Telemedicine Use among Breast Cancer Patients: Association with Neighborhood Socioeconomic Disadvantage and Comparisons of Oncology Services between Virtual and In-Person Visits

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Abstract

Background: Since the COVID-19 pandemic, we have seen rapid growth in telemedicine utilization. However, telehealth care and services are not equally distributed and not all breast cancer patients have equal access across U.S. regions. There are notable gaps in the existing literature regarding the influence of neighborhood-level socioeconomic status on telemedicine use in breast cancer patients and oncology services offered through virtual vs. in-person visits.

Objective: We assessed the relationship between neighborhood socioeconomic disadvantage and telemedicine use among breast cancer patients and examined differential provisions of oncology services between virtual and in-person visits.

Methods: Neighborhood socioeconomic disadvantage was measured by the Area Deprivation Index (ADI), with higher scores indicating greater disadvantages. Telemedicine and/or in-person visiting was defined as having had a virtual and/or in-person visit with a provider in the past 12 months. Multivariable logistic regression was performed to examine the association between ADI and telemedicine use. McNemar’s test was used to assess match-paired data on types of oncology services comparing virtual to in-person visits.

Results: Of 1,163 patients, 36.0% (of these, 65.0% videoconference only, 22.7% telephone only, and 12.3% both videoconference and telephone) had a virtual visit in the past 12 months. Higher ADI scores were associated with a lower likelihood of telemedicine utilization (adjusted odds ratio 0.89; 95% CI: 0.82-0.97). There were no significant differences in providing treatment consultation (45 vs. 55; P=0.317) or cancer genetic counseling (11 vs. 19; P=0.144) between virtual and in-person visits. Telemedicine users reported 95.8% somewhat-to-extreme satisfaction, and 61.8% were likely or very likely to continue using telemedicine.

Conclusions: In this study of multiethnic cohort of breast cancer patients, our findings suggest neighborhood-level socioeconomic disparities in telemedicine use and that virtual visits could be used to provide treatment consultation and cancer genetic counseling. Oncology programs should address these disparities and needs to improve care delivery and achieve telehealth equity for their patient populations.

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Results:

Of 1,163 patients, the mean age was 61.8 years (SD 12.0); 845 (72.8%) breast cancer patients identified as White, followed by 229 (19.7%) as Black, 52 (4.5%) as Asian, and 35 (3.0%) as Hispanic. Overall, 36.0% (416/1,157; of these, 65.0% [n=266] videoconference only, 22.7% [n=93] telephone only, and 12.3% [n=50] both videoconference and telephone) had a virtual visit in the past 12 months. Higher ADI scores were associated with a lower likelihood of telemedicine utilization (adjusted odds ratio [AOR] 0.89; 95% CI: 0.82-0.97). Black (AOR 2.38; 95% CI: 1.41-4.00) or Hispanic (AOR 2.65; 95% CI: 1.07-6.58) patients had greater odds of telemedicine use than White patients. Compared to patients with high school or less education, those with an Associate’s degree (AOR 2.67; 95% CI: 1.33-5.35), Bachelor’s degree (AOR 2.75; 95% CI: 1.38-5.48), or graduate or professional degree (AOR 2.57; 95% CI: 1.31-5.04) had higher odds of telemedicine use in the past 12 months. There were no significant differences in providing treatment consultation (45, 11.1% vs. 55, 13.6%; *P*=.32) or cancer genetic counseling (11, 2.7% vs. 19, 4.7%; *P*=.14) between virtual and in-person visits. Telemedicine users reported 95.8% (390/407) somewhat-to-extreme satisfaction, and 61.8% (254/411) were likely or very likely to continue using telemedicine.

Conclusions:

In this study of multiethnic cohort of breast cancer patients, our findings suggest neighborhood-level socioeconomic disparities in telemedicine use and that virtual visits could be used to provide treatment consultation and cancer genetic counseling. Oncology programs should address these disparities and needs to improve care delivery and achieve telehealth equity for their patient populations.

Keywords:

telemedicine; telehealth equity; Area Deprivation Index; neighborhood socioeconomic disadvantage; disparities; oncology services; treatment consultation; genetic counseling; in-person visits; breast cancer

Introduction

In the United States, telemedicine utilization has risen over the years. According to the 2019 American Hospital Association annual survey, the percentage of telehealth programs implemented across hospitals increased from 43.1% in 2015 to 61.2% in 2017 [1]. Since the COVID-19 pandemic, we have seen rapid and unprecedented growth in the demand for and use of telemedicine. A recent report from the Centers for Disease Control and Prevention has documented that the frequency of virtual care visits increased by 50.0% from 2019 to 2020 [2]. The increase in the use of telemedicine is also observed in cancer patient populations. For example, several studies conducted during 2020 and 2021 have estimated a 34.9% to 64.9% prevalence of telemedicine utilization among patients with breast or other cancers [3-11]. In 2020, the Centers for Medicare and Medicaid Services introduced policies that offered regulatory waivers and flexible reimbursement to Medicaid/Medicare providers for telehealth, contributing in part to the observed increase in telemedicine usage and implementation [12, 13]. In 2021, the American Society of Clinical Oncology performed a systematic literature review on telemedicine and published standards and recommendations for telehealth services and practices in the oncology setting [14]. Telemedicine helps facilitate access to health care and services for cancer patients and their caregivers or family members. However, telehealth care and services are not equally distributed and not all cancer patients have equal access to these care and services across different U.S. regions. There are notable gaps in the existing literature regarding the influence of neighborhood-level socioeconomic status (SES) on telemedicine use in breast cancer patients and oncology services offered through virtual vs. in-person visits.

Neighborhood-level SES is a fundamental component of the social determinants of health framework [15, 16]. Neighborhood socioeconomic disadvantage has been shown to negatively affect health outcomes [17, 18], access to care and preventive services [19, 20], survival outcomes [18, 21], and quality of life [22] among cancer patients [23]. Previous investigations also have found neighborhood socioeconomic disadvantage to be associated with a lower likelihood of telemedicine utilization among patients in primary care, outpatients, and hematology/oncology clinics [8, 24-28]. A study of 627 cancer patients experiencing financial distress during the COVID-19 pandemic reported a 3.0% decrease in the rate of telemedicine use per 10-unit increase in the Area Deprivation Index (ADI) [8], a validated composite measure of neighborhood-level SES [29, 30]. Fassas et al. conducted a univariate analysis of 64 patients with head and neck cancer, revealing no significant differential interest in virtual clinic visits by the ADI [27]. Another study noted a higher percentage of telehealth visits among patients residing in the least socioeconomically deprived neighborhoods (54.0%) than those in the most deprived neighborhoods (46.1%) in a large cohort of hematology/oncology patients from Kaiser Permanente (*P*<.01) [28]. These prior studies either lacked significant sample size and/or include heterogeneous cancer patient populations. Therefore, these findings may not be generalizable to the breast cancer patient population.

