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Breast Cancer Care Quality in South Africa's Public Health System: An Evaluation Using American Society of Clinical Oncology/National Quality Forum Measures

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abstract

PURPOSE The quality of breast cancer care in sub-Saharan Africa contributes to the region's dismal breast cancer mortality. ASCO has issued quality measures focusing on delivery of adjuvant chemotherapy, radiotherapy, and endocrine therapy. We applied these measures in five South African public hospitals and analyzed factors associated with care concordance.

MATERIALS AND METHODS Among 1,736 women with breast cancer who were enrolled in the South African Breast Cancer and HIV Outcomes study over 24 months, we evaluated care using ASCO's three measures. We also evaluated adjuvant chemotherapy receipt in 957 women with an indication. We used logistic regression to estimate associations between measure-concordant care and patient factors.

RESULTS Of 235 women with hormone receptor–negative cancer, 173 (74%) began adjuvant chemotherapy within 120 days from diagnosis. Of 194 patients who received breast-conserving surgery, 73 (37%) began radiotherapy within 365 days from diagnosis. Of 999 women with hormone receptor–positive cancer, 719 (72%) initiated endocrine therapy within 365 days from diagnosis. Chemotherapy and radiotherapy measure-concordant care were more common among women residing < 20 km from the hospital (odds ratio [OR], 1.79; 95% CI, 1.32 to 2.44 and OR, 3.17; 95% CI, 1.57 to 6.42). Endocrine therapy measure-concordant care was more common among English-speaking women (OR, 2.12; 95% CI, 1.12 to 4.02). Participating hospitals varied in care concordance. HIV infection did not affect care quality.

CONCLUSION More timely delivery of chemotherapy, radiotherapy, and endocrine therapy is needed in South Africa, particularly for women living > 20 km from the hospital or not speaking English. Focused quality improvement efforts could support that goal.

INTRODUCTION

Breast cancer (BC) is the most common cancer among women in sub-Saharan Africa (SSA).[1] Unfortunately, resource constraints limit access to surgery, radiotherapy, and systemic treatments, and mortality rates are much higher than in the United States and Europe.[2]

In 2007, ASCO published three measures for evaluating the quality of BC care[3]:

1. Proportion of women age 18-70 years with American Joint Committee on Cancer (AJCC) stage II-III disease and estrogen receptor (ER)– and progesterone receptor (PR)–negative histology who receive chemotherapy within 120 days from diagnosis
2. Proportion of women age 18-70 years with AJCC stage I-III disease treated with breast-conserving surgery (BCS) who receive radiation therapy to the breast within 365 days from diagnosis
3. Proportion of women aged ≥ 18 years with AJCC stage I-III disease, tumor size > 1 cm, and ER- or PR-positive histology who receive tamoxifen or an aromatase inhibitor within 365 days from diagnosis

These measures were based on evidence of clinical benefit from each therapy.[4-6] They were endorsed by the National Quality Forum and used in ASCO's Quality Oncology Practice Initiative.[7] Although the three measures were designed for the United States, they have previously been used to assess BC care in middle-income countries, including Brazil and Malaysia.[8,9]

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CONTEXT

Key Objective

To determine the degree to which breast cancer care in South Africa's public hospitals complies with quality measures developed by the American Society of Clinical Oncology.

Knowledge Generated

Among breast cancer patients from five South African hospitals, concordance with ASCO quality metrics assessing adjuvant chemotherapy, radiotherapy and endocrine therapy was seen in 74%, 37% and 72% of patients, respectively. Patients living less than 20 kilometers from their hospital and primarily speaking English were significantly more likely to receive measure-concordant care.

Relevance

The quality of breast cancer adjuvant therapy delivery in the South African public hospital system requires improvement, particularly the timely delivery of adjuvant radiotherapy. Quality improvement initiatives may have the greatest impact by focusing on high risk populations, such as patients residing far from their treating facility and non-native English speakers. In addition, future quality metrics should specifically address the resource-constraints seen in South Africa's public system.

The South Africa (SA) National Department of Health's BC treatment guidelines, which overlap significantly with guidelines issued by ASCO and the European Society for Medical Oncology (ESMO), recommend treatment consistent with the ASCO measures.[10] All three modalities are offered within SA's public health care system, but high patient volumes, provider shortages, and other resource constraints limit their availability. Little has been published regarding the extent to which actual BC care in SA's public hospitals aligns with national guidelines.

Given their consistency with SA's national BC guidelines, ASCO's quality metrics may be appropriate for describing the quality of BC care in SA. However, the feasibility of their use in SA and their relevance to patients in SA have not been evaluated.

In this study, therefore, we used those measures to describe the quality of BC care in five SA public hospitals and examined the role of patient factors in measure-concordant care. Through our analyses, we also hoped to gain insight into the applicability of the ASCO measures to SA's public health care system.

MATERIALS AND METHODS

Data Source and Setting

Our study population was drawn from the South African Breast Cancer and HIV Outcomes (SABCHO) study cohort. The primary aim of SABCHO, which has been enrolling women from five public SA hospitals since July 2015, is to characterize the impact of HIV infection on BC outcomes.[11] Women were eligible for SABCHO if they were $>$ 18 years of age, newly diagnosed with BC, had no history of other cancers, received their BC care at a study hospital, and provided consent.

The five study hospitals—all part of the same public system—were Chris Hani Baragwanath Academic Hospital (CHBAH), Charlotte Maxeke Johannesburg Academic Hospital (CMJAH), Inkosi Albert Luthuli Central Hospital (IALCH), Ngwelezana Hospital (NH), and Grey's Hospital (GH). CHBAH and CMJAH serve Soweto and Johannesburg, respectively, and are affiliated with the University of Witwatersrand. IALCH, NH, and GH are affiliated with the University of KwaZulu-Natal and located in the cities of Durban, Empangeni, and Pietermaritzburg, respectively. IALCH and NH share facilities and providers and were analyzed as a single site. Participants' BC care is centralized at the hospitals, where study staff enter data on patient demographics, risk factors, household wealth, pathology, treatments, and outcomes into a custom-built, Web-based electronic medical record (EMR) system originally developed for clinical use but adapted to serve as the SABCHO study database. A few participating providers continue to use paper records; study staff regularly extract their patients' data into the electronic database.

Although SA is an upper middle income country, it has tremendous income inequality. The mean household income of white families is 6 times that of black households.[12] HIV prevalence in black women is 25%, 20 times higher than in white women.[13] Per capita spending in the public health care system is $<$ 15% of that in the coexisting private system; BC survival differs significantly between the two.[14,15] National policy specifies that low- or no-cost cancer surgery, chemotherapy, radiotherapy, and endocrine therapy be available at tertiary-level public hospitals, but timely access to these treatments is inconsistent.

