

Determinants of Guideline-Discordant Breast Cancer Care



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ABSTRACT

Background: Evidence-based breast cancer treatment guidelines recommend the most appropriate course of therapy based on tumor characteristics and extent of disease. Evaluating the multilevel factors associated with guideline discordance is critical to identifying strategies to eliminate breast cancer survival disparities.

Methods: We identified females diagnosed with a first primary, stage I–III breast cancer between the ages of 20–69 years of age from the population-based Seattle-Puget Sound Surveillance, Epidemiology, and End Results registry. Participants completed a survey about social support, utilization of patient support services, hypothesized barriers to care, and initiation of breast cancer treatment. We used logistic regression to estimate odds ratios and 95% confidence intervals (CI).

Results: Among 1,390 participants, 10% reported guideline-discordant care. In analyses adjusted for patient-level sociodemographic factors, individuals who did not have someone to go with them to appointments or drive them home (OR 1.96; 95% CI, 1.09–3.59) and those who had problems talking to their doctors or their staff (OR 2.03; 95% CI, 1.13–3.64) were more likely to be guideline discordant than those with social support or without such problems, respectively. Use of patient support services was associated with a 43% lower odds of guideline discordance (OR 0.57; 95% CI, 0.36–0.88).

Conclusions: Although guideline discordance in this cohort of early-stage breast cancer survivors diagnosed <70 years of age was low, instrumental social support, patient support services, and communication with doctors and their staff emerged as potential multilevel intervention targets for improving breast cancer care delivery.

Impact: This study supports extending the reach of interventions designed to improve guideline concordance.

Introduction

The mortality rate for female breast cancer declined by 40% since 1989 (1). Improvements in breast cancer screening and treatment contributed about equally to this decline (2). Evidence-based treatment guidelines for breast cancer, such as those issued by the National Comprehensive Cancer Network (NCCN), synthesize decades of evidence to recommend the course of therapy most appropriate based on tumor characteristics and extent of disease. Clinical trials and observational studies support the use of each component of guideline-recommended care and demonstrate a strong association with improved survival (3–5). However, systematic differences in receipt of care that is discordant with treatment guidelines exist. Prior studies of radiation following breast-

conserving surgery (3, 6–10), chemotherapy (11, 12), endocrine therapy (10, 13–16), or HER2-targeted therapy (17) tend to find that individuals with less education or income, those living in high poverty areas, uninsured or unmarried individuals, and those with more comorbidities, are less likely to initiate each of these components of guideline-recommended therapy. As a consequence, disparities in breast cancer mortality are widening (18).

Evaluating the multilevel factors associated with guideline discordance is critical to identifying strategies to eliminate breast cancer survival disparities. The causes of guideline-discordant breast cancer care occur across a dynamic system with multiple levels of contextual influence, including the individual patient, provider, social support networks, and the local community, state, and national environments (19). Although the role of patient-level biological factors, beliefs, and sociodemographic factors on receipt of guideline-discordant breast cancer care have been well documented, barriers and facilitators of breast cancer care at other levels are less understood (20). Emerging evidence suggests that family and social support and the patient support services offered within oncology clinics can improve access to and increase receipt of guideline-recommended care (21). Tangible support, such as assistance with transportation, reminders to take medication, and assistance with care at home, is associated with significantly higher functioning and quality of life during breast cancer treatment (22). These types of instrumental support are provided by multiple sources, including family, friends, medical providers, and patient support services such as navigators and social workers (23). Multilevel theory suggests that social support is a form of social capital with the potential to improve health outcomes (24). However, little is known about utilization of social and patient support among population-based breast cancer survivors. To advance our understanding of the potential impact of social support and patient support services on the likelihood of receiving guideline-discordant breast cancer care, we

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McDougall et al.

conducted a retrospective cohort study of stage I–III breast cancer survivors diagnosed between age 20 and 69, and identified from the population-based Seattle-Puget Sound Surveillance, Epidemiology, and End Results (SEER) cancer registry.

Materials and Methods

Study population

We assembled a cohort of female patients with breast cancer participating in an ongoing case–case study of the major breast cancer subtypes (25, 26). The cohort is composed of females diagnosed between June 1, 2004 and June 30, 2012 with a first primary, stage I–III breast cancer between the ages of 20 and 69 years of age in the Seattle, WA greater metropolitan area (King, Pierce, and Snohomish counties). To increase the number of participants with poor prognosis breast cancer subtypes, all individuals with triple-negative [TN; estrogen receptor (ER) negative, progesterone receptor (PR) negative, and HER2-negative] and HER2-overexpressing (ER⁻, PR⁻, HER2⁺) molecular subtypes were eligible for enrollment. Individuals with ER⁺ breast cancer were frequency matched to the TN and HER2-overexpressing breast cancer cases on the basis of age and year of diagnosis. This sampling scheme resulted in a study population that was both younger and more likely to have ER⁻, PR⁻ breast cancer than the general population of breast cancer cases in the United States (27). We restricted the current analysis to cohort participants with a survey administered at least 12 months after their date of breast cancer diagnosis to allow sufficient follow-up time for initiation of guideline-recommended care prior to self-reported treatment data collection (28). The Institutional Review Board (IRB) of the Fred Hutchinson Cancer Research Center approved the study protocol and all participants provided informed consent. Oral informed consent was determined by the IRB to be sufficient for participation in this minimal risk study. All study activities were conducted in accordance with the Belmont Report.