Additionally, whether provisions or receipts of oncology services differ between virtual and in-person office visits among breast cancer patients is unclear. A recent retrospective analysis of 311 oncology patients has indicated that clinical practices, such as molecular test ordering and palliative care referrals, conducted through telehealth visits achieve similar efficiency as in-person visits [31]. A pilot study of 45 advanced cancer patients in Mexico has suggested the feasibility of supportive care delivery via telemedicine [32]. Multiple studies have found virtual care provisions or visits to be feasible, effective, and safe for patient follow-ups after ambulatory or breast surgeries [33-36]. Earlier research also has demonstrated that when comparing virtual to in-person visits, cancer patients in the United States, Canada, and Europe reported similar communication experiences or satisfaction with the oncology care consultations they received [7, 37, 38]. Moreover, telemedicine-based cancer genetic counseling has been shown to be feasible and effective and achieve high degrees of satisfaction among providers and patients with colorectal, breast, or gynecological cancer residing in remote or rural areas [39-42]. Although prior studies have elucidated the successful implementation of telemedicine and that certain cancer care and services delivered through telemedicine are equivalent to in-person office settings in mixture cohorts of cancer patients, the results may not be applicable to patients with breast cancer. Furthermore, most of these studies were not able to examine the distributions of oncology services comparing virtual to in-person visits because of small sample sizes and therefore are primarily descriptive. Understanding these associations can help oncology programs identify telehealth disparities and patient’s unmet needs, improve telemedicine practice and care delivery, reduce health disparities and inequities, and provide optimal support to breast cancer patients.

To fill these critical gaps in the literature, we undertook this study primarily seeking to evaluate 1) the association between neighborhood socioeconomic disadvantage and telemedicine use and 2) differences in provisions of oncology services comparing virtual to in-person office visits. The secondary objectives of this study were to describe 1) common perceived challenges or concerns related to virtual visits and 2) patient satisfaction with oncology services delivered via telemedicine in this breast cancer patient cohort.

Methods

Study Design and Population

This study used a cross-sectional design and analyzed data from patients with breast cancer enrolled in the ongoing Chicago Multiethnic Epidemiologic Breast Cancer Cohort (ChiMEC), which is a hospital-based cohort established at the University of Chicago Medicine since 1993 [43]. From July to September 2022, a total of 1,868 questionnaires were sent to ChiMEC participants who consented to follow-up surveys, with an overall response rate of 66.2% (n=1,236). For this analysis, we included 1,163 participants who reported having either telemedicine or in-person visits in the past 12 months. All participants provided their written informed consents to the ChiMEC study and follow-up surveys. The University Chicago Institutional Review Board reviewed and approved this study.

Measures

Neighborhood socioeconomic disadvantage was defined by the ADI, a composite measurement of patients' neighborhood-level income, education, employment, and housing quality based on linked zip codes and U.S. Census block groups [29, 30]. For this study, participants' residential addresses were geocoded to census block groups and then linked with the corresponding ADI national ranking percentile, which ranks neighborhoods by socioeconomic disadvantage at the national level in the United States. ADI scores range from 1 to 100, with higher scores reflecting higher levels of neighborhood socioeconomic deprivation. We further categorized ADI scores into quartiles. The 1st quartile represented the least socioeconomically deprived neighborhoods, whereas the 4th quartile represented the most deprived neighborhoods.

Telemedicine use was defined as having had a virtual care visit with a doctor or other health providers in the past 12 months and dichotomized as "yes/no." For patients who used telemedicine, we asked whether their visits were conducted through telephone, videoconferencing, or both. Similarly, in-person visits were assessed by asking participants whether they had an in-person office visit with a doctor or other health providers in the past 12 months. Further, participants were asked whether their telemedicine or in-person visits were related to six different types of oncology services: treatment consultation, review of laboratory, screening, and/or pathology results, management of cancer symptoms and/or treatment side effects, cancer genetic counseling, cancer clinical trial follow-up, and informed consent for a cancer clinical trial. Common cancer symptoms and treatment side effects discussed during virtual or in-person visits were also assessed, including hot flashes, chemotherapy-induced neuropathy, nausea and/or vomiting, pain related to cancer or cancer treatment, depressive symptoms or mood changes, fatigue or tiredness, anxiety or stress, lymphedema, and insomnia or sleep problems.

Additionally, we asked participants to report any challenges or concerns when using telemedicine, such as technological difficulty or lack of comfort with technology, lack of electronic device (e.g., desktop, laptop, smartphone, iPad, etc.), lack of high-speed internet or slow internet connection at home, compromising the patient-provider communication, compromising the patient-provider relationship, not being offered at the clinic or by a provider, cost, and not being covered by health insurance. We then asked how satisfied participants were with their virtual or in-person visits, using a 5-point Likert scale (i.e., not at all, a little, somewhat, very, and extremely satisfied). Participants were also asked how likely they were to continue using telemedicine, utilizing another 5-point Likert scale (i.e., very unlikely, unlikely, neutral, likely, and very likely).

Individual-level sociodemographic and clinicopathologic characteristics included age at survey, race/ethnicity, highest level of education, marital status, type of health insurance coverage, duration from cancer diagnosis to survey, Charlson comorbidity index (excluding breast cancer diagnoses), histologic type, AJCC stage group, molecular subtype, tumor grade, receipt of cancer treatment (chemotherapy, hormone therapy, or radiotherapy), and type of surgery. We obtained patients’ clinicopathologic information from electronic health records and hospital cancer registry. Distance from residence to hospital (in miles) was geocoded and calculated by taking the differences of coordinates (longitudes/latitudes) between the patient’s address and UChicago Medicine Comprehensive Cancer Center’s address based on the Haversine formula.

Statistical Analysis

We described patients' characteristics using summary statistics. Means (standard deviations [SD]) or medians (interquartile ranges [IQR]) were calculated for continuous variables, and we used Student's t, Wilcoxon rank-sum, or Kruskal-Wallis tests to conduct univariate analyses. For nominal data, we tabulated frequencies and percentages and compared the distributions using Pearson's X^2 or Fisher's exact tests. To examine the association between neighborhood socioeconomic disadvantage (continuous ADI scores) and telemedicine use, we fit three separate multivariable logistic regression models. For modeling, we implemented a stepwise regression approach. Model 1 included ADI, age at survey, race/ethnicity, duration from cancer diagnosis to survey, highest level of education, marital status, type of health insurance coverage, Charlson comorbidity index, and distance from residence to hospital. Model 2 was controlled for histologic type, AJCC stage, molecular subtype, and tumor grade, in addition to the covariates in model 1. Model 3 contained all variables in model 2 plus receipt of chemotherapy, hormone therapy, or radiotherapy, and type of surgery. Adjusted odds ratios (AOR) and corresponding 95% confidence intervals (95% CI) were calculated. To evaluate the differences in types of oncology services between virtual and in-person office visits, we conducted McNemar's tests on match-paired data of patients having both visit modalities. Two-sided *P* values <.05 were considered statistically significant. All statistical analyses were performed using Stata 17 (StataCorp, College Station, TX).

Results

Patient Characteristics

Overall, the study received 1,236 responses out of 1,868 surveys (response rate: 66.2%), with 1,163 participants having either telemedicine or in-person visits in the past 12 months. Of the 1,163 participants included in the analysis, the mean age was 61.8 years (SD 12.0). Most (n=845, 72.8%) breast cancer patients identified as White, followed by 229 (19.7%) as Black, 52 (4.5%) as Asian, and 35 (3.0%) as Hispanic. 747 (69.9%) were married, 450 (38.7%) had a graduate or professional degree, and 823 (70.8%) were privately insured and 267 (23.0%) were on Medicaid or Medicare. The median distance from residence to hospital was 19.9 miles (IQR: 9.5-32.3), and the median duration from cancer diagnosis to survey was 6.5 years (IQR: 3.6-11.0). By ADI quartile, breast cancer patients living in the most socioeconomically disadvantaged neighborhoods (4th quartile) tended to be older, Black, at a lower level of education, and on Medicaid or Medicare (Table 1).

Table 1. Characteristics of patients with breast cancer overall and by neighborhood socioeconomic disadvantage.

