black population had statistically higher rates of obesity (62% vs 32%), hypertension (60% vs 32%) and diabetes (23% vs 6%) compared with the White population.[53,35] The Women's Circle of Health Follow-Up Study evaluated Black women (n=274) in New Jersey diagnosed with breast cancer within the last 12 months who had a prior history of diabetes and/or hypertension before cancer diagnosis. Only 54% of the Black women had appropriate comorbidity management. Patients who received shared care from a medical oncologist and a primary care physician were 5 times more likely to have optimal management of prior heath conditions when adjusted for age, health insurance, cancer stage, and comorbidity severity.[54] These uncontrolled comorbidities increase the likelihood that Black patients will be excluded from clinical trials. Therefore, identifying primary care providers who can optimize chronic uncontrolled conditions before the initiation of cancer care will enhance trial enrollment in underrepresented populations.

Personalizing Treatment

Although race and ethnicity are social constructs, they also have been associated with disease risk, aggressive tumor biology, and poorer health outcomes in Blacks compared with non-Hispanic Whites. Black women younger than 40 years have a higher prevalence of *BRCA1* mutations than White women, at 16.7% vs 7.2%.[55-57] In this era of precision medicine, cancer genetics and genomic testing of tumors are widely accepted as standard of care to guide treatment options, including clinical trial opportunities. Yet, minorities diagnosed with cancer are less likely to be offered germline genetic testing or tumor genomic testing. For example, Black women with high-risk breast cancer are less likely to be offered genetic testing or counseling than White women with high-risk breast cancer.[57] The lack of Medicare funding and limited access to genetic counseling are some of the main factors that lead to testing discrepancies. Low rates of genetic testing among Black women may lead to undertreatment and low predictive accuracies of current genetic variations among those of African ancestry.[58-60] In addition, the lack of genetic/genomic testing may decrease patient awareness of illness, cause patients to underutilize screening modalities that can detect cancer earlier, reduce the chances of subspecialty referrals, decrease the chances of guideline-concordant treatment, and limit clinical trial eligibility.[61] One of the benefits of clinical trial participation would be coverage of genetically and genomically driven testing by the study sponsor to help guide personalized treatment options for each participant.

Another advantage to increasing clinical trial enrollment for Black women is to address the population's morbidity and mortality in breast cancer care. For example, there is a higher frequency of moderate to severe chemotherapy-induced neuropathy (grade 2-4) reported in Black women vs White women, at 43.3% vs 24.6%.[62] The toxicity of peripheral neuropathy is often mitigated by dose delays and reductions. Dose reductions in taxane therapies may contribute to a higher risk of breast cancer relapse. This effect may be due to not only germline variants but also nongenetic modifiers, such as body mass index, blood sugar control, social determinants of health, and depression.

As Schneider and colleagues and others have suggested, Black race and the genetic variant rs3125923 may predict taxane-induced neuropathy in patients of African descent.[62] Therefore, further investigation by the ECOG-ACRIN Cancer Research Group to specifically evaluate Black patients at high risk for life-altering peripheral neuropathy was performed. The EAZ171 study, a prospective validation trial to evaluate germline predictors of taxane-induced peripheral neuropathy in women of African descent, was completed in 2022 and results are forthcoming (NCT04001829). More studies are needed to investigate the clinical concerns of minority patients to improve outcomes. Developing a multidisciplinary approach to treating high-risk minority patients with comorbidities is

needed to manage overall wellness. Additionally, opening trials in communities that immediately address the needs of the population is important for minority engagement.

Conclusion

Black patients continue to be underrepresented in oncology clinical trials, which contributes to disparities in outcomes. Because cancer disparities are multifactorial, a one-size-fits-all approach will not alter these outcomes. Increasing the genetic knowledge of tumor biology and developing novel targeted therapies is critical. We must also acknowledge nongenetic factors and individual characteristics, including preexisting conditions, lack of access to care, and unawareness of clinical trials, that contribute to health disparities in breast cancer. We must design innovative clinical trials that address minority patients' concerns, including efficacy, while balancing drug toxicity profiles. Additionally, increasing clinical trial access to centers that provide care to minority populations is a necessary step in improving health outcomes for Black women diagnosed with breast cancer. Lastly, patient populations and clinical care teams involved in clinical trials must reflect a diverse population to optimize treatment strategies and bring equity into research and treatment in cancer care.