Data collection

Participant surveys were administered by trained interviewers using a computer-assisted telephone interview platform to ascertain information about social support, utilization of patient support services, and hypothesized barriers to care. In addition, self-reported information on the types and dates of treatments received following cancer diagnosis were collected from the survey. Prior to the survey, participants were mailed showcards containing the names and definitions for each type of treatment as well as a calendar marking their date of diagnosis. Participants were asked to review the showcards and interviewers referred to them to improve accuracy of recalled treatments. Data on covariates of interest corresponding to the year of breast cancer diagnosis, including insurance type, annual household income, highest level of education completed, occupation, marital status, and a history of depression or diabetes were also ascertained from the survey. Information on age at diagnosis, race and ethnicity, and stage of disease were collected from medical record data abstracted by SEER registry staff. Given the small number of individuals of non-White race or Hispanic ethnicity in our study population, race and ethnicity was dichotomized in univariate analyses to examine potential differences between non-Hispanic Whites and all other racial and ethnic groups. In addition, we calculated a new variable, time since diagnosis, to measure the time from the date of diagnosis to administration of the survey. Finally, data on ER, PR, and HER2

status needed to determine tumor subtype was collected from a review of pathology reports available through the SEER registry.

Definition of guideline-discordant breast cancer care

We reviewed each version of the NCCN guidelines published between June 1, 2004 and June 30, 2012 to determine the course of guideline-recommended therapy at the time of each participant's date of diagnosis. Four components of care were assessed on the basis of the tumor characteristics and year of diagnosis for each participant: (i) definitive surgical therapy consisted of receipt of breast-conserving surgery and initiation of radiotherapy or mastectomy and was guideline recommended for all study participants; (ii) initiation of chemotherapy was guideline recommended for participants whose tumors were TN or HER2-overexpressing and ≥ 1 cm or had ≥ 1 positive axillary lymph node, and participants whose tumors were ER⁺/HER2⁻ with ≥ 1 positive axillary lymph node across all years of diagnosis; (iii) initiation of adjuvant endocrine therapy was guideline recommended for participants who were ER⁺ across all years of diagnosis; and (iv) initiation of HER2-targeted therapy was guideline recommended for individuals who were HER2⁺ and diagnosed from 2007 onward. After evaluating whether each component of guideline-recommended care was initiated, we created a composite outcome of overall guideline discordance, classifying participants that did not initiate one or more components of guideline-recommended care as discordant.

Statistical analysis

We used descriptive statistics to characterize the study cohort by sociodemographic and clinical factors and to examine the proportion of participants who were guideline discordant with each component of care. Univariate logistic regression was used to estimate unadjusted ORs and 95% confidence intervals (CI) for associations between multilevel factors, including social support, utilization of patient support services, and experience with potential barriers to care, and overall guideline discordance. From this analysis, six exposures of interest emerged that were associated with overall guideline discordance at the $P < 0.20$ level, including: (i) not having someone to talk to about diagnosis, needs, problems, or fears; (ii) utilization of a patient and family resource center, patient guides, navigators, or social workers; (iii) utilization of nutrition, personal care, or emotional counseling or classes; (iv) utilization of symptom management or physical therapists; (v) utilization of a cancer support group; and (vi) problems talking to doctors or their staff when the participant had questions or problems. To evaluate potential confounding between the exposures of interest and overall guideline discordance, we explored univariate associations between patient-level sociodemographic and clinical characteristics and both the exposures of interest and overall guideline discordance. Year of diagnosis, stage of disease, and tumor subtype were not assessed as potential confounders because components of these variables were used to define the outcome. Finally, we used multivariable logistic regression to develop two adjusted models. The first included all six multilevel factors associated with overall guideline discordance at the $P < 0.20$ level to estimate the individual association of each factor with guideline concordance, adjusted for the other factors in the model. The second adjusted model included the patient-level sociodemographic factors found to be associated with one or more exposures of interest and with overall guideline discordance at the $P < 0.20$ level in exploratory univariate analyses. Data were analyzed using Stata/ICv.15.1 (STATA).

Results

A total of 1,683 individuals completed the participant survey out of 2,706 female breast cancer cases identified from the SEER registry (response 62%). Respondents had a similar age and stage distribution to nonrespondents, but they were significantly more likely to be non-Hispanic White (Supplementary Table S1). After restricting the study population to survey respondents with ≥ 12 months between their date of diagnosis and survey completion, 1,390 individuals were available for analysis. The mean age of the study population was 51 years at diagnosis and, on average, 3 years passed between a participant's initial breast cancer diagnosis and the date of survey administration (Table 1). Eighty-seven percent of the sample was non-Hispanic White, 97% were insured, and 30% had an annual household income $> \$100,000$. Forty-two percent of participants had ER⁺ breast cancer, 42% had TN tumors, and 16% had HER2-overexpressing tumors.