		Area Deprivation Index [a]				
Variable	Total (N=1,163)	1st quartile (n=381 [34.4%]), n (%)	2nd quartile (n=376 [33.9%]), n (%)	3rd quartile (n=252 [22.7%]), n (%)	4th quartile (n=99 [8.9%]), n (%)	*P* va
Age at survey (years), mean (SD)	61.8 (12.0)	60.9 (11.5)	61.6 (11.7)	62.0 (12.9)	64.2 (12.5)	.68
Age at survey (years)						
<45	107 (10.2)	33 (9.5)	37 (10.8)	26 (11.4)	7 (7.8)	.03
45-54	179 (17.0)	64 (18.4)	59 (17.3)	38 (16.7)	12 (13.3)	
55-64	308 (29.2)	116 (33.3)	99 (28.9)	58 (25.4)	22 (24.4)	
≥65	460 (43.6)	135 (38.8)	147 (43.0)	106 (46.5)	49 (54.4)	
Race/Ethnicity						
White	845 (72.8)	333 (87.6)	301 (80.3)	143 (56.7)	36 (36.4)	<.00

Black	229 (19.7)	16 (4.2)	40 (10.7)	98 (38.9)	56 (56.6)	
Asian	52 (4.5)	26 (6.8)	14 (3.7)	6 (2.4)	3 (3.0)	
Hispanic	35 (3.0)	5 (1.3)	20 (5.3)	5 (2.0)	4 (4.0)	
Highest level of education						
High school/GED or less	115 (9.9)	12 (3.1)	45 (12.0)	37 (14.7)	16 (16.2)	
Associate’s degree, or some college	259 (22.3)	52 (13.6)	86 (22.9)	70 (27.8)	44 (44.4)	<.00
Bachelor’s degree	338 (29.1)	127 (33.3)	102 (27.2)	69 (27.4)	20 (20.2)	
Graduate or professional degree	450 (38.7)	190 (49.9)	142 (37.9)	76 (30.2)	19 (19.2)	
Marital status						
Married	747 (69.9)	282 (80.3)	259 (73.4)	136 (59.6)	36 (40.4)	
Single or not married	192 (18.0)	44 (12.5)	53 (15.0)	59 (25.9)	30 (33.7)	<.00
Divorced, separated, or widowed	129 (12.1)	25 (7.1)	41 (11.6)	33 (14.5)	23 (25.8)	
Type of health insurance						
Private	823 (70.8)	302 (79.3)	276 (73.4)	162 (64.3)	49 (49.5)	
Medicaid	50 (4.3)	5 (1.3)	8 (2.1)	17 (6.7)	15 (15.2)	<.00
Medicare	217 (18.7)	54 (14.2)	74 (19.7)	55 (21.8)	24 (24.2)	
Other or unknown	73 (6.3)	20 (5.2)	18 (4.8)	18 (7.1)	11 (11.1)	
Distance from residence to hospital (miles) [c], median (IQR)	19.9 (9.5, 32.3)	20.5 (10.9, 31.9)	22.5 (13.3, 33.2)	16.4 (4.6, 30.5)	11.9 (3.3, 27.6)	<.00
Duration from cancer diagnosis to survey (years)						
Median (IQR)	6.5 (3.6, 11.0)	6.8 (3.7, 10.9)	6.2 (3.6, 10.3)	6.5 (3.6, 11.5)	8.3 (4.2, 11.6)	.61
≤3	199 (17.1)	58 (15.2)	68 (18.1)	48 (19.0)	14 (14.1)	.63
4-6	319 (27.4)	107 (28.1)	107 (28.5)	67 (26.6)	23 (23.2)	
≥7	645 (55.5)	216 (56.7)	201 (53.5)	137 (54.4)	62 (62.6)	
Charlson comorbidity index						
0	994 (88.5)	333 (90.5)	335 (91.5)	209 (85.0)	77 (82.8)	.03
1	62 (5.6)	19 (5.2)	11 (3.0)	21 (8.5)	6 (6.5)	
≥2	67 (6.0)	16 (4.3)	20 (5.5)	16 (6.5)	10 (10.8)	
Histologic type						
Ductal	742 (80.2)	247 (77.9)	238 (79.9)	159 (81.1)	64 (88.9)	.08
Lobular	92 (10.0)	38 (12.0)	34 (11.4)	15 (7.7)	1 (1.4)	
Ducal and lobular	55 (6.0)	19 (6.0)	18 (6.0)	12 (6.1)	3 (4.2)	
Other	36 (3.9)	13 (4.1)	8 (2.7)	10 (5.1)	4 (5.6)	
AJCC Stage group						
0	200 (18.1)	51 (14.2)	69 (19.0)	51 (21.1)	21 (22.6)	.002
I	515 (46.5)	189 (52.5)	160 (44.1)	104 (43.0)	36 (38.7)	
II	271 (24.5)	88 (24.4)	91 (25.1)	58 (24.0)	24 (25.8)	

III	112 (10.1)	31 (8.6)	42 (11.6)	24 (9.9)	10 (10.8)	
IV	10 (0.9)	1 (0.3)	1 (0.3)	5 (2.1)	2 (2.2)	
Molecular subtype						
HR+/HER2-	571 (66.2)	208 (69.3)	180 (66.2)	120 (65.6)	35 (53.8)	.06
HR+/HER+	98 (11.4)	34 (11.3)	36 (13.2)	15 (8.2)	8 (12.3)	
HR-/HER2+	51 (5.9)	12 (4.0)	17 (6.2)	19 (10.4)	3 (4.6)	
TNBC	142 (16.5)	46 (15.3)	39 (14.3)	29 (15.8)	19 (29.2)	
Tumor grade						
1	149 (14.3)	59 (17.3)	47 (13.8)	27 (11.9)	9 (10.3)	.047
2	471 (45.3)	159 (46.6)	146 (42.9)	99 (43.8)	42 (48.3)	
3	420 (40.4)	123 (36.1)	147 (43.2)	100 (44.2)	36 (41.4)	
Receipt of chemotherapy						
No	572 (54.3)	190 (54.6)	182 (53.2)	125 (54.8)	48 (53.3)	.92
Yes	482 (45.7)	158 (45.4)	160 (46.8)	103 (45.2)	42 (46.7)	
Receipt of hormone therapy						
No	341 (32.4)	100 (28.7)	113 (33.0)	74 (32.5)	39 (43.3)	.03
Yes	713 (67.7)	248 (71.3)	229 (67.0)	154 (67.5)	51 (56.7)	
Receipt of radiation therapy						
No	394 (37.4)	140 (40.2)	125 (36.5)	83 (36.4)	26 (28.9)	.08
Yes	660 (62.6)	208 (59.8)	217 (63.5)	145 (63.6)	64 (71.1)	
Type of surgery received						
None	13 (1.3)	5 (1.5)	3 (0.9)	2 (0.9)	3 (3.4)	.006
Lumpectomy	615 (59.3)	185 (53.8)	194 (57.4)	146 (66.1)	61 (68.5)	
Mastectomy	307 (29.6)	116 (33.7)	107 (31.7)	50 (22.6)	25 (28.1)	
Bilateral mastectomy	102 (9.9)	38 (11.0)	34 (10.1)	23 (10.4)	0 (0.0)	

[a] *P* values were calculated using Kruskal-Wallis tests.

[b] The Area Deprivation Index (national ranking percentile), a composite measure consisting domains of income, education, employment, and housing quality, that ranks neighborhoods by socioeconomic disadvantage at the national level. It is scored from 1 to 100, with higher scores representing greater neighborhood socioeconomic deprivation.

[c] Distance from residence to hospital was calculated by taking the differences of coordinates (longitudes/latitudes) between the patient’s address and UChicago Medicine Comprehensive Cancer Center’s address based on the Haversine formula.