Disclosures

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References

1. Braunholtz DA, Edwards SJ, Lilford RJ. Are randomized clinical trials good for us (in the short term)? Evidence for a "trial effect". *J Clin Epidemiol*. 2001;54(3):217-224.
2. Nipp RD, Hong K, Paskett ED. Overcoming barriers to clinical trial enrollment. *Am Soc Clin Oncol Educ Book*. 2019;39(39):105-114.
3. Unger JM, Barlow WE, Martin DP, et al. Comparison of survival outcomes among cancer patients treated in and out of clinical trials. *J Natl Cancer Inst*. 2014;106(3):dju002.
4. Wong AR, Sun V, George K, et al. Barriers to participation in therapeutic clinical trials as perceived by community oncologists. *JCO Oncol Pract*. 2020;16(9):e849-e858.
5. Baquet CR, Commiskey P, Daniel Mullins C, Mishra SI. Recruitment and participation in clinical trials: socio-demographic, rural/urban, and health care access predictors. *Cancer Detect Prev*. 2006;30(1):24-33.
6. Du W, Gadgeel SM, Simon MS. Predictors of enrollment in lung cancer clinical trials. *Cancer*. 2006;106(2):420-425.
7. Lolic M, Araojo R, Okeke M, Woodcock J. Racial and ethnic representation in US clinical trials of new drugs and biologics, 2015-2019. *JAMA*. 2021;326(21):2201-2203.
8. Stewart JH, Bertoni AG, Staten JL, Levine EA, Gross CP. Participation in surgical oncology clinical trials: gender-, race/ethnicity-, and age-based disparities. *Ann Surg Oncol*. 2007;14(12):3328-3334.
9. Unger JM, Hershman DL, Albain KS, et al. Patient income level and cancer clinical trial participation. *J Clin Oncol*. 2013;31(5):536-542.
10. Cook ED, Yeager KA, Cecchini RS, et al. Recruitment practices for U.S. minority and underserved populations in NRG oncology: results of an online survey. *Contemp Clin Trials Commun*. 2018;10:100-104.
11. Dickmann LJ, Schutzman JL. Racial and ethnic composition of cancer clinical drug trials: how diverse are we? *Oncologist*. 2018;23(2):243-246.
12. Murthy VH, Krumholz HM, Gross CP. Participation in cancer clinical trials: race-, sex-, and age-based disparities. *JAMA*. 2004;291(22):2720-2726.
13. Giaquinto AN, Sung H, Miller KD, et al. Breast cancer statistics, 2022. *CA Cancer J Clin*. 2022;72(6):524-541.
14. Giaquinto AN, Miller KD, Tossas KY, Winn RA, Jemal A, Siegel RL. Cancer statistics for African American/Black people 2022. *CA Cancer J Clin*. 2022;72(3):202-229.
15. Daly B, Olopade OI. A perfect storm: how tumor biology, genomics, and health care delivery patterns collide to create a racial survival disparity in breast cancer and proposed interventions for change. *CA Cancer J Clin*. 2015;65(3):221-238.
16. Newman LA. Breast cancer disparities: socioeconomic factors versus biology. *Ann Surg Oncol*. 2017;24(10):2869-2875.
17. Wright N, Akinyemiju T, Subhedar P, Rida P, Aneja R. Targeting risk factors for reducing the racially disparate burden in breast cancer. *Front Biosci (Schol Ed)*. 2019;11(1):136-160.
18. Sail K, Franzini L, Lairson D, Du X. Differences in treatment and survival among African-American and Caucasian women with early stage operable breast cancer. *Ethn Health*. 2012;17(3):309-323.