Overall, 10% ($n = 141$) of participants reported guideline-discordant care (Fig. 1). Of the 212 participants eligible for HER2-targeted therapy (i.e., HER2⁺, diagnosed between 2007 and 2012), 12% were discordant with HER2-targeted therapy guidelines. Of the 583 participants eligible for adjuvant endocrine therapy, 7% were discordant with adjuvant endocrine therapy guidelines. Of the 901 participants eligible for chemotherapy, 5% were guideline discordant. Two percent of all participants were discordant with definitive surgical therapy guidelines.

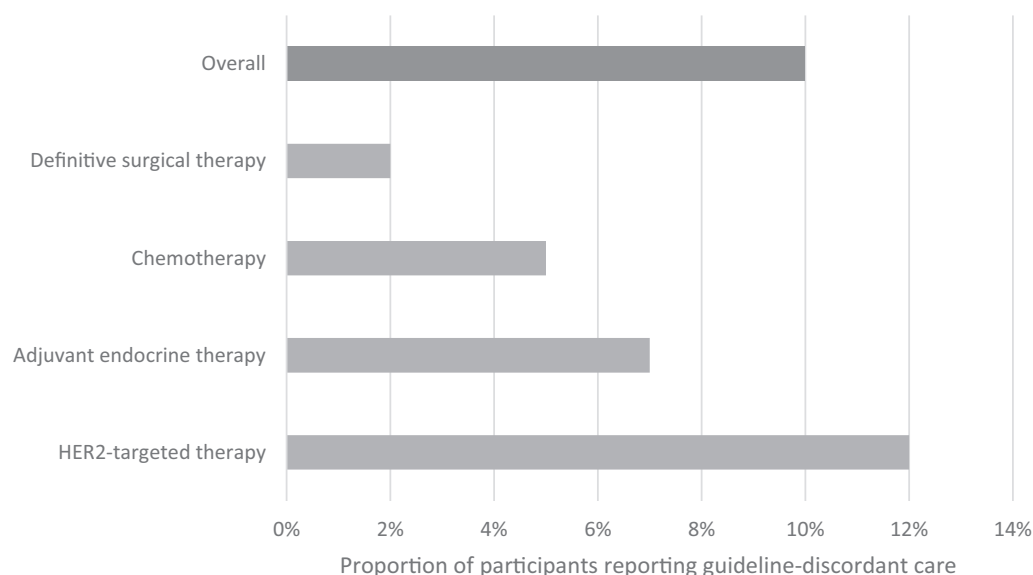
In univariate analyses, individuals who did not have someone to go with them to appointments or drive them home were twice as likely (OR 2.05; 95% CI, 1.19–3.53) to be guideline discordant than individuals who did have this type of social support (Table 2). Other types of social support, including having someone to talk to about their diagnosis, needs, problems, or fears, or having someone to help with daily chores and care for them when they were sick or tired, were not associated with guideline discordance. Those who used a patient and family resource center, patient guides, navigators, or social workers were 43% less likely (OR 0.57; 95% CI, 0.39–0.82) to be guideline discordant than individuals who did not use these patient support services. Similarly, use of a cancer support group was associated with a 47% lower odds of guideline discordance (OR 0.53; 95% CI, 0.30–0.94). Individuals who reported problems talking to their doctors or staff when they had questions or problems were nearly twice as likely (OR 1.93; 95% CI, 1.14–3.26) to be guideline discordant than those who reported no problems talking to doctors or staff. In addition, individuals that used nutrition, personal care, or emotional counseling or classes (OR 0.75; 95% CI, 0.51–1.11) and those that used symptom management or physical therapists (OR 0.71; 95% CI, 0.48–1.04) had a marginally lower odds of guideline discordance than individuals that did not use these patient support services.

Several patient-level disparities in the availability of social support, use of patient support services, and barriers to care are highlighted in Table 3. Older age at diagnosis was associated with a higher likelihood of having someone to talk to about diagnosis, needs, problems, or fears (OR 1.03; 95% CI, 1.01–1.06), but with lower use of patient support services. Relatedly, participants who were retired were substantially less likely to use a patient and family resource center, patient guides, navigators, or social workers (OR 0.49; 95% CI, 0.33–0.70); nutrition, personal care, or emotional counseling or classes (OR 0.57; 95% CI, 0.39–0.84); and symptom management or physical therapists (OR 0.56; 95% CI, 0.38–0.83) compared with participants who were working full time at diagnosis. Individuals with a \leq high

Table 1. Patient-level demographic and clinical characteristics among women with stage I–III female breast cancer, $n = 1,390$.