Telemedicine Use and Association with ADI

Overall, 36.0% (416/1,157) of patients with breast cancer had a virtual visit in the past 12 months (Table 2). By modality of telemedicine, 266 (65.0%) clinic visits were conducted through videoconferencing only, followed by 93 (22.7%) telephone only and

50 (12.3%) both videoconferencing and telephone. The mean ADI score for telemedicine users was 37.7 (SD 24.2), compared to 39.5 (SD 24.0) for those non-users (Table 2). By ADI quartile, 38.3% (145/379) of the patients living in the least socioeconomically disadvantaged neighborhoods (1st quartile) used telemedicine, followed by 37.9% (58/153), 35.1% (132/356), and 32.5% (81/249) at the 4th, 2nd, and 3rd quartile, respectively. On multivariable regression analysis (Model 3), higher ADI scores (per 10-unit increase) were associated with lower odds of telemedicine use (AOR 0.89; 95% CI: 0.82-0.97) (Table 3).

Table 2. Characteristics of patients with breast cancer by virtual visit.

	Had a virtual visit in the past 12 months (n=1,157)		
Variable	No (n=741 [64.0%]), n (row %)	Yes (n=416 [36.0%]), n (row %)	*P* value
Modality of telemedicine			
Telephone or audio call	———	93 (22.7)	
Video conference	———	266 (65.0)	
Both	———	50 (12.3)	
Area Deprivation Index, mean (SD) [a]	39.5 (24.0)	37.7 (24.2)	.18
Area Deprivation Index [a]			
1st quartile	234 (61.7)	145 (38.3)	.13
2nd quartile	224 (64.9)	132 (35.1)	
3rd quartile	168 (67.5)	81 (32.5)	
4th quartile	95 (62.1)	58 (37.9)	
Age at survey (years), mean (SD)	62.2 (11.9)	60.9 (12.2)	.09
Age at survey (years)			
<45	56 (52.3)	51 (47.7)	.04
45-54	121 (67.6)	58 (32.4)	
55-64	201 (66.3)	102 (33.7)	
≥65	299 (65.1)	160 (34.9)	
Race/Ethnicity			
White	550 (65.3)	292 (34.7)	.08
Black	136 (60.2)	90 (39.8)	
Asian	37 (71.2)	15 (28.9)	
Hispanic	17 (48.6)	18 (51.4)	
Highest level of education			
High school/GED or less	92 (80.0)	23 (20.0)	.002

Associate’s degree, or some college	163 (63.4)	94 (36.6)	
Bachelor’s degree	208 (61.9)	128 (38.1)	
Graduate or professional degree	277 (61.8)	171 (38.2)	
Marital status			
Married	481 (64.7)	263 (35.4)	.70
Single or not married	116 (61.4)	73 (38.6)	
Divorced, separated, or widowed	83 (64.3)	46 (35.7)	
Type of health insurance			
Private	515 (63.0)	302 (37.0)	.25
Medicaid	28 (56.0)	22 (44.0)	
Medicare	147 (67.7)	70 (32.3)	
Other or unknown	51 (69.9)	22 (30.1)	
Distance from residence to hospital (miles) [b], median (IQR)	19.9 (9.8, 32.3)	20.4 (9.3, 32.3)	.96
Duration from cancer diagnosis to survey (years)			
Median (IQR)	6.8 (3.7, 10.9)	6.3 (3.5, 11.0)	.22
≤3	109 (55.0)	89 (45.0)	.009
4-6	217 (68.0)	102 (32.0)	
≥7	415 (64.8)	225 (35.2)	
Charlson comorbidity index			
0	635 (64.3)	353 (35.7)	.31
1	34 (54.8)	28 (45.2)	
≥2	44 (65.7)	23 (34.3)	
Histologic type			
Ductal	459 (62.1)	280 (37.9)	.27
Lobular	63 (68.5)	29 (31.5)	
Ducal and lobular	38 (69.1)	17 (30.9)	
Other	19 (52.8))	17 (47.2)	
AJCC Stage group			
0	135 (68.5)	62 (31.5)	.26
I	333 (64.9)	180 (35.1)	
II	161 (59.6)	109 (40.4)	
III	75 (61.5)	47 (38.5)	
IV	5 (50.0)	5 (50.0)	
Molecular subtype			
HR+/HER2-	358 (62.8)	212 (37.2)	.91
HR+/HER+	64 (65.3)	34 (34.7)	
HR-/HER2+	34 (66.7)	17 (33.3)	
TNBC	87 (62.1)	53 (37.9)	
Tumor grade			
1	87 (59.6)	59 (40.4)	.10
2	316 (67.4)	153 (32.6)	
3	258 (61.6)	161 (38.4)	
Receipt of chemotherapy			
No	377 (66.4)	191 (33.6)	.19

Yes	300 (62.5)	180 (37.5)	
Receipt of hormone therapy			
No	217 (64.4)	120 (35.6)	.92
Yes	460 (64.7)	251 (35.3)	
Receipt of radiation therapy			
No	255 965.4)	135 (34.6)	.68
Yes	422 (64.1)	236 (35.9)	
Type of surgery received			
None	6 (46.2)	7 (53.8)	.35
Lumpectomy	404 (66.0)	208 (34.0)	
Mastectomy	190 (62.5)	114 (37.5)	
Bilateral mastectomy	68 (66.7)	34 (33.3)	

[a] *P* values were calculated using Student's t, Wilcoxon rank-sum, Pearson's X^2, or Fisher's exact tests, as appropriate.

[b] Distance from residence to hospital was calculated taking the differences of coordinates (longitudes/latitudes) between the patient's address and UChicago Medicine Comprehensive Cancer Center's address based on the Haversine formula.

Table 3. Association between neighborhood socioeconomic disadvantage and telemedicine use in breast cancer patients.

	Model 1	Model 2	Model 3
Variable	AOR [c] (95% CI)	AOR [d] (95% CI)	AOR [e] (95% CI
Area Deprivation Index (continuous) [a,b]	0.93 (0.87-0.99) *	0.89 (0.82-0.96) **	0.89 (0.82-0.97
Distance from residence to hospital [b]	1.04 (0.99-1.10)	1.03 (0.97-1.09)	1.02 (0.96-1.09
Age at survey (years)			
<45	1.0 (reference)	1.0 (reference)	1.0 (reference)
45-54	0.55 (0.33-0.94) *	0.53 (0.29-0.97) *	0.49 (0.27-0.91
55-64	0.57 (0.35-0.93) *	0.64 (0.37-1.11)	0.63 (0.36-1.12
≥65	0.65 (0.39-1.09)	0.62 (0.34-1.13)	0.63 (0.34-1.18
Race/Ethnicity			
White	1.0 (reference)	1.0 (reference)	1.0 (reference)
Black	1.86 (1.21-2.86) **	2.50 (1.48-4.20) **	2.38 (1.41-4.00
Asian	0.55 90.26-1.17)	0.50 (0.20-1.22)	0.50 (0.20-1.23
Hispanic	2.12 (1.02-4.41) *	2.85 (1.17-6.91) *	2.65 (1.07-6.58
Highest level of education			
High school/GED or less	1.0 (reference)	1.0 (reference)	1.0 (reference)
Associate's degree, or some college	2.66 (1.47-4.81) **	2.76 (1.40-5.44) **	2.67 (1.33-5.35
Bachelor's degree	2.43 (1.35-4.38) **	2.61 (1.33-5.10) **	2.75 (1.38-5.48
Graduate or professional degree	2.46 (1.39-4.38) **	2.55 (1.32-4.93) **	2.57 (1.31-5.04
Duration from cancer diagnosis to survey (years)			
≤3	1.0 (reference)	1.0 (reference)	1.0 (reference)
4-6	0.63 (0.41-0.96) *	0.67 (0.42-1.08)	0.75 (0.46-1.21
≥7	0.67 (0.45-1.01)	0.60 (0.38-0.96) *	0.65 (0.40-1.05

[a] The Area Deprivation Index (national ranking percentile), a composite measure consisting domains of income, education, employment, and housing quality, that ranks

neighborhoods by socioeconomic disadvantage at the national level. It is scored from 1 to 100, with higher scores representing greater neighborhood socioeconomic deprivation.