19. Mandelblatt JS, Cronin KA, Berry DA, et al. Modeling the impact of population screening on breast cancer mortality in the United States [St Gallen International Breast Cancer Conference]. *Breast*. 2011;20(suppl 3):S75-S81.
20. Mandelblatt JS, Stout NK, Schechter CB, et al. Collaborative modeling of the benefits and harms associated with different US breast cancer screening strategies. *Ann Intern Med*. 2016;164(4):215-225.
21. Schwartz AL, Alsan M, Morris AA, Halpern SD. Why diverse clinical trial participation matters. *N Engl J Med*. 2023;388(14):1252-1254.
22. Gidwani R, Franks JA, Enogela EM, et al. Survival in the real world: a national analysis of patients treated for early-stage breast cancer. *JCO Oncol Pract*. 2022;18(2):e235-e249.
23. Kyalwazi B, Yau C, Olopade O, et al. Abstract GS4-02: Analysis of clinical outcomes and expression-based immune signatures by race in the I-SPY 2 trial [AACR abstract GS4-02]. *Cancer Res*. 2022;82(4)(suppl).
24. Loree JM, Anand S, Dasari A, et al. Disparity of race reporting and representation in clinical trials leading to cancer drug approvals from 2008 to 2018. *JAMA Oncol*. 2019;5(10):e191870-e191870.
25. Awidi M, Al Hadidi S. Participation of Black Americans in cancer clinical trials: current challenges and proposed solutions. *JCO Oncol Pract*. 2021;17(5):265-271.
26. Ford JG, Howerton MW, Lai GY, et al. Barriers to recruiting underrepresented populations to cancer clinical trials: a systematic review. *Cancer*. 2008;112(2):228-242.
27. George S, Duran N, Norris K. A systematic review of barriers and facilitators to minority research participation among African Americans, Latinos, Asian Americans, and Pacific Islanders. *Am J Public Health*. 2014;104(2):e16-e31.
28. Hamel LM, Penner LA, Albrecht TL, Heath E, Gwede CK, Eggly S. Barriers to clinical trial enrollment in racial and ethnic minority patients with cancer. *Cancer Control*. 2016;23(4):327-337.
29. Rivers DA, Pal T, Vadaparampil ST, Adams LA, Dash-Pitts L, Quinn GP. A community-academic partnership to explore informational needs of African American women as a primer for cancer clinical trial recruitment. *Ethn Health*. 2019;24(6):679-693.
30. Stringer-Reasor EM, Elkhanany A, Khoury K, Simon MA, Newman LA. Disparities in breast cancer associated with African American identity. *Am Soc Clin Oncol Educ Book*. 2021;41(41):e29-e46.
31. Caston NE, Williams CP, Wan C, et al. Associations between geography, decision-making style, and interest in cancer clinical trial participation. *Cancer*. 2022;128(22):3977-3984.
32. Burrow GN. Medical student diversity—elective or required? *Acad Med*. 1998;73(10):1052-1053.
33. Cohen JJ. Improving America's health status through a more diverse physician workforce. *Acad Med*. 1997;72(2):130.
34. Whitla DK, Orfield G, Silen W, Teperow C, Howard C, Reede J. Educational benefits of diversity in medical school: a survey of students. *Acad Med*. 2003;78(5):460-466.