	<i>n</i> (%)
Age at diagnosis (years)	
Mean (minimum, maximum)	51 (26, 69)
Time since diagnosis (years)	
Mean (minimum, maximum)	3 (1, 10)
Year of diagnosis	
2004–2006	461 (33%)
2007–2009	499 (36%)
2010–2012	430 (31%)
Race/ethnicity	
Non-Hispanic White	1,208 (87%)
Hispanic (any race)	25 (2%)
African American	68 (5%)
Asian/Pacific Islander	70 (5%)
American Indian	14 (1%)
Missing	5 (<1%)
Insurance	
Private or government insurance	1,337 (97%)
No insurance	46 (3%)
Missing	7 (<1%)
Income	
<\$35,000	209 (15%)
\$35,000–\$69,999	354 (25%)
\$70,000–\$99,999	336 (24%)
\geq \$100,000	415 (30%)
Missing	76 (5%)
Education	
\leq High school	395 (28%)
Associate's/technical/some college	355 (26%)
Bachelor's degree	430 (31%)
Graduate degree	206 (15%)
Missing	4 (<1%)
Occupation	
Working full time	736 (53%)
Working part time	228 (16%)
Unemployed	101 (7%)
Homemaker	149 (11%)
Retired	163 (12%)
Missing	13 (<1%)
Marital status	
Married	1,011 (73%)
Separated/divorced/widowed	275 (20%)
Never married	100 (7%)
Missing	4 (<1%)
Stage of disease	
I	614 (44%)
II	552 (40%)
III	224 (16%)
Tumor subtype	
ER ⁺ /HER2 [–]	509 (37%)
ER ⁺ /HER2 ⁺	74 (5%)
TN	579 (42%)
HER2-overexpressing	228 (16%)
Comorbidities	
Depression	
No	993 (71%)
Yes	395 (28%)
Missing	2 (<1%)
Diabetes	
No	1,261 (91%)
Yes	127 (9%)
Missing	2 (<1%)

McDougall et al.

**Figure 1.**

Proportion of participants reporting guideline-discordant care overall and among those eligible for each treatment component, $n = 1,390$.

school level of education were also significantly less likely to utilize the various patient support services, while individuals with no insurance were >2 times as likely to use a patient and family resource center, patient guides, navigators, or social workers than insured participants (OR 2.62; 95% CI, 1.40–4.92). Compared with those with an annual household income >\$100,000, individuals with an income <\$35,000 were >2 times as likely to report problems talking to doctors or staff. Finally, compared with married individuals, separated/divorced/widowed individuals (OR 4.59; 95% CI, 2.94–7.16) and those who were never married (OR 3.80; 95% CI, 1.99–7.23) were less likely to have someone to talk to about diagnosis, needs, problems, or fears, but more likely to utilize patient support services.

Patient-level characteristics associated with both exposures of interest (Table 3) and guideline discordance (Table 4) at the $P < 0.20$ level included age at diagnosis, time since diagnosis, insurance, income, and marital status.

In our combined multivariable model adjusted for the other exposures of interest (Table 5, Model 1), individuals who did not have someone to go with them to appointments or drive them home were more than twice as likely (OR 2.19; 95% CI, 1.26–3.80) to be guideline discordant than individuals who did have this type of social support. Further adjustment for patient-level sociodemographic factors attenuated this association between social support and guideline discordance slightly (OR 1.96; 95% CI, 1.09–3.54; Table 5, Model 2). In our fully adjusted model (Table 5, Model 2), use of a patient and family resource center, patient guide, patient navigator, or social workers was associated with a 43% lower odds of guideline discordance (OR 0.57; 95% CI, 0.36–0.88), while problems talking to doctors or staff was associated with 2-fold higher odds of guideline discordance (OR 2.03; 95% CI, 1.13–3.64). Older age at diagnosis was positively associated with guideline discordance (OR 1.03; 95% CI, 1.00–1.05) while a longer time between diagnosis and the participant survey was associated with a lower odds of reporting guideline discordance (OR 0.87; 95% CI, 0.79–0.97). Individuals with no insurance had >3 times the odds of

guideline discordance as those with private or government insurance (OR 3.30; 95% CI, 1.36–7.98).

Discussion

In this cohort of breast cancer survivors, we identified multiple determinants of guideline discordance including patient insurance and age, problems talking to doctors or staff, and available social and patient support. Guideline discordance was relatively rare in this study, reported by only 10% of participants, with most individuals (90%) receiving all guideline-recommended care for which they were eligible. Several recent SEER-Medicare studies find higher guideline discordance among people with breast cancer enrolled in Medicare, ranging from 21% to 60% (29, 30). However, the use of claims data to define guideline discordance and the older age of Medicare enrollees, compared with our relatively young population of individuals diagnosed with breast cancer before age 70 years, likely explain the higher proportion of guideline discordance in these studies. Earlier population-based SEER studies of specific components of guideline-recommended care find similar proportions of guideline discordance as our study, with 7% of women receiving breast-conserving surgery failing to receive radiation (9), 24% discordant with chemotherapy guidelines (31), and 20% discordant with adjuvant endocrine therapy (10). Although guideline discordance was uncommon in our study, not having someone to go with to appointments and provide a ride home if needed and having problems talking to doctors or their staff significantly increased the odds of guideline discordance. Conversely, using a patient and family resource center, patient guide, patient navigator, or social worker was associated with a lower odds of guideline discordance. These findings are meaningful because they identify potential multilevel intervention targets to reduce the receipt of guideline-discordant breast cancer care.