Study Design and Participants

We analyzed women enrolled in the SABCHO study between July 1, 2015, and July 1, 2017, with follow-up through August 2018. We used data on age, American Joint Committee on Cancer 7th edition stage, ER/PR status,

and type of surgery to establish three cohorts, each corresponding to the denominator described by the ASCO measures for delivery of chemotherapy (ASCO-C cohort), radiotherapy (ASCO-R cohort), or endocrine therapy (ASCO-E cohort). Patients were excluded from a given cohort if they died during that measure's follow-up period. We also created an additional cohort of women < 70 years old with an indication for adjuvant chemotherapy according to ESMO 2015 guidelines for BC management (ESMO-C cohort; ie, luminal B, human epidermal growth factor receptor 2 [HER2]–enriched, and triple-negative [TNBC] tumors or luminal A tumors with metastases in ≥ 4 lymph nodes, ≥ T3 tumor stage, or grade 3 tumor histology).[16] Thus, the ESMO-C cohort included all women in the ASCO-C cohort and additional women with aggressive luminal-type cancers. The molecular subtype definitions used for SABCHO analyses have been published.[17] Laboratories accredited by the South African National Accreditation System conducted all immunohistochemistry.

Variables

We compiled participant data on age, race, primary language, relationship status (ie, married/cohabitating *v* not), employment status (ie, full- or part-time employment *v* unemployed or retired), HIV status, and other comorbidities. Addresses were used to calculate straight-line distance from the treating hospital. Date of diagnosis was the date of first biopsy confirming invasive disease.

Adapting a strategy used by the Demographics and Health Surveys Program to create a single variable approximating socioeconomic status, we performed principal component analysis on items from each patient's baseline household wealth survey, including water sources, toilet facilities, and physical amenities.[18] We assigned participants to quintiles using the value of the first principal component.

Outcomes

For each ASCO measure cohort, our primary outcome was initiation of the relevant therapy within the specified time frame. For the ESMO-C cohort, our primary outcome was initiation of chemotherapy within 120 days from diagnosis. We therefore collected the dates of surgery, chemotherapy initiation, radiotherapy initiation, and endocrine therapy initiation. We reviewed paper records as well as the electronic study database to minimize underestimation of delivered therapies.

Statistical Analysis

We categorized the care of participants who received the relevant therapy within the time frame as measure concordant and that of those who did not as discordant. We report rates of concordance with each measure. We computed crude odds ratios for the association of each the above-mentioned patient characteristics with measure-concordant care using bivariate logistic regression. Factors showing a *P*-value ≤ .1 on Wald testing for crude association were included as covariates in multivariate logistic regression models used to calculate adjusted odds ratios (ORs). All calculations were performed using SAS Studio, version 3.6 (Cary, NC).

Ethics

This work was approved by the institutional review boards of Columbia University, the University of Witwatersrand, and the University of KwaZulu-Natal. All participants provided informed consent for inclusion in the SABCHO study cohort.

RESULTS

Participants

Of the 1,795 women enrolled in the SABCHO study, 59 either lacked invasive disease or had a second cancer diagnosis. The remaining 1,736 were eligible for the 4 study cohorts. Median age at diagnosis was 55.5 (interquartile range [IQR], 44.9-66.2) years, median distance from home to the hospital was 20.7 (IQR, 8.7-42.9) km, and 1,320 (76%) women were black (Table 1). The most common primary language was Zulu (42%). At diagnosis, 743 (43%) patients had stage III disease, and 353 (20%) had stage IV. ER/PR expression and HER2 overexpression were detected in 1,356 (79%) and 467 (27%) women, respectively, and 367 (22%) women were HIV infected (Table 1). The ASCO-C, ESMO-C, ASCO-R, and ASCO-E cohorts included 235, 957, 194, and 999 patients, respectively (Fig 1).

Chemotherapy

Among ASCO-C patients, 173 (74%) received chemotherapy within 120 days from diagnosis (ie, measure-concordant care). An additional 33 (14%) patients received chemotherapy after 120 days; overall median time to treatment was 66.5 (IQR, 50-105) days (Table 2). Among ESMO-C patients, 642 (67%) received chemotherapy within 120 days. Another 166 (17%) patients were treated later; median time to treatment was 75 (IQR, 49.5-112.5) days (Table 2; Fig 2A).

The ESMO-C cohort's multivariate model included age; distance from the hospital; employment status; stage; molecular subtype; concurrent hypertension, diabetes, and arthritis; treating hospital; and receipt of radiotherapy (Table 3). Concordant care was more likely in patients residing < 20 km from the hospital (OR, 1.79; 95% CI, 1.32 to 2.44) or who had received radiotherapy (OR, 2.81; 95% CI, 2.06 to 3.85). Concordant care was less likely in patients with stage II disease (OR, 0.47; 95% CI, 0.34 to 0.64), with luminal A versus TNBC subtype (OR, 0.32; 95% CI, 0.18 to 0.55), or treated at IALCH/NH versus CHBAH (OR, 0.38; 95% CI, 0.26 to 0.57; Table 3).

Radiation Therapy

In the ASCO-R cohort, 73 patients (37%) received radiotherapy within 365 days. An additional 69 (36%) patients received radiotherapy after 365 days; median time to treatment was 358 (IQR, 296-425) days (Table 2; Fig 2B).

TABLE 1. Overall Demographic and Clinical Characteristics Among All Eligible SABCHO Study Participants and Within Each Quality Measure Cohort

Characteristic	Eligible Cohort (N = 1,736)	ASCO-C (n = 232)	ESMO-C (n = 957)	ASCO-R (n = 194)	ASCO-E (n = 999)
Age at diagnosis, years	55.5 (44.9-66.2)	51.5 (42.6-61.6)	50.8 (42.1-59.4)	50.0 (41.5-59.0)	55.2 (44.8-66.7)
Distance from the hospital, kilometers	20.7 (8.7-42.9)	21.8 (8.9-39.2)	20.1 (8.6-37.8)	18.4 (8.5-33.1)	19.9 (8.5-39.0)
Race					
Black	1,320 (76.0)	178 (76.7)	752 (78.6)	125 (64.4)	725 (72.6)
Asian	206 (11.9)	33 (14.2)	102 (10.7)	35 (18.0)	127 (12.7)
White	125 (7.2)	15 (6.5)	58 (6.1)	19 (9.8)	86 (8.6)
Mixed race	85 (4.9)	6 (2.6)	45 (4.7)	15 (7.7)	61 (6.1)
Education completed					
Informal only	148 (8.6)	16 (6.9)	43 (4.5)	4 (2.1)	64 (6.5)
Some primary school	94 (5.5)	9 (3.9)	37 (3.9)	9 (4.6)	52 (5.3)
Completed primary school	667 (39.0)	94 (40.7)	353 (37.3)	64 (33.0)	373 (37.9)
Completed high school	659 (38.5)	96 (41.6)	428 (45.2)	87 (44.9)	410 (41.6)
Technical or professional college	94 (5.5)	7 (3.0)	57 (6.0)	25 (12.9)	64 (6.5)
Postgraduate/university	50 (2.9)	9 (3.9)	29 (3.1)	5 (2.6)	22 (2.2)
Relationship status					
Partnered	668 (38.9)	111 (48.1)	417 (43.9)	96 (49.5)	380 (38.3)
Not partnered	1,051 (61.1)	120 (52.0)	532 (56.1)	98 (50.5)	611 (61.7)
Employment status					
Employed	455 (26.3)	76 (32.9)	336 (35.3)	80 (41.2)	282 (28.3)
Unemployed	1,273 (73.7)	155 (67.1)	616 (64.7)	114 (58.8)	715 (71.7)
Primary language					
Zulu	729 (42.0)	104 (44.8)	398 (41.6)	62 (32.0)	383 (38.3)
English	317 (18.3)	45 (19.4)	156 (16.3)	53 (27.3)	205 (20.5)
Other	690 (39.8)	83 (35.8)	403 (42.1)	79 (40.7)	411 (41.1)
Stage					
I	80 (4.6)	—	—	27 (13.9)	53 (5.3)
II	555 (32.1)	82 (35.3)	339 (35.4)	130 (67.0)	438 (43.8)
III	743 (42.9)	150 (64.7)	618 (64.6)	37 (19.1)	508 (50.9)
IV	353 (20.4)	—	—	—	—
Estrogen/progesterone receptor status					
Positive	1,356 (78.5)	—	722 (75.7)	158 (81.4)	999 (100)
Negative	371 (21.5)	232 (100)	232 (24.3)	36 (18.6)	—
HER2 status					
Positive	467 (27.1)	69 (29.9)	307 (32.2)	49 (25.3)	248 (24.8)
Negative	1,259 (72.9)	162 (70.1)	647 (67.8)	145 (74.7)	752 (75.2)
Comorbidities					
HIV infection	367 (21.5)	59 (25.7)	232 (24.5)	28 (14.6)	188 (19.0)
Hypertension	718 (41.6)	79 (34.2)	329 (34.6)	60 (30.9)	430 (43.2)
Heart disease	69 (4.0)	6 (2.6)	29 (3.1)	6 (3.1)	47 (4.7)
Diabetes	236 (13.7)	33 (14.3)	111 (11.7)	21 (10.8)	141 (14.2)
Stroke	43 (2.5)	5 (2.2)	14 (1.5)	1 (0.5)	21 (2.1)