35. Nouvini R, Parker PA, Malling CD, Godwin K, Costas-Muñiz R. Interventions to increase racial and ethnic minority accrual into cancer clinical trials: a systematic review. *Cancer*. 2022;128(21):3860-3869.
36. Niranjan SJ, Martin MY, Fouad MN, et al. Bias and stereotyping among research and clinical professionals: perspectives on minority recruitment for oncology clinical trials. *Cancer*. 2020;126(9):1958-1968.
37. Niranjan SJ, Wenzel JA, Martin MY, et al. Perceived institutional barriers among clinical and research professionals: minority participation in oncology clinical trials. *JCO Oncol Pract*. 2021;17(5):e666-e675.
38. Lee NC, Wong FL, Jamison PM, et al. Implementation of the national breast and cervical cancer early detection program: the beginning. *Cancer*. 2014;120(0 16)(suppl 16):2540-2548.
39. McCaskill-Stevens W, Lyss AP, Good M, Marsland T, Lilenbaum R. The NCI Community Oncology Research Program: what every clinician needs to know. *Am Soc Clin Oncol Educ Book*. 2013;33(1):e84-e89.
40. National Resident Matching Program. NRMP releases the 2022 Main Residency Match Results and Data publication, the most comprehensive data resource for the Main Residency Match®. https://www.nrmp.org/about/news/2022/06/nrmp-releases-the-2022-main-residency-match-results-and-data-publication-the-most-comprehensive-data-resource-for-the-main-residency-match. Accessed February 27, 2024.
41. Durant RW, Wenzel JA, Scarinci IC, et al. Perspectives on barriers and facilitators to minority recruitment for clinical trials among cancer center leaders, investigators, research staff, and referring clinicians: enhancing minority participation in clinical trials (EMPaCT). *Cancer*. 2014;120(suppl 7):1097-1105.
42. Woodcock J, Araojo R, Thompson T, Puckrein GA. Integrating research into community practice—toward increased diversity in clinical trials. *N Engl J Med*. 2021;385(15):1351-1353.
43. Proctor JW, Martz E, Schenken LL, Rainville R, Marlowe U. A screening tool to enhance clinical trial participation at a community center involved in a radiation oncology disparities program. *J Oncol Pract*. 2011;7(3):161-164.
44. Wujcik D, Wolff SN. Recruitment of African Americans to national oncology clinical trials through a clinical trial shared resource. *J Health Care Poor Underserved*. 2010;21(1)(suppl):38-50.
45. Geana M, Erba J, Krebill H, et al. Searching for cures: inner-city and rural patients' awareness and perceptions of cancer clinical trials. *Contemp Clin Trials Commun*. 2016;5:72-79.
46. Linden HM, Reisch LM, Hart A Jr, et al. Attitudes toward participation in breast cancer randomized clinical trials in the African American community: a focus group study. *Cancer Nurs*. 2007;30(4):261-269.
47. Igwe E, Woodburn J, Davolos J, et al. Patient perceptions and willingness to participate in clinical trials. *Gynecol Oncol*. 2016;142(3):520-524.
48. Katz RV, Green BL, Kressin NR, Claudio C, Wang MQ, Russell SL. Willingness of minorities to participate in biomedical studies: confirmatory findings from a follow-up study using the Tuskegee Legacy Project Questionnaire. *J Natl Med Assoc*. 2007;99(9):1052-1060.
49. Langford AT, Resnicow K, Dimond EP, et al. Racial/ethnic differences in clinical trial enrollment, refusal rates, ineligibility, and reasons for decline among patients at sites in the National Cancer Institute's Community Cancer Centers Program. *Cancer*. 2014;120(6):877-884.
50. Unger JM, Hershman DL, Till C, et al. "When offered to participate": a systematic review and meta-analysis of patient agreement to participate in cancer clinical trials. *J Natl Cancer Inst*. 2021;113(3):244-257.
51. Wendler D, Kington R, Madans J, et al. Are racial and ethnic minorities less willing to participate in health research? *PLoS Med*. 2006;3(2):e19.
52. Walker S, Carlson M, White CB, Howell J, Felder TM. Increasing Black patient participation in metastatic breast cancer clinical trials: The BECOME (Black Experience of Clinical Trials and Opportunities for Meaningful Engagement) project [ASCO abstract 1014]. *J Clin Oncol*. 2022;40(16)(suppl).
53. Nyrop KA, Damone EM, Deal AM, et al. Obesity, comorbidities, and treatment selection in Black and White women with early breast cancer. *Cancer*. 2021;127(6):922-930.
54. Doose M, Steinberg MB, Xing CY, et al. Comorbidity management in Black women diagnosed with breast cancer: the role of primary care in shared care. *J Gen Intern Med*.2021;36(1):138-146.
55. Chapman-Davis E, Zhou ZN, Fields JC, et al. Racial and ethnic disparities in genetic testing at a hereditary breast and ovarian cancer center. *J Gen Intern Med*. 2021;36(1):35-42.
56. John EM, Miron A, Gong G, et al. Prevalence of pathogenic BRCA1 mutation carriers in 5 US racial/ethnic groups. *JAMA*. 2007;298(24):2869-2876.
57. Levy DE, Byfield SD, Comstock CB, et al. Underutilization of BRCA1/2 testing to guide breast cancer treatment: black and Hispanic women particularly at risk. *Genet Med*. 2011;13(4):349-355.
58. Manrai AK, Funke BH, Rehm HL, et al. Genetic misdiagnoses and the potential for health disparities. *N Engl J Med*. 2016;375(7):655-665.
59. Martin AR, Kanai M, Kamatani Y, Okada Y, Neale BM, Daly MJ. Clinical use of current polygenic risk scores may exacerbate health disparities. *Nat Genet*. 2019;51(4):584-591.
60. Morales J, Welter D, Bowler EH, et al. A standardized framework for representation of ancestry data in genomics studies, with application to the NHGRI-EBI GWAS Catalog. *Genome Biol*. 2018;19(1):21.
61. Reid S, Cadiz S, Pal T. Disparities in genetic testing and care among black women with hereditary breast cancer. *Curr Breast Cancer Rep*. 2020;12(3):125-131.
62. Schneider BP, Li L, Radovich M, et al. Genome-wide association studies for taxane-induced peripheral neuropathy in ECOG-5103 and ECOG-1199. *Clin Cancer Res*. 2015;21(22):5082-5091.