A Multi-faceted Intervention Aimed at Black-White Disparities in the Treatment of Early Stage Cancers: The ACCURE Pragmatic Quality Improvement trial

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Abstract: Background: Reports continue to show that Blacks with curable lung or breast cancer complete treatment less often than similar Whites contributing to worse survival. ACCURE is an intervention trial designed to address this problem.

Patients and methods: A pragmatic, quality improvement trial comparing an intervention group to retrospective and concurrent controls. Patients with early stage breast or lung cancer aged 18 to 85 were enrolled ($N = 302$) at 2 cancer centers between April 2013 and March 2015 for the intervention component. Data from patients seen between January 2007 and December 2012 with these diagnoses were obtained to establish control completion rates. Concurrent data for non-study patients were used to identify secular trends. The intervention included: a real time registry derived from electronic health records of participants to signal missed appointments or unmet care milestones, a navigator, and clinical feedback. The primary outcome was "Treatment Complete", a composite variable representing completion of surgery, recommended radiation and chemotherapy for each patient.

Results: The mean age in the intervention group was 63.1 years; 37.1% of patients were Black. Treatment completion in retrospective and concurrent controls showed significant Black-White differences (Blacks (B) 79.8% vs. Whites (W) 87.3%, $p < 0.001$; 83.1% B vs. 90.1% W, $p < 0.001$, respectively). The disparity lessened within the intervention (B 88.4% and W 89.5%, $p = 0.77$). Multivariate analyses confirmed disparities reduction. OR for Black-White disparity within the intervention was 0.98 (95% CI 0.46–2.1); Black completion in the intervention compared favorably to Whites in retrospective (OR 1.6; 95% CI 0.90–2.9) and concurrent (OR 1.1; 95% CI 0.59–2.0) controls.

Conclusion: A real time registry combined with feedback and navigation improved completion of treatment for all breast and lung cancer patients and narrowed disparities. Similar multi-faceted interventions could mitigate disparities in the treatment of other cancers and chronic conditions.

Keywords: Cancer disparities■Institutional racism■Intervention■Quality improvement

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INTRODUCTION

Inequalities in the treatment of early stage breast and lung cancer have been consistently documented for Black patients compared to similar White patients for decades.[1–4] These treatment differences are extremely important because lung cancer is the leading cause of cancer death for both men and women[5] nationally and breast cancer is second to only lung cancer in women.[5] While Bach and Hershman demonstrated a direct contribution of disparities to excess mortality for Blacks more than a decade ago,[1,2] recent data show that lung cancer survival disparities persist while breast cancer survival disparities have actually widened.[6] Even after controlling for confounders, such as comorbidity, health insurance, and socioeconomic status, studies still report less care and increased mortality for Blacks.[1,2,7,8] Factors such as implicit bias, mistrust, and poor communication have been associated with treatment variability[4,9–11] but interventions to address these issues have been sparse.[12,13] In response to these gaps in research and persistent unequal outcomes, the Greensboro Health Disparities Collaborative (GHDC), the UPMC Hillman Cancer Center, the University of Pittsburgh School of Medicine, Pittsburgh Pennsylvania, and Cone Health Cancer Center, Greensboro, North Carolina joined together to test a system change intervention to enhance racial equity in the completion of cancer treatment. We conducted a trial, Accountability for Cancer Care through Undoing Racism and Equity (ACCURE), using a multi-faceted intervention designed to address barriers identified in our preliminary studies and informed by community-based participatory research. In this report, we describe the intervention and the clinical results.

MATERIALS AND METHODS

Study design and intervention

We performed a 5-year study to examine the effect of an intervention on disparities in treatment completion for Black patients with stages 1 and 2 lung or breast cancer compared to similar White patients. Our study was a pragmatic trial as assessed by the PRECIS-2 definition[14]; specifically, the patients were community based with broad enrollment criteria, treated by usual care providers in a typical cancer care setting using tools and personnel that could easily fit into routine clinic workflows. Study diagnoses were selected because of our community partners' awareness that these cancers were very common and often fatal among people in their communities with similar racial and socioeconomic backgrounds.