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TABLE 1. Overall Demographic and Clinical Characteristics Among All Eligible SABCHO Study Participants and Within Each Quality Measure Cohort (Continued)

Characteristic	Eligible Cohort (N = 1,736)	ASCO-C (n = 232)	ESMO-C (n = 957)	ASCO-R (n = 194)	ASCO-E (n = 999)
Tuberculosis	131 (7.6)	18 (7.8)	75 (7.9)	5 (2.6)	68 (6.8)
Arthritis	196 (11.4)	15 (6.5)	84 (8.8)	22 (11.3)	134 (13.5)
Asthma/COPD	94 (5.5)	10 (4.3)	47 (4.9)	12 (6.2)	56 (5.6)
Treating hospital					
CHBAH	585 (32.6)	77 (33.2)	362 (37.9)	61 (31.6)	354 (35.4)
CMJAH	407 (23.4)	56 (24.1)	227 (23.7)	65 (33.7)	232 (23.2)
IALCH/NH	429 (24.7)	57 (24.6)	213 (22.3)	57 (29.5)	238 (23.8)
GH	335 (19.3)	42 (18.1)	154 (16.1)	10 (5.2)	175 (17.5)

NOTE. Data presented as No. (%) or median (IQR).

Abbreviations: C, chemotherapy; CHBAH, Chris Hani Baragwanath Academic Hospital; CMJAH, Charlotte Maxeke Johannesburg Academic Hospital; COPD, chronic obstructive pulmonary disease; E, endocrine therapy; ESMO, European Society for Medical Oncology; GH, Grey's Hospital; HER2, human epidermal growth factor receptor 2; IALCH, Inkosi Albert Luthuli Central Hospital; IQR, interquartile range; NH, Ngwelezana Hospital; R, radiotherapy; SABCHO, South African Breast Cancer and HIV Outcomes study.

The multivariate model included distance from the hospital, stage, molecular subtype, and receipt of chemotherapy (Table 4). Patients residing < 20 km from the hospital (OR, 3.17; 95% CI, 1.57 to 6.42) or having stage I versus stage III disease (OR, 6.74; 95% CI, 1.83 to 24.88) were more likely to receive radiotherapy measure-concordant care, and those with luminal B subtype versus TNBC (OR 0.30, 95% CI 0.12-0.78) were less likely.

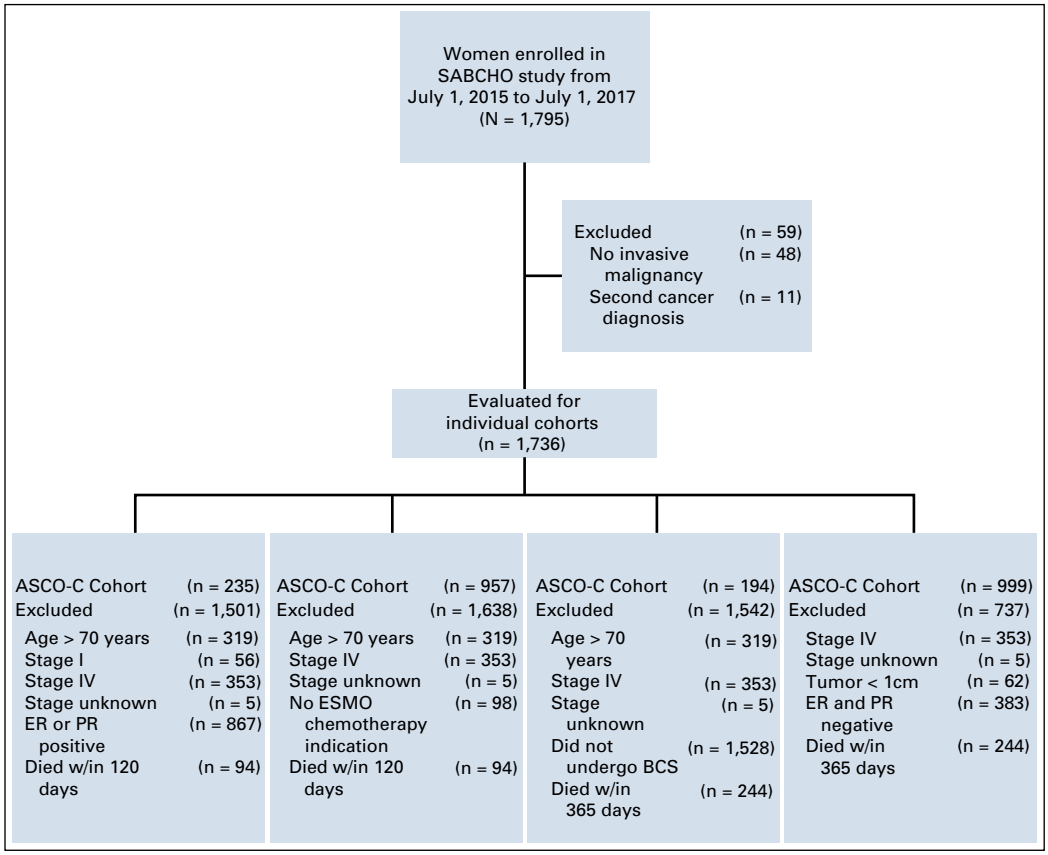

FIG 1. Women enrolled in the SABCHO (South African Breast Cancer and HIV Outcomes) study from July 2015 to July 2017 and eligibility for individual measure cohorts. Listed reasons for exclusion are not mutually exclusive. C, chemotherapy; BCS, breast-conserving surgery; E, endocrine therapy; ER, estrogen receptor; ESMO, European Society for Medical Oncology; PR, progesterone receptor; R, radiotherapy.