[b] Odds ratios were per 10-unit increase.

[c] Additionally adjusted for marital status, health insurance, and Charlson comorbidity index.

[d] Additionally adjusted for marital status, health insurance, Charlson comorbidity index, histologic type, stage, molecular subtype, and tumor grade.

[e] Additionally adjusted for marital status, type of health insurance, Charlson comorbidity index, histologic type, stage, molecular subtype, tumor grade, receipt of chemotherapy, of hormone therapy, or of radiotherapy, and type of surgery.

* *P*<0.05; ** *P*<0.01.

In the same model (Model 3), breast cancer patients aged 45-54 years had lower odds of having a virtual visit than those aged <45 years (AOR 0.49; 95% CI: 0.27-0.91). Patients aged 55-64 years (AOR 0.63; 95% CI: 0.36-1.12) or ≥65 years (AOR 0.63; 95% CI: 0.34-1.18) also had a lower likelihood, but these differences were not statistically significant. Black (AOR 2.38; 95% CI: 1.41-4.00) or Hispanic (AOR 2.65; 95% CI: 1.07-6.58) patients had greater odds of telemedicine use than White patients. Compared to patients with high school or less education, those with an Associate’s (AOR 2.67; 95% CI: 1.33-5.35), Bachelor’s (AOR 2.75; 95% CI: 1.38-5.48), or graduate (AOR 2.57; 95% CI: 1.31-5.04) degree had higher odds of telemedicine use in the past 12 months. Longer distance from residence to hospital (per 10-mile increase) was associated with greater odds of use of telemedicine, though not statistically significant (AOR 1.02; 95% CI: 0.96-1.09) (Table 3). Clinicopathologic and treatment factors were not significantly associated with telemedicine use (Table S1 in Multimedia Appendix 1). In subgroup analyses, ADI was not statistically significantly different between videoconferencing and telephone (AOR 0.88; 95% CI: 0.73-1.07), though there was a trend that patients living in high ADI areas were less likely to use videoconference than telephone. We also observed that patients with a graduate or professional degree had greater odds of using videoconference (AOR 5.78; 95% CI: 1.03-32.55) and patients on Medicare had significantly lower odds of videoconference use than those privately insured (AOR 0.26; 95% CI: 0.07-0.91) (Table S2 in Multimedia Appendix 1).

Comparisons of Oncology Services between Virtual and In-Person Visits

Figure 1 displays the breakdown of oncology services by visit type for breast cancer patients. Overall, 31.3% (130/416) of the patients used telemedicine for the purpose of treatment consultation, 22.4% (93/416) for reviewing laboratory, screening, and/or pathology results, 13.5% (56/416) for managing cancer symptoms and/or treatment side effects, 4.3% (18/416) for cancer genetic counseling, and 3.4% (14/416) for cancer clinical trial follow-ups. Among patients who had in-person visits, reviewing laboratory, screening, and/or pathology was reported the most (30.0%, 322/1,072), followed by 24.7% (265/1,072) treatment consultation, 15.8% (169/1,072) management of cancer symptoms and/or treatment side effects, 5.0% (54/1,072) genetic counseling, and 5.0% (54/1,072) cancer clinical trial follow-ups. After analyzing match-paired data (Table 4), we observed significant differences between virtual and in-person visits in the provision of management of cancer symptoms and/or treatment side effects, review of laboratory, screening, and/or pathology results, or cancer clinical trial follow-ups. However, there were no significant differences in offering treatment consultation (45, 11.1% vs. 55, 13.6%; *P*=.32) or cancer genetic counseling (11, 2.7% vs. 19, 4.7%; *P*=.14) between virtual and in-person visits (Table 4).

Table 4. Analysis of match-paired data on oncology services by type of visit among

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breast cancer patients.

Type of visit	Variable	Telemedicine visits n (%)		*P* value[a]
		No	Yes	
	Treatment consultation			
In-person visits n (%)	No	222 (54.8)	45 (11.1)	.32
	Yes	55 (13.6)	83 (20.5)	
	Management of treatment side effects or cancer symptoms			
In-person visits n (%)	No	295 (72.8)	15 (3.7)	<.001
	Yes	54 (13.3)	41 (10.1)	
	Review of laboratory, screening and/or pathology results			
In-person visits n (%)	No	224 (55.3)	26 (6.4)	<.001
	Yes	90 (22.2)	65 (16.0)	
	Cancer genetic counselling			
In-person visits n (%)	No	368 (90.9)	11 (2.7)	.14
	Yes	19 (4.7)	7 (1.7)	
	Cancer clinical trial follow-up visits			
In-person visits n (%)	No	379 (93.6)	4 (1.0)	.046
	Yes	12 (3.0)	10 (2.5)	

[a] *P* values were calculated using McNemar's test.

Among breast cancer patients who reported the management of cancer symptoms and/or treatment side effects (Figure 2), those with in-person visits had greater proportions of having discussed fatigue (50.3%, 85/169 vs. 41.1%, 23/56), hot flashes (45.6%, 77/169 vs. 33.9%, 19/56), lymphedema (26.0%, 44/169 vs. 19.6%, 11/56), chemotherapy-induced neuropathy (24.9%, 42/169 vs. 19.5%, 11/56), or nausea and/or vomiting (16.0%, 27/169 vs. 8.9%, 5/56) than patients with virtual visits; whereas a higher proportion of patients having discussed depressive symptoms through telemedicine than in-person visits (37.5%, 21/56 vs. 29.6%, 50/169). By modality of telemedicine, a higher percentage of the patients used both telephone and video for treatment consultation than video or telephone alone (Table S3 in Multimedia Appendix

1). In addition, there were no significant differences in the distributions of various management of cancer symptoms and/or treatment side effects across the three telemedicine modalities (Table S4 in Multimedia Appendix 1).

Telemedicine Use Challenges or Concerns and Satisfaction

Compared with breast cancer patients who did not use telemedicine, those who did reported a higher percentage of technology difficulty or lack of comfort with technology (51, 12.3% vs. 21, 2.8%; *P*<.001), compromising the patient-provider communication (28, 6.7% vs. 16, 2.2%; *P*<.001), compromising the patient-provider relationship (35, 8.4% vs. 12, 1.6%; *P*<.001) (Table 5). Further, Telemedicine users reported 93.7% (132/141) and 95.5% (301/315) somewhat-to-extreme satisfaction with their telephone call and video conference experiences, respectively, and 61.8% (254/411) of the patients were likely or very likely to continue using telemedicine (Table S5 in Multimedia Appendix 1). In addition, no significant differential distributions of satisfaction with virtual visits across all oncology services were observed, stratified by modality of telemedicine (Table 6) or overall (Table S6 in Multimedia Appendix 1).

Table 5. Percentages of challenges or concerns regarding telemedicine use reported by breast cancer patients.