The ACCURE intervention study utilized the People's Institute for Survival and Beyond (PISAB) Undoing Racism™ framework as a conceptual model for medical care. Recognized by the Aspen Institute (2004) as one of the top 10 anti-racism training programs in the U.S., the PISAB Undoing Racism™ framework suggests that the world is controlled by powerful systems with historically traceable roots. Once people are shown how they benefit from or are oppressed by those systems, they can work together and lead system change. Therefore, transparency in measuring system effects and accountability to implement change become the key concepts for undoing institutional racism and establishing racial equity.[15] In this vain, all consented patients received the intervention which consisted of a real time warning system derived from automated uploads of data from electronic health records (EHRs) to enhance transparency, feedback to clinical teams on completion of cancer treatments according to race (enhance both transparency and accountability), and a nurse navigator with access to the warning system (to formalize accountability). Health equity training sessions covering concepts such as implicit bias, gatekeeping, and institutional racism were offered to all staff and providers quarterly to make them aware of these concepts. See Fig. 1 which demonstrates the relationship of the real time registry derived from EHR downloads leading to transparency of substandard or delayed care within a window of actionable intervention connecting to the accountability provided by the interactions of the navigator and physician champion with patients and the relevant clinical team resulting in quality improvement for all.

Because of the ubiquitous nature of EHRs and the pervasiveness of quality improvement (QI) work in practice, we felt it was unethical to randomize patients to a "control" group devoid of data feedback and electronic tools so we used a QI approach. We established 2

Fig. 1. ACCURE conceptual model.

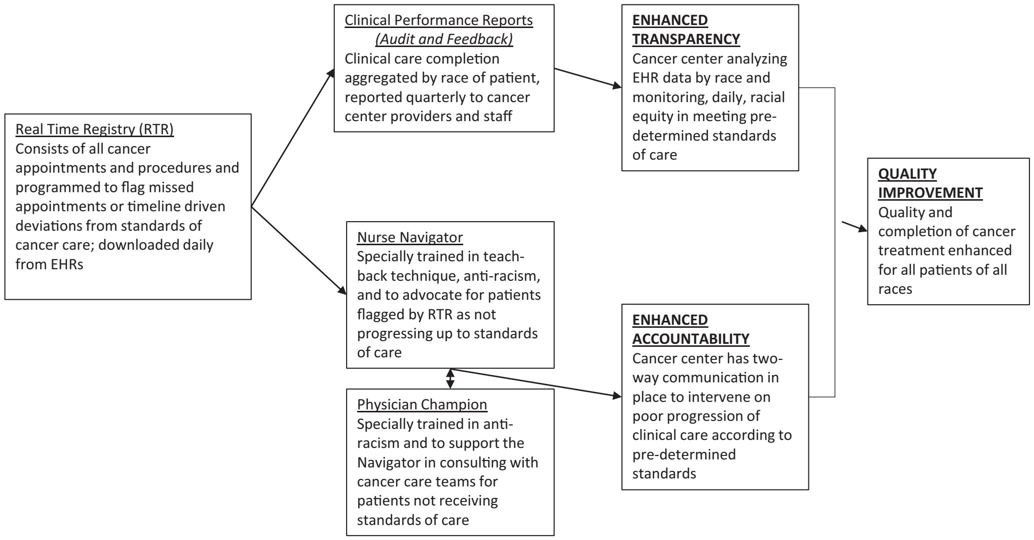


Table 1. Unmet milestones used to trigger warnings in the real time registry for study patients.