Having someone to go with a woman to appointments and drive her home if needed is a type of instrumental social support. To receive all components of guideline-recommended care, patients with breast cancer face logistical challenges to accommodating an often grueling

Determinants of Guideline-Discordant Breast Cancer Care

Table 2. Univariate associations between social support, patient support, barriers to care, and overall guideline discordance, $n = 1,390$.

	Discordant ($n = 141$; 10%) n (%)	Concordant ($n = 1,249$; 90%) n (%)	OR (95% CI)	P
Social Support. <i>During your breast cancer treatment, was there someone ...</i>				
You could talk to about your diagnosis, needs, problems, or fears?				0.87
Yes	132 (94%)	1,189 (95%)	1.00 (Ref.)	
No	7 (5%)	59 (5%)	1.07 (0.48–2.38)	
Missing	2 (1%)	1 (<1%)		
To help you with daily chores and care for you when you were sick or tired?				0.98
Yes	120 (85%)	1,093 (88%)	1.00 (Ref.)	
No	17 (12%)	154 (12%)	1.01 (0.59–1.72)	
Missing	4 (3%)	2 (<1%)		
To go with you to appointments and drive you home if needed?				0.01
Yes	121 (86%)	1,159 (93%)	1.00 (Ref.)	
No	18 (13%)	84 (7%)	2.05 (1.19–3.53)	
Missing	2 (1%)	6 (<1%)		
Patient Support Services. <i>During your breast cancer treatment did you ever use any of these patient support services ...</i>				
Free shuttle or van transportation or public transportation vouchers?				0.78
No	134 (95%)	1,197 (96%)	1.00 (Ref.)	
Yes	5 (4%)	51 (4%)	0.88 (0.34–2.23)	
Missing	2 (1%)	1 (<1%)		
Patient and family resource center, patient guides, navigators, or social workers?				<0.01
No	94 (67%)	681 (55%)	1.00 (Ref.)	
Yes	44 (31%)	564 (45%)	0.57 (0.39–0.82)	
Missing	3 (2%)	4 (<1%)		
Financial services?				0.79
No	115 (82%)	1,051 (84%)	1.00 (Ref.)	
Yes	23 (16%)	197 (16%)	1.07 (0.66–1.71)	
Missing	3 (2%)	1 (<1%)		
Nutrition, personal care, or emotional counseling or classes?				0.14
No	99 (70%)	812 (65%)	1.00 (Ref.)	
Yes	40 (28%)	436 (35%)	0.75 (0.51–1.11)	
Missing	2 (1%)	1 (<1%)		
Symptom management or physical therapists?				0.07
No	99 (70%)	800 (64%)	1.00 (Ref.)	
Yes	39 (28%)	447 (36%)	0.71 (0.48–1.04)	
Missing	3 (2%)	2 (<1%)		
Cancer support group?				0.02
No	125 (89%)	1,030 (82%)	1.00 (Ref.)	
Yes	14 (10%)	217 (17%)	0.53 (0.30–0.94)	
Missing	2 (1%)	2 (<1%)		
Childcare services?				0.94
No	137 (97%)	1,230 (98%)	1.00 (Ref.)	
Yes	2 (1%)	17 (1%)	1.06 (0.24–4.62)	
Missing	2 (1%)	2 (<1%)		
Potential Barriers to Care. <i>When you were being treated for breast cancer, did you have problems ...</i>				
Talking to your doctors or their staff when you had questions or problems?				0.02
No	117 (83%)	1,151 (92%)	1.00 (Ref.)	
Yes	19 (13%)	97 (8%)	1.93 (1.14–3.26)	
Missing	4 (4%)	1 (<1%)		
Scheduling and finding time for appointments?				0.28
No	127 (90%)	1,172 (94%)	1.00 (Ref.)	
Yes	12 (9%)	77 (6%)	1.44 (0.76–2.71)	
Missing	2 (1%)	0 (0%)		
Transportation to and from appointments?				0.36
No	133 (94%)	1,171 (94%)	1.00 (Ref.)	
Yes	6 (4%)	77 (6%)	0.67 (0.29–1.60)	
Missing	2 (1%)	1 (<1%)		
The amount of money you paid for your doctor visits, treatments, and medications?				0.99
No	101 (72%)	903 (72%)	1.00 (Ref.)	
Yes	38 (27%)	340 (27%)	1.00 (0.67–1.48)	
Missing	2 (1%)	6 (<1%)		

Note: Bold values represent significance at the $P < 0.05$ level.