		Had a virtual visit in the past 12 months		
Variable	Overall (N=1,157), n (%)	No (n=741 [64.0%]), n (col %)	Yes (n=416 [36.0%]), n (row %)	*P* valu
Technology difficulty or lack of comfort with technology				
No	1,085 (93.8)	720 (97.2)	365 (87.7)	<.001
Yes	72 (6.2)	21 (2.8)	51 (12.3)	
Lack of an electronic device (e.g., desktop, laptop, smartphone, iPad)				

No	1,151 (99.5)	739 (99.7)	412 (99.0)	.20
Yes	6 (0.5)	2 (0.3)	4 (1.0)	
Lack of high-speed internet or slow internet connection at home				
No	1,133 (97.9)	730 (98.5)	403 (96.9)	.06
Yes	24 (2.1)	11 (1.5)	13 (3.1)	
Compromising the patient-provider communication				
No	1,113 (96.2)	725 (97.8)	388 (93.3)	<.001
Yes	44 (3.8)	16 (2.2)	28 (6.7)	
Compromising the patient-provider relationship				
No	1,110 (95.9)	729 (98.4)	381 (91.6)	<.001
Yes	47 (4.1)	12 (1.6)	35 (8.4)	
Not being offered at the clinic or by a provider				
No	1,140 (98.5)	729 (98.4)	411 (98.8)	.80
Yes	17 (1.5)	12 (1.6)	5 (1.2)	
Cost				
No	1,148 (99.2)	737 (99.5)	411 (98.8)	.30
Yes	9 (0.8)	4 (0.5)	5 (1.2)	
Not being covered by health insurance				
No	1,146 (99.0)	736 (99.3)	410 (98.6)	.22
Yes	11 (1.0)	5 (0.7)	6 (1.4)	

[a] *P* values were calculated using Pearson's X^2 or Fisher's exact tests.

Table 6. Percentages of satisfaction with telephone call or videoconferencing by oncology services in breast cancer patients

	How satisfied were you with your telephone call with doctors or other health care providers? (n=141)					
Were your telemedicine visits related to the following oncology services?	Not at all (n=2 [1.4%]), n (row %)	A little (n=7 [5.0%]), n (row %)	Somewhat (n=28 [19.9%]), n (row %)	Very (n=62 [44.0%]), n (row %)	Extremely (n=42 [29.8%]), n (row %)	*P* va
Treatment consultation						
No	1 (1.0)	5 (5.0)	20 (19.8)	44 (43.6)	31 (30.7)	.70
Yes	1 (2.5)	2 (5.0)	8 (20.0)	18 (45.0)	11 (27.5)	
Review of laboratory, screening and/or pathology results						
No	1 (1.0)	3 (3.0)	25 (24.8)	41 (40.6)	31 (30.7)	.92
Yes	1 (2.5)	4 (10.0)	3 (7.5)	21 (52.5)	11 (27.5)	
Management of treatment side effects or cancer symptoms						

No	1 (0.8)	7 (5.7)	24 (19.5)	51 (41.5)	40 (32.5)	.22
Yes	1 (5.6)	0	4 (22.2)	11 (61.1)	2 (11.1)	
Cancer genetic counselling						
No	2 (1.5)	7 (5.3)	26 (19.6)	57 (42.9)	41 (30.8)	.58
Yes	0	0	2 (25.0)	5 (62.5)	1 (12.5)	
Cancer clinical trial follow-up visits						
No	2 (1.4)	7 (5.0)	28 (20.0)	61 (43.6)	42 (30.0)	.95
Yes	0	0	0	1 (100.0)	0	

	How satisfied were you with your video conference with doctors or other health care providers?					
	(n=315)					
	Not at all (n=8 [2.5%]), n (row %)	A little (n=6 [1.9%]), n (row %)	Somewhat (n=56 [17.8%]), n (row %)	Very (n=157 [49.8%]), n (row %)	Extremely (n=88 [27.9%]), n (row %)	*P* va
Treatment consultation						
No	4 (2.0)	5 (2.5)	36 (17.7)	104 (51.0)	55 (27.0)	.78
Yes	4 (3.6)	1 (0.9)	20 (18.0)	53 (47.8)	33 (29.7)	
Review of laboratory, screening and/or pathology results						
No	6 (2.4)	4 (1.6)	47 (19.1)	117 (47.6)	72 (29.3)	.77
Yes	2 (2.9)	2 (2.9)	9 (13.0)	40 (58.0)	16 (23.2)	
Management of treatment side effects or cancer symptoms						
No	8 (3.0)	6 (2.2)	50 (18.5)	132 (48.9)	74 (27.4)	.20
Yes	0	0	6 (13.3)	25 (55.6)	14 (31.1)	
Cancer genetic counselling						
No	7 (2.3)	6 (2.0)	54 (17.9)	150 (49.8)	84 (27.9)	.98
Yes	1 (7.1)	0	2 (14.3)	7 (50.0)	4 (28.6)	
Cancer clinical trial follow-up visits						
No	8 (2.7)	6 (2.0)	54 (17.9)	146 (48.5)	87 (28.9)	.48
Yes	0	0	2 (14.3)	11 (78.6)	1 (7.1)	

[a] *P* values were calculated using Wilcoxon rank-sum tests.

Discussion

Principal Findings

The current study built on previous work investigating the relationship between neighborhood socioeconomic disadvantage and telemedicine use among breast cancer patients and provisions of oncology services comparing virtual to in-person office visits. Telemedicine utilization has expanded dramatically since the COVID-19 pandemic. However, not all breast cancer patients benefited from the expansion, as our study uncovered that patients with higher ADI scores (i.e., lower neighborhood-level SES) were less likely to have used telemedicine in the past 12 months. Although patients cited technology difficulty or lack of comfort with technology and compromises of patient-provider communication and relationship as common challenges or concerns, they expressed high degrees of satisfaction with virtual experiences and willingness to continue using telehealth care and services in the future. Additionally, both telemedicine and in-person visits were equally likely to deliver treatment consultation and cancer genetic counseling, while management of cancer symptoms and/or treatment side effects, review of laboratory, screening, and/or pathology results, or cancer clinical trial follow-ups were more likely to be offered in person.

One key study finding is that breast cancer patients living in greater socioeconomically disadvantaged neighborhoods were less likely to utilize telemedicine for care and services, consistent with previous studies of patients in primary care, adult outpatients, and hematology/oncology settings [8, 24-28]. A descriptive study suggested no correlation between the ADI and interest in telehealth visits among only 64 patients with head and neck cancers (interested: median ADI score=4.0 vs. not interested: median ADI score=5.0; *P*=.79) [27], while the small sample size limited the reliability of these findings. Lee et al. analyzed a cohort of 341,089 hematology/oncology patients, demonstrating a significant difference in the distribution of telemedicine utilization between patients living in the most socioeconomically disadvantaged neighborhoods than those in the least (46.1% vs. 54.0%; *P*<.01) [28]. However, the proportion of breast cancer patients and adjusted estimates are unknown due to the descriptive nature of this analysis. In another study, Hassan et al. observed a 3.0% decrease in the number of telemedicine visits as the ADI increased per 10 units among financially distressed oncology patients [8], whereas an 11.0% decrease in telemedicine use was observed in our breast cancer patient cohort. Our estimated effect is larger possibly due to our large sample size and the heterogenous group of breast cancer patients. Our findings indicate that neighborhood-level SES may have a bigger impact on the use of telemedicine among patients with breast cancer. Neighborhood socioeconomic disadvantage is associated with access to virtual care and services. Strategies to enhance the accessibility of telehealth are needed to reduce neighborhood-level socioeconomic disparities in telemedicine utilization among breast cancer patients, particularly among patients living in socioeconomically deprived neighborhoods and regions.