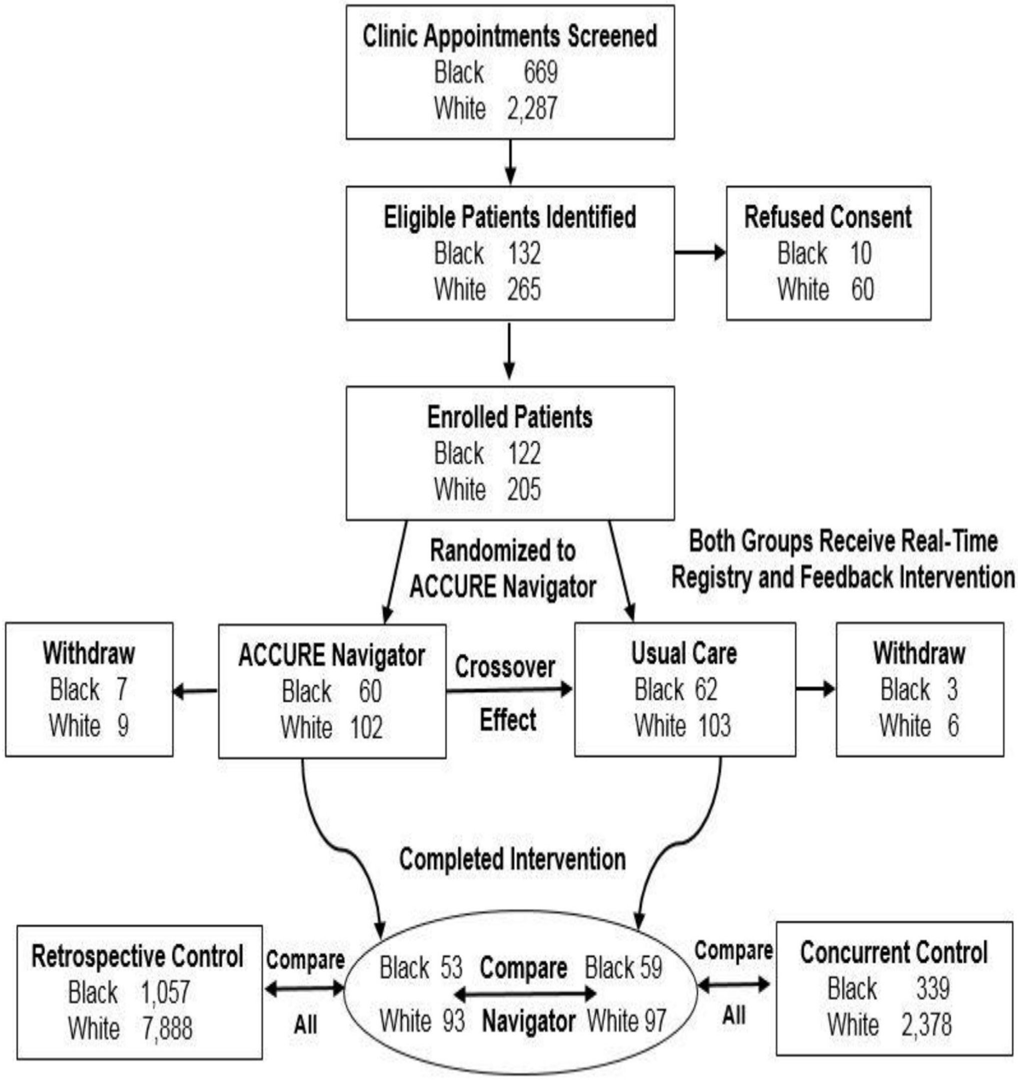
Lung Cancer
No clinical appointment, diagnostic test, or treatment scheduled within 30 days of the index visit
No surgery or radiation scheduled within 90 days of the index visit
No surgery performed by day 130 from the index visit
Breast Cancer
No clinical appointment, diagnostic test, or treatment scheduled within 30 days of the index visit
No breast cancer surgery completed within 30 days of the initial visit
No chemotherapy or radiation appointments scheduled within 21 days of breast cancer surgery
No chemotherapy treatments actually received within 90 days of breast cancer surgery
No radiation treatments actually received within 90 days of breast cancer surgery