Abbreviations: CI, confidence interval; OR, odds ratio; Ref., reference category.

Table 3. Univariate associations between patient-level characteristics and social support, patient support services, and potential barriers to care, $n = 1,390$.

	Social Support, During your breast cancer treatment; was there someone			Patient Support Services, During your breast cancer treatment did you ever use any of these patient support services			Nutrition, personal care, or emotional counseling or classes? (Yes)			Symptom management or physical therapists? (Yes)			Cancer support group? (Yes)			Potential Barriers to Care, When you were being treated for breast cancer, did you have problems		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Age at diagnosis (years)	1.03	1.01-1.06	<0.01	0.97	0.96-0.98	<0.01	0.97	0.95-0.98	<0.01	0.96	0.95-0.98	<0.01	0.98	0.96-0.99	<0.01	1.01	0.98-1.03	0.61
Time since diagnosis (years)	1.07	0.97-1.18	0.19	0.92	0.87-0.97	<0.01	0.94	0.89-0.99	0.04	0.87	0.82-0.93	<0.01	1.04	0.97-1.12	0.30	0.95	0.86-1.04	0.27
Race/ethnicity			0.25			0.12			0.93			0.31			0.08			0.38
Non-Hispanic White	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
All others	1.40	0.81-2.41	0.17	1.29	0.94-1.77	<0.01	1.01	0.73-1.41	0.94	0.84	0.60-1.18	0.38	1.43	0.97-2.12	0.78	1.28	0.75-2.17	0.54
Insurance																		
Private or government insurance	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
No insurance	1.95	0.81-4.72		2.62	1.40-4.92		1.02	0.55-1.90		1.31	0.72-2.39		0.89	0.39-2.02		1.36	0.53-3.50	
Income			<0.01			0.08			0.88			<0.01			0.59			0.02
<\$35,000	3.86	2.13-6.99		1.37	0.98-1.91		0.88	0.62-1.25		0.52	0.36-0.75		0.81	0.51-1.30		2.15	1.25-3.71	
\$35,000-\$69,999	1.80	0.98-3.27		0.90	0.68-1.21		0.99	0.74-1.34		0.63	0.47-0.85		1.02	0.70-1.50		0.97	0.55-1.70	
\$70,000-\$99,999	1.32	0.69-2.51		0.91	0.68-1.22		1.01	0.75-1.36		0.78	0.58-1.05		1.13	0.78-1.66		1.16	0.67-2.01	
≥\$100,000	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Education			0.83			<0.01			<0.01			<0.01			<0.01			0.40
≤High school	1.06	0.57-1.98		0.44	0.31-0.62		0.50	0.35-0.70		0.37	0.26-0.52		0.53	0.33-0.83		1.39	0.72-2.70	
Associate's/technical/some college	0.94	0.49-1.80		0.54	0.38-0.76		0.51	0.36-0.73		0.45	0.31-0.64		0.72	0.46-1.12		1.68	0.87-3.24	
Bachelors' degree	0.83	0.44-1.57		0.82	0.59-1.14		0.70	0.50-0.98		0.74	0.53-1.03		0.99	0.66-1.50		1.23	0.63-2.39	
Graduate degree	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Occupation			<0.01			<0.01			0.02			0.01			0.12			0.47
Working full time	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Working part time	0.48	0.23-0.98		1.26	0.93-1.69		0.92	0.67-1.26		1.20	0.88-1.62		1.31	0.90-1.93		1.26	0.75-2.14	
Unemployed	2.11	1.14-3.88		1.28	0.85-1.95		1.29	0.84-1.97		0.80	0.51-1.26		1.51	0.90-2.52		1.85	0.97-3.52	
Homemaker	0.32	0.11-0.90		0.90	0.63-1.29		0.97	0.67-1.40		1.08	0.75-1.55		1.18	0.75-1.88		1.20	0.64-2.26	
Retired	1.10	0.60-2.01		0.49	0.33-0.70		0.57	0.39-0.84		0.56	0.38-0.83		0.71	0.42-1.18		1.07	0.57-2.01	
Marital status			<0.01			<0.01			<0.01			<0.01			0.09			0.44
Married	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Separated/divorced/widowed	4.59	2.94-7.16		1.38	1.05-1.80		0.88	0.66-1.17		0.74	0.55-0.99		0.78	0.53-1.14		1.30	0.82-2.07	
Comorbidities																		
Never married	3.80	1.99-7.23		2.22	1.45-3.38		1.93	1.28-2.92		1.75	1.15-2.66		1.51	0.92-2.47		1.34	0.67-2.68	
Depression	1.71	1.13-2.59	0.01	1.43	1.13-1.81	<0.01	1.27	1.00-1.62	0.06	1.25	0.98-1.60	0.07	1.17	0.86-1.59	0.32	1.11	0.73-1.69	0.62
Diabetes	1.81	1.00-3.25	0.06	0.81	0.56-1.18	0.27	0.83	0.56-1.24	0.36	0.71	0.47-1.06	0.09	0.93	0.56-1.53	0.77	1.40	0.78-2.53	0.28

Note: Bold values represent significance at the $P < 0.05$ level. Abbreviations: CI, confidence interval; OR, odds ratio; Ref., reference category.