TABLE 2. Rates of Metric-Concordant Care and Median Times to Treatment Initiation for All Measure Cohorts, by Hospital

Quality Measure Cohort	Total	CHBAH	CMJAH	IALCH/NH	GH
ASCO-C	(n = 232)	(n = 77)	(n = 56)	(n = 57)	(n = 42)
Measure-concordant/chemotherapy by 120 days	173 (74)	60 (78)	42 (75)	36 (63)	35 (83)
Chemotherapy after 120 days	33 (14)	6 (8)	3 (5)	17 (30)	7 (17)
Never received chemotherapy	26 (11)	11 (14)	11 (20)	4 (7)	0 (0)
Days to chemotherapy	66.5 (50-105)	61 (50-83)	50 (38-70)	101 (69-130)	68.5 (54-111)
ESMO-C	(n = 957)	(n = 362)	(n = 227)	(n = 213)	(n = 154)
Measure-concordant/chemotherapy by 120 days	642 (67)	262 (72)	165 (73)	112 (53)	103 (67)
Chemotherapy after 120 days	166 (17)	24 (7)	19 (8)	79 (37)	44 (29)
Never received chemotherapy	149 (16)	76 (21)	43 (19)	22 (10)	7 (5)
Days to chemotherapy	75 (49.5-112.5)	62 (45-85)	56 (43-88.5)	110 (79-159)	96 (63-139)
ASCO-R	(n = 194)	(n = 61)	(n = 65)	(n = 57)	(n = 10)
Measure-concordant/radiotherapy by 365 days	73 (37)	27 (44)	26 (40)	17 (30)	3 (30)
Radiotherapy after 365 days	69 (36)	15 (25)	19 (29)	31 (54)	4 (40)
Never received radiotherapy	52 (27)	19 (31)	20 (31)	9 (16)	3 (30)
Days to radiotherapy	358 (296-425)	326.5 (294-399)	345 (271-425)	389 (313-433.5)	374 (320-413)
ASCO-E	(n = 999)	(n = 354)	(n = 232)	(n = 238)	(n = 175)
Measure-concordant/endocrine therapy by 120 days	719 (72)	230 (65)	147 (63)	195 (82)	147 (84)
Endocrine therapy after 120 days	117 (12)	53 (15)	10 (4)	36 (15)	18 (10)
Never received endocrine therapy	163 (16)	71 (20)	75 (32)	7 (3)	10 (6)
Days to endocrine therapy	238 (157-308.5)	251 (185-330)	234 (123-282)	225 (106-317)	224 (180-292)

NOTE. Data presented as No. (%) or median (IQR).

Abbreviations: C, chemotherapy; CHBAH, Chris Hani Baragwanath Academic Hospital; CMJAH, Charlotte Maxeke Johannesburg Academic Hospital; E, endocrine therapy; ESMO, European Society for Medical Oncology; GH, Grey's Hospital; IALCH, Inkosi Albert Luthuli Central Hospital; NH, Ngwelezana Hospital; R, radiotherapy.

Endocrine Therapy

Of the 999 eligible patients, 719 (72%) patients initiated endocrine therapy within 365 days. Another 117 (12%) patients started after 365 days; median time to initiation was 238 (IQR, 157-308.5) days (Table 2; Fig 2C). Age; race; primary language; stage; molecular subtype; HIV infection, hypertension, heart disease, diabetes, arthritis, or asthma/chronic obstructive pulmonary disease; hospital; and receipt of radiotherapy were included in the multivariate model. Measure-concordant care was increased in women whose primary language was English (OR, 2.12; 95% CI, 1.12 to 4.02), with stage I versus stage III (OR, 3.17; 95% CI, 1.18 to 8.50), treated at GH versus CHBAH (OR, 2.25; 95% CI, 1.39 to 3.65), and those who received radiotherapy (OR, 2.32; 95% CI, 1.69 to 3.18). It was decreased in those age < 45 years or 45-65 years versus ≥ 65 years (OR, 0.44; 95% CI, 0.27 to 0.73; OR, 0.51; 95% CI, 0.34 to 0.77; Table 5).

DISCUSSION

In this cohort from 5 public SA hospitals, we found variations in the concordance of BC care with ASCO's quality measures. Regarding chemotherapy, 73% of patients in the ASCO-C cohort and 67% with an ESMO guideline indication for chemotherapy received their first dose within 120 days from diagnosis. In the ASCO-R and the ASCO-E cohorts, 37% and 72% of patients initiated radiotherapy and endocrine therapy, respectively, within 365 days. Women living < 20 km from the treating hospital were less likely to receive care concordant with the chemotherapy and radiotherapy measures, and those who primarily spoke English were more likely to receive care concordant with the endocrine therapy measure. HIV infection showed no association with care quality, and study hospitals' provision of measure-concordant care varied.

Measure performance is often lower than expected on initial evaluation in US hospitals. Baseline chemotherapy, radiotherapy, and endocrine therapy compliance rates at hospitals from the National Cancer Institute Community Centers Cancer Program were 85%, 79%, and 58% but improved to 93%, 92%, and 92% with just implementation of real-time reporting.[19] Increased data capture with routine measurement of performance likely contributed to the rapid improvement, suggesting that baseline reports may underestimate actual care quality. Investigators at Parkland Memorial Hospital in Dallas saw drastic improvement in performance when data were drawn from all available clinical documents rather than from medical records alone.[20] Our study used all available clinical documents though, decreasing the likelihood that performance is significantly underestimated.