Consistent with prior research in patients with breast, gynecological, or other cancer [3, 4, 11], we found that more than one in 3 breast cancer patients had a virtual visit in the past 12 months. With respect to race/ethnicity, Black or Hispanic patients were more than twice as likely as their White counterparts to have used telemedicine. In previous studies, Campos-Castillo et al. [44] observed that Black or Latino U.S. adults were more likely to have telehealth visits, and Reed et al. [45] documented a higher likelihood of using both phone and video for primary care. However, a study in an outpatient oncology care center revealed that Hispanic or Asian patients were less likely than White patients to have used telemedicine, while no significant difference between Black and White patients [11]. These inconsistent results are possibly due to sampling variability and the heterogeneous characteristics of patient populations in oncology and other clinical settings. Nevertheless, our finding indicates that racial/ethnic minority breast cancer patients may have unique and greater needs for telehealth. Similarly, compared to patients with high school or less education, those with an Associate’s, Bachelor’s, or graduate degree had more than two-fold greater odds of telemedicine use. Older age groups were associated with a lower likelihood of telemedicine utilization. These findings are well-documented in the literature and highlight the influence of individual-level SES on the use of telemedicine. Telemedicine may have the potential to improve telehealth care and service utilization among racial/ethnic minority patients with breast cancer. Oncology programs should also ensure that patients who are older or with lower levels of education have equal access to these care and services.

Another notable finding is that patient-reported treatment consultations and cancer genetic counseling services occur with an equal frequency when comparing telemedicine to in-person office visits. Our study supports existing literature on the feasibility and acceptability of teleoncology consultations and telehealth-based cancer genetic counseling in providers and their cancer patients [7, 31-42]. But only a few prior studies compared these oncology services between virtual and in-person visits, and most samples were small. A univariate analysis of 509 oncology patients from the University of Texas MD Anderson Cancer Center reported a similar distribution of seeking integrative oncology consultation between telehealth and in-person settings [37]. McDonald et al. illustrated no significant differences in providing cancer genetic services (in-person vs. telegenetics) by rural/urban residence or perceived cancer risk [46]. We also observed that patients were particularly more likely to join treatment consultations through videoconference than telephone. However, we found significant variations in provisions of management of cancer symptoms and/or treatment side effects, review of laboratory, screening, and/or pathology results, and cancer clinical trial follow-ups between virtual and in-person office visits. In the subgroup of breast cancer patients who reported the management of cancer symptoms and/or treatment side effects, more than one-third of the patients discussed depressive symptoms/mood change or anxiety/stress during virtual visits with their providers. This finding indicates that telemedicine may be in greater need among these patients. Taken together, our data demonstrate the variations of provisions of oncology services between virtual and in-person visits among breast cancer patients. Cancer programs and providers may consider tailoring the delivery of care and services according to patients' care needs and preferences. Future research will be necessary to explore reasons or factors that explain these variations and whether there are unmet telehealth needs in breast cancer patients experiencing certain mental health symptoms.

When asked about challenges or concerns related to telemedicine use, we found that significantly higher proportions of the breast cancer patients who had virtual visits cited technology difficulty or lack of comfort with technology, compromise of the patient-provider communication, or compromise of the patient-provider relationship. Possibly, those telemedicine nonusers did not have first-hand experience of technology difficulty. Our finding is aligned with previous research [27], but not with two cross-sectional studies [9][38], which reported similar patient-provider communication experiences when comparing virtual to in-person visits. Analyses are further needed to determine the correlations between telemedicine utilization and these challenges or concerns in breast cancer patients. Despite these challenges or concerns, patients reported a remarkably high level of satisfaction with their telemedicine use experiences (>95.0%) and over 60.0% expressed the willingness to continue telemedicine use, congruent with prior studies in oncology patients [6, 7, 10, 33, 34]. However, prior research evaluated only overall satisfaction, whereas we found a similar level of satisfaction by type of oncology services or across various cancer symptoms and/or treatment side effects discussed during virtual visits, irrespective of the modality of telemedicine. These findings offer a practical implication for telehealth implementation and care and service delivery, but future research in telemedicine program evaluation is necessary.

Limitations

Several limitations of this study should be considered. First, the survey data were per self-report, which is prone to recall error or social desirability. However, this bias is likely very minimal because our research staff had limited-to-none interaction with the participants that would influence the survey responses. Second, the study sample included only breast cancer patients who were willing to respond to our survey. The proportions of self-reported visits for oncology services and perceived challenges or concerns related to telemedicine use probably have been underestimated. Our estimated effect of neighborhood socioeconomic disadvantage on telehealth usage in breast cancer patients also may be underestimated. Third, the current study evaluate the broader access to telehealth care and services including oncology and therefore, the results may not be specific to breast oncology. However, it is important to point out that regardless of treatment status and duration since diagnosis, patients have other care and service needs across the cancer care continuum and different clinical settings. Fourth, distance from residence to hospital was not associated with telemedicine use. It was calculated based on the Haversine formula, which did not account for travel time, traffic patterns, lack of transportation, road conditions, weather, and other environmental factors. Additionally, we were not able to assess other unmeasured potential confounding factors, such as the availability and density of telehealth clinics or cancer programs in the geographic area, local technology or digital infrastructure, that could affect the associations or variability we observed in this analysis. Thus, this warrants future research. Lastly, participants in the ChiMEC study may not be representative of all patients with breast cancer nationally, which limits the generalizability of our findings.

Conclusions

In conclusion, our findings from ChiMEC breast cancer patients offer insights into the impact of neighborhood socioeconomic disadvantage on telemedicine utilization and provisions of oncology services comparing virtual to in-person visits, underscoring the importance of identifying neighborhood-level socioeconomic disparities and patients' unmet needs for telemedicine. Oncology programs should address these disparities and needs to improve care delivery and achieve telehealth equity for their patient populations. Meanwhile, as cancer centers and research organizations further embrace telemedicine and other digital platforms, it is essential to tackle patients' perceived challenges or concerns and consider allocating these platforms to particular care and services, such as genetic counseling, treatment consultation, and management of depressive symptoms and anxiety, in order to provide high-quality virtual care and services to patients with breast cancer.

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Authors' Contributions

J.Q.F.: Conceptualization, methodology, design, survey development, data analysis, formatting tables/figures, and writing the initial manuscript. F.Z.: Methodology, design, survey development, research implementation, and data collection. F.M.H.: Conceptualization, methodology, and design. R.N.: Methodology, design, survey development, and research implementation. O.I.O.: Methodology, design, and research

implementation. D.H.: Conceptualization, methodology, design, survey development, research implementation, and overall supervision. All authors contributed to interpretations of the findings, writing, review, and editing of the manuscript, and approval of the final manuscript and submission.

Data Availability

Data used in this study cannot be publicly shared due to patient confidentiality and privacy concerns. However, the data can be acquired upon reasonable request pending the approval of the University of Chicago Institutional Review Board and the corresponding author.

Conflicts of Interest

J.Q.F., F.M.H., F.Z., and D.H. declare no financial or non-financial competing interests.