Determinants of Guideline-Discordant Breast Cancer Care

Table 4. Univariate associations between patient-level factors and overall guideline discordance, $n = 1,390$.

	OR	95% CI	P
Age at diagnosis (years)	1.02	1.01-1.04	0.01
Time since diagnosis (years)	0.92	0.83-1.01	0.06
Race/ethnicity			0.30
Non-Hispanic White	1.00	Ref.	
All others	0.74	0.42-1.32	
Insurance			0.05
Private or government insurance	1.00	Ref.	
No insurance	2.26	1.07-4.78	
Income			0.17
<\$35,000	1.24	0.71-2.17	
\$35,000-\$69,999	1.49	0.94-2.38	
\$70,000-\$99,999	0.88	0.52-1.49	
≥\$100,000	1.00	Ref.	
Education			0.74
≤High school	0.85	0.49-1.46	
Associate's/technical/some college	0.76	0.43-1.34	
Bachelors' degree	0.95	0.56-1.62	
Graduate degree	1.00	Ref.	
Occupation			0.30
Working full time	1.00	Ref.	
Working part time	1.16	0.70-1.91	
Unemployed	0.89	0.41-1.91	
Homemaker	1.51	0.88-2.60	
Retired	1.61	0.96-2.70	
Marital status			0.10
Married	1.00	Ref.	
Separated/divorced/widowed	1.57	1.05-2.36	
Never married	1.25	0.64-2.42	
Comorbidities			0.41
Depression	1.17	0.80-1.71	
Diabetes	1.02	0.56-1.86	

Note: Bold values represent significance at the $P < 0.05$ level. Abbreviations: CI, confidence interval; OR, odds ratio; Ref., reference category.

schedule of appointments. Considerable evidence suggests that women who have lower levels of social support or are socially isolated are less likely to receive guideline-recommended care (32-34). Greater social support is associated with better quality of life and lower symptom burden (22, 35). Moreover, an analysis of data from the Nurses' Health Study found a 2-fold increased risk of breast cancer mortality in women who were socially isolated compared with those who were socially integrated (32). Our results highlight the importance of instrumental support, whereas we did not find an association between having someone to talk to, a measure of emotional support, and guideline discordance.

The use of patient support services, including a patient and family resource center, patient guide, patient navigator, or social worker, appeared to lower the odds of guideline discordance. Common to this group of services is their location within the organization or practice setting level of the healthcare delivery system (19). Patient navigation is the most studied of these services, and its effectiveness on improving adherence to treatment is unclear. First introduced to improve breast cancer screening and treatment outcomes among women with low incomes in Harlem (36), patient navigation is effective at improving outcomes related to the diagnosis of cancer. Yet, systematic reviews of patient navigation studies do not find conclusive evidence of benefit

related to treatment adherence (37, 38). In our study, these patient services were used by 31% of guideline-discordant and 45% of guideline-concordant individuals, respectively. It is possible that those who sought out these services were more likely to adhere to their guideline-recommended treatment regimen than individuals who did not use these services, thus inducing an association not found in randomized trials of patient navigation. However, upon exploring the characteristics of participants who used these patient support services, we found that uninsured participants were >2 times as likely to use these services as insured individuals, suggesting that systematic referral of patients with breast cancer without insurance could also explain the apparent benefit of patient support services in our study.

Problems talking to doctors or their staff when a participant had questions or problems was also an important determinant of guideline discordance in our study. In a prior study of the receipt of adjuvant chemotherapy, Griggs and colleagues found that most guideline-discordant patients reported physician recommendation or lack of physician discussion about chemotherapy as the reasons for not receiving chemotherapy (31). The authors note in their discussion that this may be an issue of patient perception rather than omission of chemotherapy by physicians, suggesting communication problems contribute to guideline discordance. Such communication problems with providers may also be an indicator of lower literacy or health literacy, which is associated with worse breast cancer outcomes (39, 40). Although NCCN publishes NCCN Guidelines for Patients, with the stated goal of helping patients get the best care for breast cancer, a literacy assessment found the readability and complexity levels of these materials to be too high for the general U.S. population (41). In addition, problems talking about the cost of breast cancer care may lead to surprise bills, denied insurance claims, and problems receiving components of guideline-recommended care. Although patients with cancer have questions about costs that they would like to communicate to providers (42, 43), nearly one third of oncologists report a high degree of discomfort in discussing costs with patients (44). We did not find an association between problems with the amount of money paid for doctor visits, treatments, and medications and guideline discordance, although this could be because most participants in our study had private insurance and relatively high socioeconomic status.