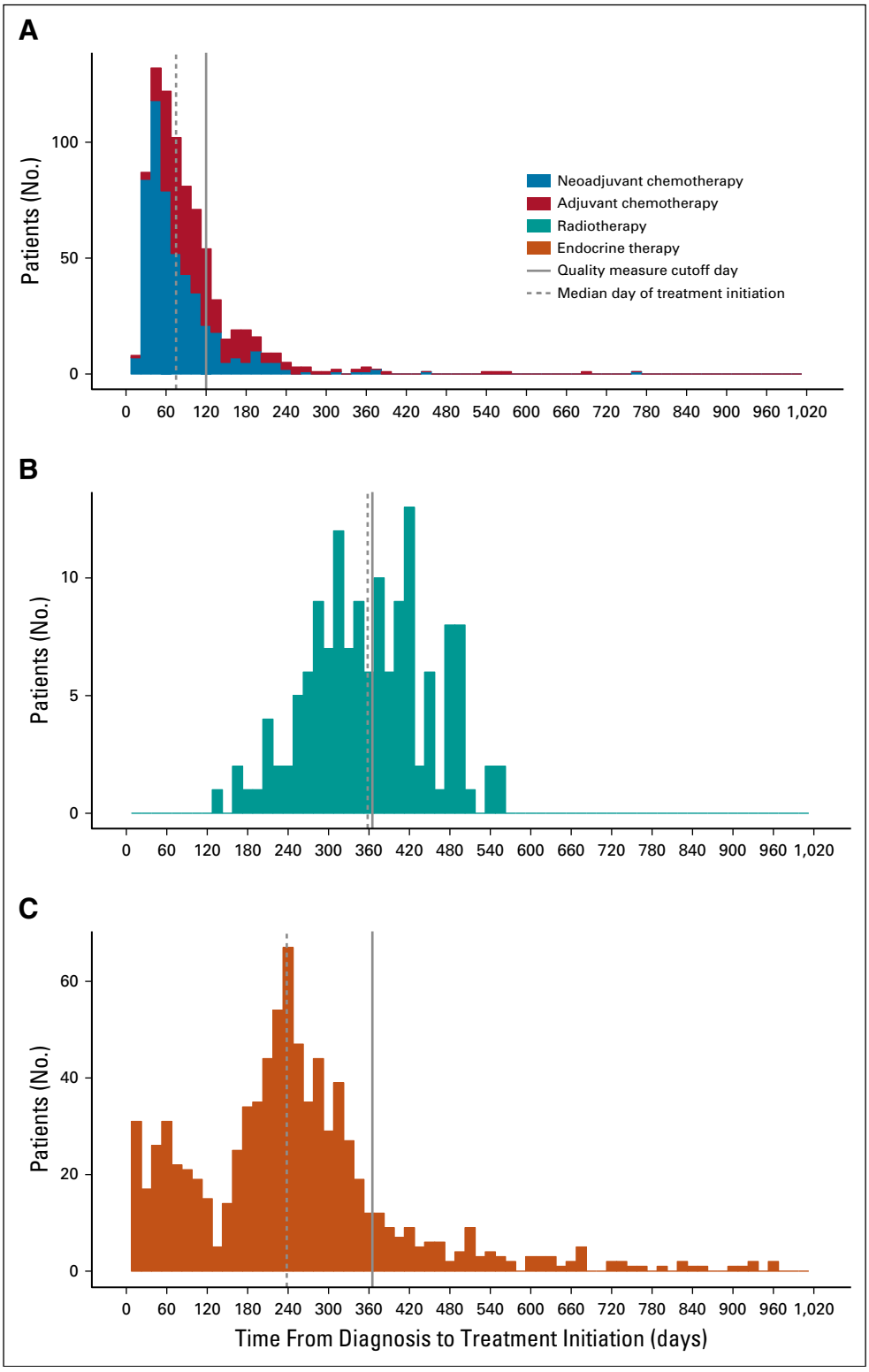

FIG 2. Days from diagnosis to first receipt of (A) neoadjuvant or adjuvant chemotherapy in the European Society for Medical Oncology–chemotherapy cohort, (B) radiotherapy in the ASCO-radiotherapy cohort, and (C) endocrine therapy in the ASCO—endocrine therapy cohort.

TABLE 3. Sociodemographic and Clinical Factors in Relation to Chemotherapy Receipt Within 120 Days From Diagnosis Among Women in the ESMO-C Cohort

Factor	Measure Concordance* No. (%)	Measure Discordance* No. (%)	Crude OR (95% CI)	Adjusted OR† (95% CI)
Age, years				
< 45	225 (73.3)	82 (26.7)	2.30 (1.44 to 3.66)	1.45 (0.82 to 2.59)
45-65	362 (65.9)	187 (34.1)	1.62 (1.05 to 2.49)	1.28 (0.78 to 2.11)
≥ 65	55 (54.5)	46 (45.5)	1 (Ref)	1 (Ref)
Distance from the hospital, km				
< 20	348 (72.8)	130 (27.2)	1.68 (1.28 to 2.20)	1.79 (1.32 to 2.44)
≥ 20	294 (61.5)	184 (38.5)	1 (Ref)	1 (Ref)
Race				
Black	515 (68.5)	237 (31.5)	1.34 (0.97 to 1.84)	—
Other	127 (62.0)	78 (38.1)	1 (Ref)	
Wealth percentile				
≤ 20th	98 (61.6)	61 (38.4)	0.81 (0.52 to 1.28)	—
21st-40th	136 (68.3)	63 (31.7)	1.09 (0.70 to 1.69)	—
41st-60th	138 (67.0)	68 (33.0)	1.02 (0.66 to 1.58)	—
60-80th	159 (70.4)	67 (29.7)	1.20 (0.78 to 1.84)	—
> 80th	111 (66.5)	56 (33.5)	1 (Ref)	—
Education completed				
Informal only	25 (58.1)	18 (41.9)	0.85 (0.32 to 2.23)	—
Some primary school	18 (48.7)	19 (51.4)	0.58 (0.22 to 1.56)	—
Completed primary school	238 (67.4)	115 (32.6)	1.27 (0.58 to 2.77)	—
Completed high school	300 (70.1)	128 (29.9)	1.43 (0.66 to 3.12)	—
Technical or professional college	41 (71.9)	16 (28.1)	1.57 (0.61 to 4.04)	—
Postgraduate/ university	18 (62.1)	11 (37.9)	1 (Ref)	—
Relationship status				
Partnered	294 (70.5)	123 (29.5)	1.27 (0.97 to 1.68)	—
Not partnered	347 (65.2)	185 (34.8)	1 (Ref)	—
Employment status				
Employed	240 (71.4)	96 (28.6)	1.34 (1.00 to 1.79)	1.16 (0.83 to 1.62)
Unemployed	401 (65.1)	215 (34.9)	1 (Ref)	1 (Ref)
Primary language				
English	101 (64.7)	55 (35.3)	0.88 (0.62 to 1.27)	—
Other	541 (67.5)	260 (32.5)	1 (Ref)	
Stage				
II	198 (58.4)	141 (41.6)	0.55 (0.42 to 0.73)	0.47 (0.34 to 0.64)
III	444 (71.8)	174 (28.2)	1.00 (Ref)	1.00 (Ref)
Molecular subtype				
Luminal A	60 (51.3)	57 (48.7)	0.37 (0.23 to 0.61)	0.32 (0.18 to 0.55)
Luminal B	409 (67.6)	196 (32.4)	0.74 (0.50 to 1.08)	0.70 (0.46 to 1.06)
HER2 enriched	51 (72.9)	19 (27.1)	0.95 (0.50 to 1.78)	1.11 (0.56 to 2.20)
Triple negative	122 (73.9)	43 (26.1)	1 (Ref)	1 (Ref)

(Continued on following page)

TABLE 3. Sociodemographic and Clinical Factors in Relation to Chemotherapy Receipt Within 120 Days From Diagnosis Among Women in the ESMO-C Cohort (Continued)