statistical control groups. The first group included all patients diagnosed with stages 1 and 2 breast cancer or non-small cell lung cancer at UPMC and Cone from January 1, 2007 to December 31, 2012 to establish baseline treatment completion rates and racial differences. The second control was the concurrent population of stage 1 and 2 breast and lung cancer patients who were diagnosed in 2014 and 2015 and not enrolled in the intervention. The latter group ensured that improvement documented in the intervention did not represent spontaneous improvement in the participating centers thus eliminating the possibility of secular trends. Variables collected in all groups included site, gender, age, race, health insurance status, marital status, zip code, cancer stage at diagnosis, and co-morbid illnesses. We recorded whether patients received surgical treatment, radiation therapy (and dose), or chemotherapy (and number of treatments) and the dates of all treatments. Within the intervention group, we conducted a small, preplanned randomized trial in which half received standard nurse navigation consisting of nurse availability for patient initiated contacts on an as needed basis and half received a specially trained nurse navigator who attended a racial equity training delivered as a 2 day workshop by the Racial Equity Institute (Greensboro, NC) that included components on the culture and history of racism, institutional aspects of racism, the role of implicit bias, and systematic approaches to establish "anti-racism". These special navigators also received case-based training on barriers more specific to the Black community such as medical mistrust, lack of self-efficacy, poor communication, and beliefs that negatively influence care (e.g. "air will cause the spread of cancer during surgery"). This latter training was delivered by one of the principal investigators (Cykert) during two 1-h sessions during the first 3-months of recruitment and was based on findings of a prospective cohort study that explored factors leading to disparities in receipt of lung cancer surgery.[4] The special ACCURE Navigator protocol was proactive and not dependent on patient initiation. It required 2 navigator initiated face-to-face meetings within the first month of diagnosis; then monthly contact was scheduled, usually by telephone, to assess progress in addition to any patient initiated communications. The real time registry system generated reminders for these visits until the visit was documented by the navigator. These meetings occurred for all patients randomized to the special navigator regardless of patient race. A priori, we estimated that by enrolling 270 patients (162 White and 108 Black) that we had 80% power to detect a treatment completion difference of 14% in the special navigator group above usual care navigation.

Other important features of the intervention are described. For the real time registry, we received automated nightly uploads of EHR data including patients' appointments for clinician visits, tests, treatments, and procedures. The registry was configured to deliver alerts when a patient either missed a scheduled appointment or did not reach an expected milestone in care. Programmed milestones were determined a priori with cancer center clinicians and are shown in Table 1. To monitor intervention fidelity, we logged all warnings and navigator responses in the registry system.

For each cancer center, we selected a practicing oncologist to serve as the ACCURE physician champion. The champion made other clinicians and staff aware of the study through scheduled staff meetings and was responsible for delivering quarterly reports that included surgical rates and completion rates for chemotherapy and radiation therapy of the cancer center population and intervention group stratified by race. Note that the study team did not determine whether actual initiation of adjuvant

Fig. 2. Patient enrollment, randomization, and progression in ACCURE.



chemotherapy was appropriate. Once chemotherapy was started the number of completed cycles were ascertained again through automated EHR uploads. We assumed that all patients who received breast conserving surgery (BCS) should start and complete adjuvant radiation.

Patient Enrollment

Patients with the new diagnosis of stage 1 or 2 breast or lung cancer between the ages of 18 and 85 were eligible for intervention. Exclusions included pregnancy, inability to speak English, and cognitive impairment. Enrollment occurred from April of 2013 until March of 2015. Our goal was to recruit consecutive patients at the participating centers as quickly as possible so that everyone experienced 2−3 years of follow-up. To identify eligible patients, research assistants (RA) screened patient schedules from breast surgery, thoracic surgery, oncology, pulmonary, and multi-disciplinary cancer clinics. All these schedules were available through the EHR. Most patients screened were not eligible because of a non-cancer diagnosis, a follow-up visit rather than an initial diagnostic visit, a cancer diagnosis other than breast or lung, or a stage more advanced than stage 2. See Fig. 2 for a schematic representation of enrollment. The top row of this Consort diagram represents all the patients screened regardless of eligibility. The second row shows the number of eligible patients identified by race and those refusing consent. When eligible patients shared simultaneous appointment times, RA's were trained to prioritize Black patients for enrollment as a method of oversampling. Informed consent was given by

Table 2. Characteristics of stage 1 and 2 breast and lung cancer patients by study group.