Several limitations of this study affect the interpretation of the results. Our sample of female breast cancer cases from the Seattle-Metropolitan SEER registry resulted in a population of largely non-Hispanic White, insured individuals with relatively high levels of income and education. We also restricted the sample to people under 70 years of age and included more individuals with TN and HER2-overexpressing tumor subtypes, all of which likely contributed to rarity of guideline discordance in this study. However, limiting the study to those <70 years of age at diagnosis also provided the opportunity to assess guideline discordance in a population with fewer comorbidities than would be expected in an older population, in which the benefit of adjuvant treatment is equivocal (28). Moreover, differences between the 62% of individuals who completed surveys and those who did not participate may have also contributed to our relatively low estimate of guideline concordance. We used self-reported treatment data from the interviews to characterize guideline discordance, which required participants to recall their breast cancer experience. This self-reported treatment data provided the opportunity to characterize initiation

McDougall et al.

Table 5. Multivariable models of the associations between social support, patient support, and barriers to care and guideline discordance, $n = 1,390$.

	Model 1		Model 2	
	OR	95% CI	OR	95% CI
Social Support, During your breast cancer treatment, was there someone . . .				
To go with you to your appointments and drive you home if needed?				
Yes	1.00	Ref.	1.00	Ref.
No	2.19	1.26–3.80	1.96	1.09–3.54
Patient Support Services, During your breast cancer treatment did you ever use any of these patient support services . . .				
Patient and family resource center, patient guide, patient navigator, or social worker?				
No	1.00	Ref.	1.00	Ref.
Yes	0.63	0.42–0.95	0.57	0.36–0.88
Nutrition, personal care, or emotional counseling or classes?				
No	1.00	Ref.	1.00	Ref.
Yes	1.00	0.65–1.54	1.08	0.68–1.71
Symptom management or physical therapists?				
No	1.00	Ref.	1.00	Ref.
Yes	0.81	0.53–1.24	0.85	0.54–1.33
Cancer support group?				
No	1.00	Ref.	1.00	Ref.
Yes	0.63	0.35–1.14	0.77	0.42–1.42
Potential Barriers to Care, When you were being treated for breast cancer, did you have problems . . .				
Talking to your doctors or their staff when you had questions or problems?				
No	1.00	Ref.	1.00	Ref.
Yes	2.03	1.17–3.50	2.03	1.13–3.64
Patient-Level Sociodemographic Factors				
Age at diagnosis (years)			1.03	1.00–1.05
Time since diagnosis (years)			0.87	0.79–0.97
Insurance				
Private or government insurance			1.00	Ref.
No insurance			3.30	1.36–7.98
Income				
<\$35,000			0.71	0.35–1.42
\$35,000–\$69,999			1.25	0.75–2.08
\$70,000–\$99,999			0.83	0.48–1.43
≥\$100,000			1.00	Ref.
Marital status				
Married			1.00	Ref.
Separated/divorced/widowed			1.40	0.84–2.32
Never married			1.25	0.57–2.73

Note: Model 2 estimates adjusted for all variables shown in the table; bold values represent significance at the $P < 0.05$ level. Abbreviations: CI, confidence interval; OR, odds ratio; Ref, reference category.

of guideline-recommended therapy, but lacked the specificity needed to measure therapy completion. In this retrospective study, recall of social support, patient support services, potential barriers to care, and initiation of treatment may have differed by patient-level characteristics and time since diagnosis. In general, time since diagnosis was associated with lower reported utilization of patient support services but also with lower guideline discordance. Our fully adjusted multivariable model included time since diagnosis to control for potential recall bias. Finally, although we adjusted our estimates for age, time since diagnosis, and insurance, and evaluated many other factors as potential confounders, it is possible that unmeasured differences between individuals who did and did not have social support, use patient services, or have problems talking to doctors or their staff could explain our observed associations.

Despite these limitations, the evidence from this study highlights instrumental social support, patient support services, and communication with doctors and their staff as potential multilevel intervention targets for improving breast cancer care delivery, especially among

early-stage breast cancer survivors diagnosed <70 years of age. Systematic identification of social support needs and linking individuals without strong social ties to a guide who can accompany the patient to appointments and provide transportation when needed could improve care. Future multilevel intervention trials that integrate social support and communication enhancement using patient support services may help to reduce guideline-discordant care.

Authors' Disclosures

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Authors' Contributions

J.A. McDougall: Conceptualization, formal analysis, investigation, methodology, writing—original draft, writing—review and editing. **L.S. Cook:** Resources, funding acquisition, investigation, methodology, writing—review and editing. **M.-T.C. Tang:** Data curation, formal analysis, writing—review and editing. **H.M. Linden:** Conceptualization, methodology, writing—review and editing. **B. Thompson:** Conceptualization, resources, supervision, funding acquisition, investigation,

Determinants of Guideline-Discordant Breast Cancer Care

methodology, writing–review and editing. C.I. Li: Conceptualization, resources, formal analysis, supervision, funding acquisition, investigation, methodology, writing–review and editing.

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McDougall et al.

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