Factor	Measure Concordance* No. (%)	Measure Discordance* No. (%)	Crude OR (95% CI)	Adjusted OR† (95% CI)
HIV				
Positive	159 (68.5)	73 (31.5)	1.09 (0.80 to 1.50)	—
Negative	477 (66.6)	239 (33.4)	1 (Ref)	—
Hypertension				
Present	200 (60.8)	129 (39.2)	0.64 (0.48 to 0.84)	0.83 (0.57 to 1.19)
Absent	441 (70.9)	181 (29.1)	1 (Ref)	1 (Ref)
Heart disease				
Present	12 (41.4)	17 (58.6)	0.33 (0.16 to 0.70)	0.42 (0.18 to 1.0)
Absent	629 (68.2)	293 (31.8)	1 (Ref)	1 (Ref)
Diabetes				
Present	62 (55.9)	49 (44.1)	0.57 (0.38 to 0.85)	0.79 (0.49 to 1.28)
Absent	579 (68.9)	261 (31.1)	1 (Ref)	1 (Ref)
Stroke				
Present	9 (64.3)	5 (35.7)	0.87 (0.29 to 2.61)	—
Absent	632 (67.5)	305 (32.6)	1 (Ref)	—
Tuberculosis				
Present	46 (61.3)	29 (38.7)	0.75 (0.46 to 1.22)	—
Absent	595 (67.9)	281 (31.1)	1 (Ref)	—
Arthritis				
Present	45 (53.6)	39 (46.4)	0.53 (0.33 to 0.83)	1.02 (0.61 to 1.73)
Absent	596 (68.7)	271 (31.3)	1 (Ref)	1 (Ref)
Asthma/COPD				
Present	33 (70.2)	14 (29.8)	1.15 (0.61 to 2.18)	—
Absent	608 (67.3)	296 (32.7)	1 (Ref)	—
Treating hospital				
CHBAH	262 (72.4)	100 (27.6)	1 (Ref)	1 (Ref)
CMJAH	165 (72.7)	62 (27.3)	1.02 (0.70 to 1.47)	0.91 (0.61 to 1.37)
IALCH/NH	112 (52.6)	101 (47.4)	0.42 (0.30 to 0.60)	0.38 (0.26 to 0.57)
GH	103 (66.9)	51 (33.1)	0.77 (0.51 to 1.16)	0.85 (0.54 to 1.35)
Radiotherapy‡				
Received	346 (77.4)	101 (22.6)	2.48 (1.87 to 3.29)	2.81 (2.06 to 3.85)
Never received	296 (58.0)	214 (42.0)	1 (Ref)	1 (Ref)
Endocrine therapy‡				
Received	386 (68.0)	182 (32.0)	1.10 (0.84 to 1.45)	—
Never received	256 (65.8)	133 (34.2)	1 (Ref)	—

Abbreviations: C, chemotherapy; CHBAH, Chris Hani Baragwanath Academic Hospital; CMJAH, Charlotte Maxeke Johannesburg Academic Hospital; COPD, chronic obstructive pulmonary disease; GH, Grey's Hospital; HER2, human epidermal growth factor receptor 2; IALCH, Inkosi Albert Luthuli Central Hospital; NH, Ngwelezana Hospital; OR, odds ratio; Ref, reference.

*Row percentages displayed.

†Model includes age group; distance from the hospital; employment status; stage; molecular subtype; presence of hypertension, heart disease, diabetes, and arthritis; treating hospital; and receipt of radiotherapy.

‡Includes receipt of treatment type at any time after study enrollment.

TABLE 4. Sociodemographic and Clinical Factors in Relation to Radiotherapy Receipt Within 365 Days From Diagnosis by Women in the ASCO-R Cohort

Factor	Measure Concordance* No. (%)	Measure Discordance* No. (%)	Crude OR (95% CI)	Adjusted OR† (95% CI)
Age, years				
< 45	23 (33.3)	46 (66.7)	4.50 (0.54 to 37.71)	—
45-65	49 (42.6)	66 (57.4)	6.68 (0.82 to 54.50)	—
≥ 65	1 (10.0)	9 (90.0)	1 (Ref)	—
Distance from the hospital, km				
< 20	49 (46.7)	56 (53.3)	**2.33 (1.27 to 4.23)**	**3.17 (1.57 to 6.42)**
≥ 20	24 (27.3)	64 (72.7)	1 (Ref)	1 (Ref)
Missing	0	1		
Race				
Black	47 (37.6)	78 (62.4)	1.00 (0.54 to 1.83)	—
Other	26 (37.7)	43 (62.3)	1 (Ref)	
Wealth percentile				
≤ 20th	6 (35.3)	11 (64.7)	0.57 (0.18 to 1.74)	—
21st-40th	10 (31.3)	22 (68.8)	0.47 (0.19 to 1.17)	—
41st-60th	11 (28.2)	28 (71.8)	0.41 (0.17 to 0.97)	—
60-80th	18 (36.7)	31 (63.3)	0.60 (0.28 to 1.31)	—
> 80th	28 (49.1)	29 (50.9)	1 (Ref)	—
Education completed				
Informal only	3 (75.0)	1 (25.0)	12.00 (0.51 to 280.09)	—
Some primary school	3 (33.3)	6 (66.7)	2.00 (0.15 to 26.73)	—
Completed primary school	28 (43.8)	36 (56.3)	3.11 (0.33 to 29.41)	—
Completed high school	28 (32.2)	59 (67.8)	1.90 (0.20 to 17.78)	—
Technical or professional college	10 (40.0)	15 (60.0)	2.67 (0.26 to 27.49)	—
Postgraduate/university	1 (20.0)	4 (80.0)	1 (Ref)	—
Relationship status				
Partnered	33 (34.4)	63 (65.6)	0.76 (0.42 to 1.36)	—
Not partnered	40 (40.8)	58 (59.2)	1 (Ref)	—
Employment status				
Employed	29 (36.3)	51 (63.8)	0.91 (0.50 to 1.64)	—
Unemployed	44 (38.6)	70 (61.4)	1 (Ref)	—
Primary language				
English	17 (32.1)	36 (67.9)	0.72 (0.37 to 1.40)	—
Other	56 (39.7)	85 (60.3)	1 (Ref)	—
Stage				
I	20 (74.1)	7 (25.9)	**8.89 (2.84 to 27.86)**	**6.74 (1.83 to 24.88)**
II	44 (33.9)	86 (66.2)	1.59 (0.69 to 3.67)	1.26 (0.52 to 3.05)
III	9 (24.3)	28 (75.7)	1 (Ref)	1 (Ref)
Molecular subtype				
Luminal A	26 (53.1)	23 (46.9)	1.13 (0.44 to 2.93)	0.70 (0.23 to 2.08)
Luminal B	31 (28.4)	78 (71.6)	**0.40 (0.17 to 0.95)**	**0.30 (0.12 to 0.78)**
HER2 enriched	3 (30.0)	7 (70.0)	0.43 (0.09 to 2.03)	0.39 (0.08 to 2.01)
Triple negative	13 (50.0)	13 (50.0)	1 (Ref)	1 (Ref)

(Continued on following page)

TABLE 4. Sociodemographic and Clinical Factors in Relation to Radiotherapy Receipt Within 365 Days From Diagnosis by Women in the ASCO-R Cohort (Continued)

Factor	Measure Concordance* No. (%)	Measure Discordance* No. (%)	Crude OR (95% CI)	Adjusted OR† (95% CI)
HIV				
Positive	8 (28.6)	20 (71.4)	0.63 (0.26 to 1.50)	—
Negative	64 (39.0)	100 (61.0)	1 (Ref)	—
Hypertension				
Present	20 (33.3)	40 (66.7)	0.76 (0.40 to 1.45)	—
Absent	53 (39.6)	81 (60.5)	1 (Ref)	—
Heart disease				
Present	3 (50.0)	3 (50.0)	1.69 (0.33 to 8.58)	—
Absent	70 (37.2)	118 (62.8)	1 (Ref)	—
Diabetes				
Present	7 (33.3)	14 (66.7)	0.81 (0.31 to 2.11)	—
Absent	66 (38.2)	107 (61.9)	1 (Ref)	—
Stroke				
Present	1 (100.0)	0 (0.0)	—	—
Absent	72 (37.3)	121 (62.7)	—	—
Tuberculosis				
Present	2 (40.0)	3 (60.0)	1.11 (0.18 to 6.79)	—
Absent	71 (37.6)	118 (62.4)	1 (Ref)	—
Arthritis				
Present	11 (50.0)	11 (50.0)	1.77 (0.73 to 4.33)	—
Absent	62 (36.1)	110 (64.0)	1 (Ref)	—
Asthma/COPD				
Present	5 (41.7)	7 (58.3)	1.20 (0.37 to 3.92)	—
Absent	68 (37.4)	114 (62.6)	1 (Ref)	—
Treating hospital				
CHBAH	27 (44.3)	34 (55.7)	1 (Ref)	—
CMJAH	26 (40.0)	39 (60.0)	0.84 (0.41 to 1.70)	—
IALCH/NH	17 (29.8)	40 (70.2)	0.54 (0.25 to 1.14)	—
GH	3 (30.0)	7 (70.0)	0.54 (0.13 to 2.29)	—
Chemotherapy‡				
Received	50 (33.3)	100 (66.7)	**0.46 (0.23 to 0.90)**	0.51 (0.22 to 1.21)
Never received	23 (52.3)	21 (47.7)	1 (Ref)	1 (Ref)
Endocrine therapy‡				
Received	53 (38.1)	86 (61.9)	1.08 (0.57 to 2.06)	—
Never received	20 (36.4)	35 (63.6)	1 (Ref)	