Characteristics	Retrospective Whole Population Cohort (Control Group) N = 8945 (percent, 95% CI[b])	Concurrent Whole Population Cohort (Control Group) N = 2717 (percent, 95% CI)	Intervention Group N = 302 (percent, 95% CI)
Mean Age (years)	61.7 (61.4, 61.9)	62.7 (62.2, 63.1)	63.1 (61.8, 64.4)
Female Gender	88.0 (87.3, 88.7)	89.3 (88.2, 90.5)	83.1 (78.9, 87.3)[a]
Married or Lives with Significant Other	60.4 (59.4, 61.4)	58.3 (56.5, 60.2)	47.4 (41.7, 53.0)[a]
Black Race	11.8 (11.1, 12.5)	12.5 (11.2, 13.7)	37.1 (31.6, 42.5)[a]
Private Insurance	51.7 (50.7, 52.8)	47.0 (45.1, 48.0)	30.8 (25.6, 36.0)[a]
Mean of Median Household Income by Zip Code ($)	53.6K (53.3K,54.0K)	54.1K (53.5K,54.8K)	49.2K (47.2K,51.0K)[a]
Mean Charlson Score	2.8 (2.70, 2.82)	2.7 (2.55, 2.77)	2.6 (2.33, 2.97)
Clinical Stage 1 at Diagnosis	64.7 (63.7, 65.7)	64.5 (62.7, 66.3)	74.5 (69.6, 79.4)[a]
Breast Cancer	76.2 (75.3, 77.1)	78.0 (76.5,79.6)	59.6 (54.1, 65.1)[a]

[a] *Difference statistically significant comparing the intervention cohort to the whole population cohorts, $p < 0.05$.*
[b] *CI = confidence interval.*

all participants. Institutional Review Board approval was obtained from each study institution. ACCURE was registered with ClinicalTrials.Gov (NCT01954641).

Primary outcome

The primary outcome reflecting a full course of treatment for both cancers is the composite, "Treatment Complete". Treatment Complete is defined: (1) for lung cancer, a patient must receive resection surgery or a full course of stereotactic radiation calculated for potential cure. If chemotherapy was started for stage 1B or stage 2 patients, then administration of at least 3 of 4 cycles had to have occurred to be deemed complete. (2) For breast cancer, any patient who did not undergo surgery received a, "no" for Treatment Complete. If surgery was BCS, then adjuvant radiation had to be completed. If chemotherapy was initiated either in the setting of complete mastectomy or BCS plus radiation, then a patient must have received at least 4 cycles.

THEORY/CALCULATION

Patient characteristics including gender, age, median household income by zip code, race, and marital status were summarized using descriptive statistics and compared across study groups and within study groups between races using chi-square and F-tests for categorical and continuous variables, respectively. Since we were interested in estimating treatment completion differences between Black and White race for each study group, a logistic regression model including a combination of study group and race variables was used to estimate treatment completion percentages and differences in treatment completion percentages for each study group by race. The retrospective data were used to define baseline treatment disparity between Black and White patients. Concurrent data were used to assess the disparity during the intervention period and therefore assess secular trends or spillover effects for non-enrolled patients. In order to control for bivariate differences across study samples and between races within each study sample, a similar logistic regression model that included age, marital status, health insurance status, median household income, study site and Charlson Comorbidity Score in addition to study group by race combinations was employed to estimate differences in treatment completion between Black and White patients within each study group. Subsequently, using the same model and data from all 3 study groups, we compared estimates of racial differences between baseline (retrospective) and intervention and between concurrent and intervention study groups to further assess effectiveness of the intervention.