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Abbreviations

ADI: Area Deprivation index

AJCC: American Joint Committee on Cancer

AOR: adjusted odds ratio

ChiMEC: Chicago Multiethnic Epidemiologic Breast Cancer Cohort

CI: confidence interval

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COVID-19: coronavirus disease 2019

GED: general educational development

HER2: human epidermal growth factor receptor 2

HR: hormone receptors

IQR: interquartile range

SD: standard deviation

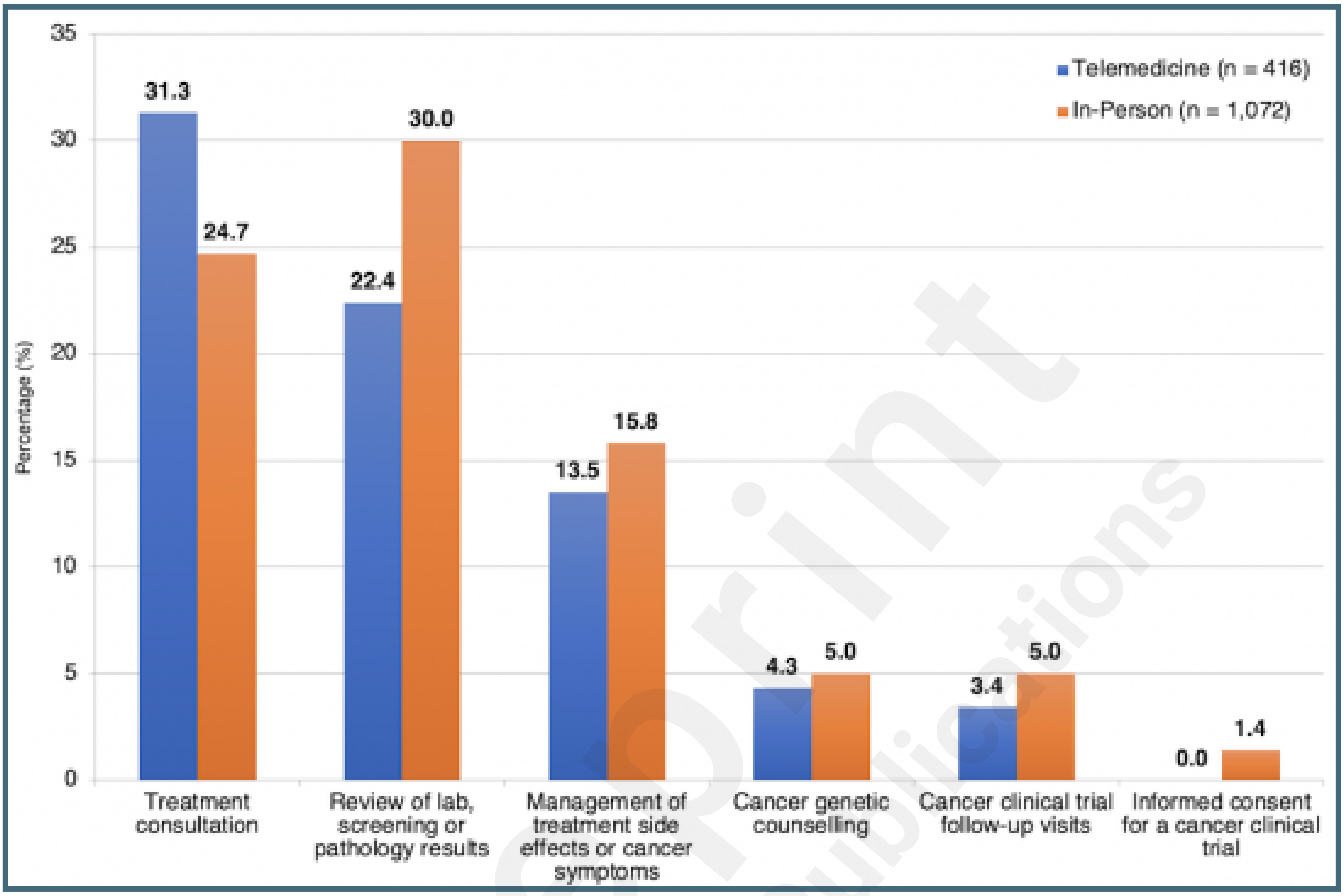
SES: socioeconomic status

TNBC: triple-negative breast cancer

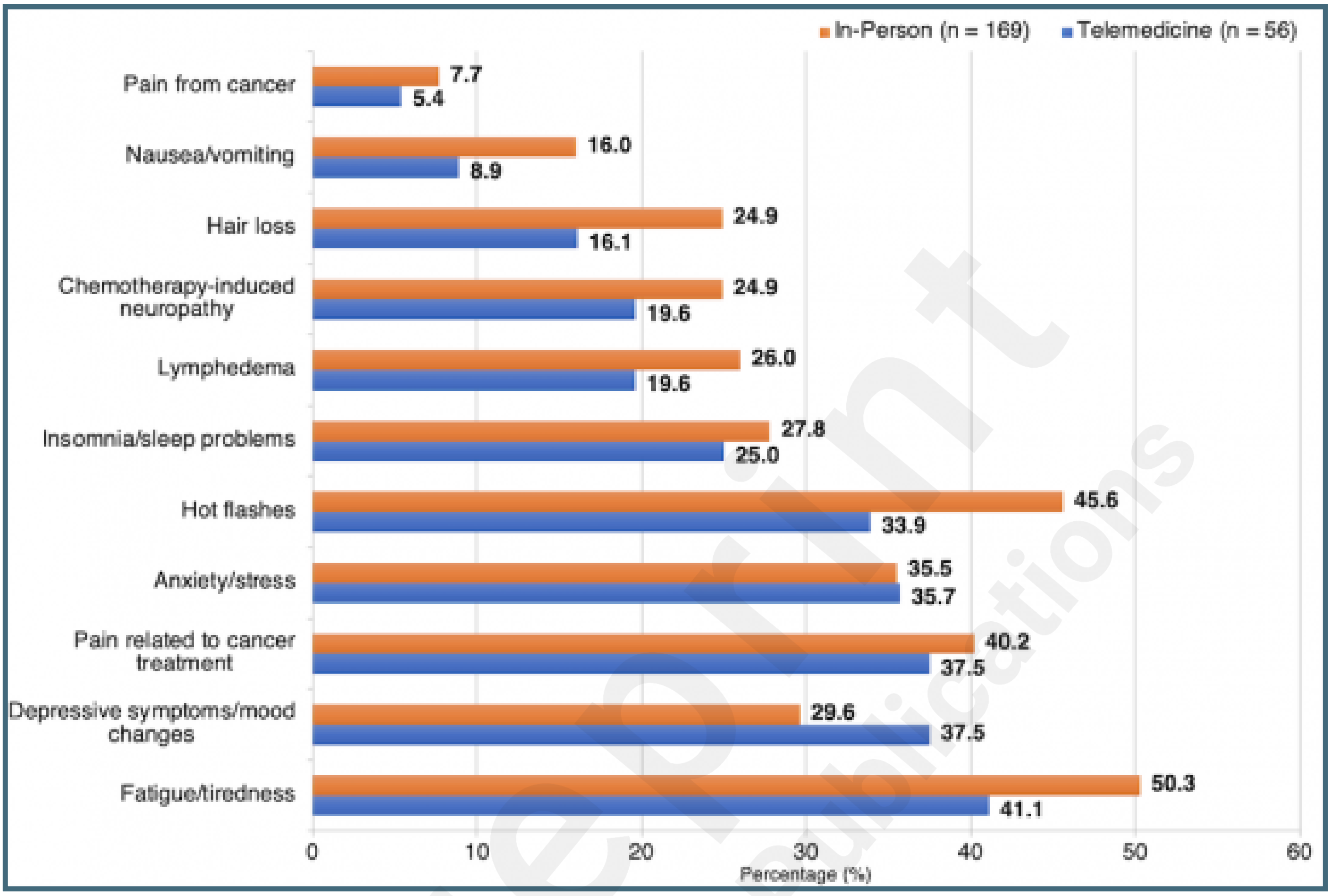
Supplementary Files

Figures

Percentages of oncology services by type of visit among patients with breast cancer.



Percentages of cancer symptoms and treatment side effects discussed during virtual or in-person visits reported by breast cancer patients.



Multimedia Appendixes

Supplemental Materials: Tables S1-S6 and Survey Questions.
URL: http://asset.jmir.pub/assets/25d20540c8a5a6c399125cf0352b7347.docx