Abbreviations: CHBAH, Chris Hani Baragwanath Academic Hospital; CMJAH, Charlotte Maxeke Johannesburg Academic Hospital; COPD, chronic obstructive pulmonary disease; GH, Grey's Hospital; HER2, human epidermal growth factor receptor 2; IALCH, Inkosi Albert Luthuli Central Hospital; NH, Ngwelezana Hospital; OR, odds ratio; R, radiotherapy; Ref, reference.

*Row percentages displayed.

†Model includes distance from the hospital, stage, molecular subtype, and receipt of chemotherapy.

‡Includes receipt of treatment type at any time after study enrollment.

The performance of our sites on the radiotherapy measure was poor. Radiotherapy equipment is in short supply in SA's public health care system. This constraint is a barrier to the use of BCS throughout SSA. SA's national guidelines include lack of access to radiotherapy as a contraindication to BCS, and until access improves, breast conservation should be used cautiously.

TABLE 5. Sociodemographic and Clinical Factors in Relation to Endocrine Therapy Receipt Within 365 Days From Diagnosis by Women in the ASCO-E Cohort

Factor	Measure-Concordance* No. (%)	Measure-Discordance* No. (%)	Crude OR (95% CI)	Adjusted OR† (95% CI)
Age, years				
< 45	165 (65.5)	87 (34.5)	**0.46 (0.31 to 0.68)**	**0.44 (0.27 to 0.73)**
45-65	326 (70.3)	138 (29.7)	**0.57 (0.40 to 0.81)**	**0.51 (0.34 to 0.77)**
≥ 65	228 (80.6)	55 (19.4)	1 (Ref)	1 (Ref)
Distance from the hospital, km				
< 20	372 (73.8)	132 (26.2)	1.19 (0.91 to 1.58)	—
≥ 20	347 (70.2)	147 (29.8)	1 (Ref)	—
Missing	0	1	—	—
Race				
Black	494 (68.1)	231 (31.9)	**0.47 (0.33 to 0.66)**	1.12 (0.66 to 1.90)
Other	225 (82.1)	49 (17.9)	1 (Ref)	1 (Ref)
Wealth percentile				
≤ 20th	115 (71.0)	47 (29.0)	0.81 (0.51 to 1.29)	—
21st-40th	128 (67.7)	61 (32.3)	0.70 (0.45 to 1.08)	—
41st-60th	140 (67.6)	67 (32.4)	0.69 (0.45 to 1.06)	—
60-80th	179 (77.2)	53 (22.8)	1.12 (0.72 to 1.73)	—
> 80th	157 (75.1)	52 (24.9)	1 (Ref)	—
Education completed				
Informal only	54 (84.4)	10 (15.6)	1.59 (0.48 to 5.29)	—
Some primary school	38 (73.1)	14 (26.0)	0.80 (0.25 to 2.57)	—
Completed primary school	276 (74.0)	97 (26.0)	0.84 (0.30 to 2.33)	—
Completed high school	282 (68.8)	128 (31.2)	0.65 (0.23 to 1.80)	—
Technical or professional college	44 (68.8)	20 (31.3)	0.65 (0.21 to 2.00)	—
Postgraduate/ university	17 (77.3)	5 (22.7)	1 (Ref)	—
Relationship status				
Partnered	268 (70.5)	112 (29.5)	0.88 (0.66 to 1.17)	—
Not partnered	447 (73.2)	164 (26.8)	1 (Ref)	
Employment status				
Employed	195 (69.2)	87 (30.9)	0.82 (0.60 to 1.11)	—
Unemployed	524 (73.3)	191 (26.7)	1 (Ref)	
Primary language				
English	178 (86.8)	27 (13.2)	**3.08 (2.00 to 4.75)**	**2.12 (1.12 to 4.02)**
Other	541 (68.1)	253 (31.9)	1 (Ref)	1 (Ref)
Stage				
I	48 (90.6)	5 (9.4)	**4.41 (1.72 to 11.30)**	**3.17 (1.18 to 8.50)**
II	323 (73.7)	115 (26.3)	1.29 (0.97 to 1.72)	1.22 (0.89 to 1.67)
III	348 (68.5)	160 (31.5)	1 (Ref)	1 (Ref)
Molecular subtype				
Luminal A	240 (79.5)	62 (20.5)	**1.76 (1.28 to 2.43)**	1.32 (0.92 to 1.88)
Luminal B	479 (68.7)	218 (31.3)	1 (Ref)	1 (Ref)

(Continued on following page)

TABLE 5. Sociodemographic and Clinical Factors in Relation to Endocrine Therapy Receipt Within 365 Days From Diagnosis by Women in the ASCO-E Cohort (Continued)

Factor	Measure-Concordance* No. (%)	Measure-Discordance* No. (%)	Crude OR (95% CI)	Adjusted OR† (95% CI)
HIV				
Positive	120 (63.8)	68 (36.2)	**0.61 (0.44 to 0.86)**	0.82 (0.56 to 1.20)
Negative	593 (74.2)	206 (25.8)	1 (Ref)	1 (Ref)
Hypertension				
Present	322 (74.9)	108 (25.1)	1.27 (0.96 to 1.68)	0.81 (0.56 to 1.15)
Absent	397 (70.1)	169 (29.9)	1 (Ref)	1 (Ref)
Heart disease				
Present	42 (89.4)	5 (10.6)	**3.73 (1.32 to 8.62)**	1.98 (0.71 to 5.50)
Absent	677 (71.3)	272 (28.7)	1 (Ref)	1 (Ref)
Diabetes				
Present	111 (78.7)	30 (21.3)	1.50 (0.98 to 2.31)	0.99 (0.61 to 1.61)
Absent	608 (71.1)	247 (28.9)	1 (Ref)	1 (Ref)
Stroke				
Present	16 (76.2)	5 (23.8)	1.24 (0.45 to 3.41)	—
Absent	703 (72.1)	272 (27.9)	1 (Ref)	—
Tuberculosis				
Present	46 (67.7)	22 (32.4)	0.79 (0.47 to 1.34)	—
Absent	673 (72.5)	255 (27.5)	1 (Ref)	—
Arthritis				
Present	110 (82.1)	24 (17.9)	**1.90 (1.20 to 3.03)**	1.16 (0.69 to 1.94)
Absent	609 (70.7)	253 (29.4)	1 (Ref)	1 (Ref)
Asthma/COPD				
Present	46 (82.1)	10 (17.9)	1.83 (0.91 to 3.67)	1.40 (0.66 to 2.98)
Absent	673 (71.6)	267 (28.4)	1 (Ref)	1 (Ref)
Treating hospital				
CHBAH	230 (65.0)	124 (35.0)	1 (Ref)	1 (Ref)
CMJAH	147 (63.4)	85 (36.6)	0.93 (0.66 to 1.32)	0.75 (0.52 to 1.10)
IALCH/NH	195 (81.9)	43 (18.1)	**2.45 (1.65 to 3.63)**	1.52 (0.97 to 2.38)
GH	147 (84.0)	28 (16.0)	**2.83 (1.79 to 4.48)**	**2.25 (1.39 to 3.65)**
Chemotherapy‡				
Received	522 (73.4)	189 (26.6)	1.28 (0.95 to 1.72)	—
Never received	197 (68.4)	91 (31.6)	1 (Ref)	—
Radiotherapy‡				
Received	345 (79.1)	91 (20.9)	**1.92 (1.43 to 2.56)**	**2.32 (1.69 to 3.18)**
Never received	374 (66.4)	189 (33.6)	1 (Ref)	1 (Ref)