RESULTS AND DISCUSSION

During the recruitment period, 132 Black and 265 White patients eligible for the study were identified and 92.4% and 77%, respectively, agreed to participate. Ten Black

Table 3. Bivariate treatment completion results according to patient characteristics within each study group.

Patient Characteristic	Retrospective Whole Population Cohort (Control Group) N = 8945	Concurrent Whole Population Cohort (Control Group) N = 2717	Intervention Group N = 302
Mean Age (years) Treatment Complete			
Yes	62.4	62.8	62.7
No	63.7	63.2	66.5
p-value	0.004	0.59	0.07
Median Income ($) Treatment Complete			
Yes	54,442	54,810	48,524
No	51,489	50,303	54,468
p-value	<0.001	<0.001	0.13
Married (% TC*)			
Yes	88.2	90.9	90.9
No	83.8	88.6	87.4
p-value	<0.001	0.05	0.33
Private Insurance (% TC)			
Yes	89.3	91.3	89.3
No	83.6	88.7	89.0
p-value	<0.001	0.03	0.95
Charlson Score (% TC)			
≤1	86.8	91.9	93.3
>1	86.1	88.5	88.4
p-value	0.39	0.005	0.22
Race (% TC)			
White	87.3	91.9	89.5
Black	79.8	83.1	88.4

TC = Treatment Complete.

(8.2%) and 18 White (8.7%) patients withdrew prior to ascertainment of clinical outcomes and were removed from the analyses. See Fig. 2. For characteristics of the 3 study groups, see Table 2. Black patients in the intervention group were intentionally oversampled. Patients in the intervention group were older, had less private insurance, and there were proportionally more males and fewer married individuals than in the other cohorts.

The unadjusted rates for Treatment Complete in the retrospective group were 79.8% for Black patients (B) and 87.3% for White patients (W), ($p < 0.001$); in the concurrent group treatment completion rates also significantly favored White patients − 83.1% B vs. 90.1% W, ($p < 0.001$) − suggesting persistence of disparities. In contrast, Black patients in the intervention group achieved a Treatment Complete rate of 88.4% compared to 89.5% for Whites ($p = 0.77$). Bivariate comparisons within the retrospective and concurrent whole population groups showed that in addition to Black race, lower median income, a lack of private insurance, and being unmarried were associated with lower treatment completion. Within the intervention group, these variables were not associated with significant treatment differences. For the intervention, Site 1 had a completion rate of 88.3% compared to 91.0% for Site 2 ($p = 0.44$). See Table 3 for full bivariate results.

Multivariate analysis within study groups confirmed reduced treatment completion for Black compared to White patients for the retrospective (OR 0.79; 95% CI, 0.65−0.96) and concurrent control (OR 0.69; 95% CI 0.49−0.96). There was no Black-White disparity

Table 4. Results from multivariate logistic regression of treatment completions including all race-group combinations; within and between group comparisons are shown.

Variable	Beta	Odds Ratio (95% Confidence Interval)	p-Value
Age	0.004	1.00 (0.99, 1.01)	0.15
Charlson Score (>1 vs. < or = 1)	−0.12	0.89 (0.79, 1.0)	0.06
Median Zip Code Income	0.003	1.00 (1.0, 1.01)3	0.15
Marital Status Not Married vs. Married	−0.22	0.80 (0.71, 0.90)	<0.001
Private Insurance No vs. Yes	−0.29	0.75 (0.65, 0.86)	<0.0001
Site	−0.74	0.48 (0.42, 0.54)	<0.001
Race and Study Group			
Black-Retrospective[a]	−0.24	0.79 (0.65, 0.96)	0.02
Black-Intervention[a]	0.48	1.6 (0.90, 2.9)	0.11
Black-Concurrent[b]	−0.37	0.69 (0.49, 0.96)	0.03
White-Intervention[a]	0.50	01.6 (1.03, 2.7)	0.04
Black-Intervention[b]	0.08	1.1 (0.59, 2.0)	0.80
Black-Intervention[c]	−0.02	0.98 (0.46, 2.1)	0.95