Abbreviations: CHBAH, Chris Hani Baragwanath Academic Hospital; CMJAH, Charlotte Maxeke Johannesburg Academic Hospital; COPD, chronic obstructive pulmonary disease; E, endocrine therapy; GH, Grey's Hospital; IALCH, Inkosi Albert Luthuli Central Hospital; NH, Ngwelezana Hospital; OR, odds ratio; R, radiotherapy; Ref, reference.

*Row percentages displayed

†Model includes age group; race; primary language; stage; molecular subtype; presence of HIV infection, hypertension, heart disease, diabetes, arthritis, and asthma/COPD; treating hospital; and receipt of radiotherapy.

‡Includes receipt of treatment type at any time after study enrollment.

The relationship between measure-concordant care and distance from the hospital is revealing. In high-income countries (HICs), proximity to a health care facility affects BC stage at diagnosis, treatment, and outcomes.[21-23] In an earlier breast cancer cohort, greater distance from CHBAH was associated with later stage at diagnosis.[24] In SSA, decentralized services for HIV and noncommunicable diseases have improved access and survival, but specialized and multidisciplinary cancer care is harder to make available in remote areas.[25,26] Interventions to instead reduce burdens related to frequent travel may significantly improve care quality. Poorer performance among women whose primary language is not English may reflect miscommunication between these patients and their English-speaking providers. Multilingual providers or standardized communication tools may also improve care.

Hospital-level variations persisted after adjustment for patient factors, so they do not seem to be entirely due to differences in populations served. Anecdotal reports of differences in available resources may explain our findings. The medical oncology division at IALCH/NH experienced high provider attrition during the study period and provided less chemotherapy measure-concordant care. GH serves a small population and had an especially well-organized clinical support staff, which may have allowed more consistent provision of endocrine therapy. These differences, although hard to quantify, illustrate the instability of resource-limited care systems.

We did not find associations between care quality and race, household wealth, education, relationship status, or employment. Socioeconomic factors certainly affect access to SA's private health care system, but we found no evidence of racial or socioeconomic disparities in public system care quality. This finding may signal a true equivalence of care, a limited ability of our wealth indicator to represent socioeconomic status, or low variability in socioeconomic status within our cohort preventing any measurable effect.

A Lancet Global Health commission recently reported that, in low- and middle-income countries (LMICs), low-quality health care is responsible for more deaths than lack of access.[27] Our findings similarly suggest that quality improvement will be needed to decrease BC mortality and must start with the identification of meaningful quality measures. Appropriateness of a process measure can be evaluated according to several characteristics: the feasibility of measurement, the existence of variability and substandard performance, the possibility of improving performance, and the potential to affect clinical outcomes (both the strength of the scientific evidence supporting the process under evaluation and the proportion of patients to whom it applies).[28]

Performance variability and room for improvement were clearly demonstrated. The ASCO measures also relied on data routinely captured from the EMR at our 5 hospitals. Such EMR systems allow for real-time quality monitoring with regular reporting at the institutional level, just as in the United States. Reporting itself can prompt quality improvement by increasing providers' attention to the monitored processes and their own performance.

Multiple randomized trials have confirmed that the ASCO measures' therapies improve survival. Early Breast Cancer Trialists' Collaborative Group meta-analyses estimate the relative risks of death with appropriate use of adjuvant chemotherapy, radiotherapy after BCS, and endocrine therapy as 0.75 at 4 years, 0.82 at 15 years, and 0.71 at 4 years, respectively.[4-6] There is less real-world evidence that measure-concordant care leads to improved outcomes. A study of high- versus low-performing regions in the US National Cancer Database did not show differences in survival.[29] However, even low-performing regions provided $>$ 80% concordant care, and variation was slight. Stronger associations with survival might be observed in health care systems with poorer baseline performance and less access to advanced treatments.

The ESMO chemotherapy and endocrine therapy measures were applicable to $>$ 50% of our patients with BC. However, the radiotherapy measure was less relevant because only 20% of patients received BCS.

The ASCO measures may also overlook challenges specific to SSA. They focus on treatment initiation, ignoring long-term adherence. Moreover, patients may receive only a portion of indicated treatment types. A "treatment completion" measure used in Rwanda found that only half of patients initiate all indicated treatment types (surgery, chemotherapy, and endocrine therapy).[30] Furthermore, these measures examine only care processes. Patient experience, quality of life, and safety are important quality considerations but rarely studied in LMICs.[31]

This study provides the largest and, as far as we are aware, first prospective, multicenter description of BC care quality in SSA. SA's public health system is better resourced than most SSA systems but serves many impoverished patients, providing a unique context for establishing quality baselines. We believe our findings are broadly representative of SA's public system. The South African National Cancer Registry reports 8,230 new BC diagnoses in 2014.[32] Of these, approximately 3,500 were in the public system, suggesting the SABCHO study enrolled nearly 25% of the public system's incident patients with BC over the 2-year period.

Limitations include uncertainty that our findings are generalizable to other nations. Care across SSA is drastically heterogeneous.[33] In addition, we captured only patient-level factors and, thus, are unable to assess the potentially significant effects of system-level factors (eg, number of providers, chemotherapy chairs and radiotherapy machines per facility, drug stock-outs) on care quality. Data on care received outside our study sites were not available,

although we believe that this limitation had little effect on our findings; public BC care is centralized at tertiary hospitals, and public patients are unlikely to seek private care for these expensive services.

In summary, in our cohort of patients with BC receiving care in five public hospitals in SA, baseline care was reasonably concordant with the ASCO BC care quality measures for chemotherapy and endocrine therapy but poor for radiotherapy. Measure-concordant care was associated with proximity to the hospital and with speaking English, and study hospitals varied in performance. The measures, designed for HICs, likely require adaptation for use in LMICs. Although the measures proved informative about care quality in SA's public system, they call for quality improvement initiatives that target both high-risk patient groups and system-level barriers to the provision of high-quality care. Such initiatives are necessary, although not sufficient, to eliminate the disparities in outcomes between SA patients with BC and those from HICs.

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