[a] *White retrospective cohort is the referent group.*
[b] *White concurrent cohort is the referent group.*
[c] *White intervention cohort is the referent group.*

demonstrated within the intervention group (OR 0.98; 95% CI 0.46–2.1). Between group comparisons using the combined model examining race-group interactions showed completion rates for Black patients in the intervention compared favorably to Whites in the retrospective group (OR 1.6; 95% CI 0.90–2.9) and the concurrent group (OR 1.1; 95% CI 0.59–2.0). Patients without private insurance and unmarried had lower completion rates in the overall model and a site effect was noted (See Table 4).

The small randomized study within the intervention cohort did not show a statistically significant difference in favor of the special navigator (91% vs. 87%, $p = 0.38$).

Fidelity monitoring for the real time registry revealed 3340 missed appointment warnings; all but 45 were resolved through appointment rescheduling and completion. 111 milestone warnings were triggered; 59 were resolved by achieving treatment completion. Nineteen of these missed milestones were for “no lung cancer surgery in 130 days” but these actually represented patients who received definitive treatment with stereotactic radiation and completed treatment. Therefore, 40 warnings did not lead to advancements in care.

When interpreting the results of ACCURE, some of the history concerning racial disparities must be considered. As noted by the Sullivan Commission (2004),[16] the more visible racial barriers of the U.S. health care system were eradicated by the Civil Rights Era, but today’s effects from “institutional racism” are subtle. Institutional racism has been defined as a process of oppression, unconscious or not, functioning as “a system of structuring opportunity and assigning value based on race phenotype, that unfairly disadvantages some and undermines the potential of the whole society”.[17] Examples include: lack of providers within reasonable traveling distance, poor institutional understanding of how to mobilize community organizations that principally serve Black residents, and racial discordance between patients and clinicians that may affect care-seeking behaviors.[18–20] Our previous work demonstrating that Blacks with higher comorbid risk, poor perceptions of communication, or no regular source of care were less apt to receive cancer surgery served as a poignant example of how unintended, institutional biases can be operationalized.[4]

Given the many factors contributing to treatment disparities and lack of data supporting a single intervention, the research team and community partners determined that a multi-faceted approach utilizing transparency of clinical data and care team accountability achieved through race-specific audit and feedback was required for the highest probability of success. With the diffuse prevalence of EHRs since passage of the HITECH Act of 2009, we hypothesized that digital data available at nearly all cancer centers could rapidly populate a real time registry and generate warnings providing the transparency needed to identify barriers to treatment completion whether attributable to patient factors (e.g. missed appointments) or clinical inertia (e.g. unmet milestones in the context of appointment adherence). Bickell et al. previously demonstrated that a registry could narrow undertreatment disparities for adjuvant breast cancer care intended for Black and Hispanic patients.[12] Their registry was populated with hand entry by RAs who called the offices of patients' providers including surgeons, oncologists, and primary care physicians asking about consultations obtained and adjuvant treatments started. These tedious steps were followed by supplemental, manual chart reviews. Similar "hand-entered" systems would be untenable as a population-based, real time tool. The system built for ACCURE mimicked the treatment categories of the Bickell intervention but accomplished this in a fully automated manner translatable to widespread use. Given the demonstrated effectiveness of QI approaches such as audit and feedback, this accountability piece was added.[21,22] To disentangle the structural issues of race and social class, community partners advocated making feedback race-specific. In addition, we presented the results stratified by comorbid conditions and race to address concerns about implicit bias in decision-making associated with the uneven interpretation of comorbidies highlighted in our prior work.[4] Lastly, given past barriers to patient adherence such as poor perceptions of communication, negative beliefs (e.g. air exposure spreads cancer), religiosity, and low health literacy, we included assessment and discussion of these issues in navigator training. Although race-related navigation has not been shown to specifically improve cancer treatment disparities, reports have described improvements in screening and diagnosis.[23−25] Navigation in ACCURE worked regardless of concordance in navigator-patient pairs suggesting that training related to the harsh realities and histories of the African American experience results in enhanced communication regardless of the race of the trainee. A more formal analysis of this result could be considered in future work in order to maximize the navigation effect.

As noted, all ACCURE components are supported in the literature, but which interventions really worked? An unintended limitation of the study helped answer this question. One cancer center experienced high clinician turnover mid-intervention. This turnover limited opportunities for effective audit and feedback. Despite this circumstance, improvement in the affected center was strong though not quite as robust as the second center. This result suggested high efficacy of the real time registry and the nurse navigators who acted on registry warnings. The efficacy of registry function plus navigation was further supported by the high rate of rescheduling action noted for missed appointments and the resolution of most deficient milestones in care. Regarding the health equity training sessions, if they played a major role in improvement, we should have seen a spillover effect through narrowing of racial differences in the concurrent control group. This effect did not occur.

Another important observation concerns the nurse navigators. In the small randomized portion of the study comparing navigators according to training, we saw no significant treatment completion increase favoring the ACCURE navigator compared to the usual care nurse navigator. This result could have several explanations. First, the ACCURE navigator did interact with the other nurse navigators so there could have been some adoption of ACCURE principles by the usual care nurses. Also, the ACCURE navigator did not specifically target patients of Black race, lower socioeconomic status, or low health literacy. Therefore, the effectiveness of the special training may have been diluted by including patients that didn't need more intense engagement. Conversely, it is possible that nurse navigators perform equally well when supported by real time tools that identify patients who need more engagement to complete difficult treatment regimens.

Given the shallow pool of evidence for effective system change interventions, the potential impact of ACCURE's promising results is two-fold. First, the ACCURE use of a real time registry derived from multiple EHRs can directly incorporate digital data to impact completion of important treatments. Second, race-specific feedback delivered during the actual course of care can be complementary to evolving registry systems such as the American Colleges of Surgeons (ACOS) *Rapid Quality Reporting System* and, ultimately, drive sustainable transformations within the 1472 cancer facilities already accredited by the ACOS *Commission on Cancer*.[26−28] This process of systematically combining real time informatics support, data usage, and appropriate role responsibilities for using these data is crucial.

Since the time of Bach's report on lung cancer disparities, despite sharp definition of the problem and the application of individual level interventions such as culture competence education, recent data demonstrate little progress.[1,4,11] In fact, 2016 cancer statistics show lung cancer mortality remained 20% higher for Black than White men[6] and the Black-White mortality gap for breast cancer is actually widening.[6] Although social determinants and comorbid illness can all contribute to these survival differences, a significant part of the chasm for both cancers are directly attributable to the lack of treatment completion for Black patients. Specifically, Black lung cancer patients receive surgery and curative radiotherapy less often than similar White patients[1,4,29]; Black breast cancer patients undergo less surgery, radiation, and chemotherapy than White patients.[30,31] Even when chemotherapy is prescribed, completion rates are lower for Black women and lower completion rates are independently associated with worse survival.[2,32] These data make the case for systematic, practice transformation interventions like ACCURE all the more compelling.

IMPLICATIONS

A multifaceted, system-based, practical intervention applied to patients with either early stage breast or lung cancer resulted in improved treatment completion for Black and White patients and reduced the racial disparity demonstrated in historic and concurrent controls. If applied broadly, this intervention could potentially improve cancer treatment and reduce disparities in over 1400 cancer centers in the U.S. As the intervention incorporates a real time electronic registry and other simple tools to promote transparency and accountability in care, future research using this approach could focus on improving treatment of cancers and common chronic illnesses with longer therapeutic horizons. Success in applying similar system based approaches to these areas of care could potentially mitigate disparities and result in substantial gains in quality of life and survival for Black patients and the population at large.

APPENDIX A. SUPPLEMENTARY DATA

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jnma.2019.03.001.

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