Evaluation of Health Perceptions And Healthcare Utilization Among Population-Based Female Cancer Survivors And Cancer-Free Women

Kate E Dibble (✉ kdibble2@jhu.edu)

Johns Hopkins University Bloomberg School of Public Health   https://orcid.org/0000-0001-6791-2977

Maneet Kaur

Johns Hopkins University Bloomberg School of Public Health

Junrui Lyu

Johns Hopkins University Bloomberg School of Public Health

Avonne E Connor

Johns Hopkins University Bloomberg School of Public Health

Abstract

Purpose. Cancer survivors are more likely to report having a poor health status when compared to the general population; however, few studies have focused on the impact of cancer on perceived health status, in combination with other healthcare utilization and access outcomes, among women from disadvantaged health populations.

Methods. 25,741 women with and without a history of cancer from the National Health and Nutrition Examination Survey (NHANES) from 1999 to 2016 contributed data. Adjusted odds ratios (aORs) and 95% confidence intervals (CIs) were estimated using multivariable logistic regression models for the associations between cancer status and healthcare utilization and access outcomes. Models were stratified by race/ethnicity, federal poverty level (FPL), education, and comorbidities.

Results. A total of 2,415 (9.4%) women had a history of cancer with breast cancer as the most common site (*n*=704, 29.2%). While most survivors were non-Hispanic white (68.4%), 15.2% were Hispanic, 12.1% were non-Hispanic Black, and 4.3% were additional racial/ethnic groups. Survivors were 1.28 times more likely to report fair/poor perceived health status (95% CI, 1.09-1.50), 1.61 times more likely to report hospitalizations in the last year (95% CI, 1.40-1.86), and 1.37 times more likely to see a mental health provider within the last year (95% CI, 1.12-1.66) compared to controls. Race/ethnicity and FPL were the only significant effect modifiers.

Conclusion. Our study identifies disparities in health status and healthcare utilization among female cancer survivors and recognizes the importance of evaluating these associations among disadvantaged health populations. These findings could inform future cancer survivorship care.

Introduction

In 2020 there were an estimated 16.9 million cancer survivors living in the United States (US), with more than 67% surviving more than five years post-diagnosis[1]. The National Cancer Institute (NCI)[2] estimated that female cancers comprised 48.8% of all new cancers, with the most common, breast (30%), lung/bronchus (13%), and colorectal (8%) accounting for approximately 50% of new cancer cases. Surviving cancer does not guarantee higher quality of life (QOL) or overall betterment of health, as there are many complications from cancer treatment, recurrence, and related comorbid conditions that occur throughout survivorship[3-5]. Past literature has shown that cancer survivors, in general, are more likely to report poorer health status when compared to individuals without cancer[5]. Specifically, female cancer survivors face barriers to successful and long-term health, including several physical and psychosocial aspects (e.g., related comorbid conditions, recurrence, mental health outcomes, etc.) that span the entire cancer continuum, a framework that describes the understanding and experience from cancer etiology to survivorship[6].

Much of past healthcare utilization research focusing on female cancer survivors has concentrated on the role of fear of recurrence[7, 8], and by association, continuous cancer screening[9] and healthcare utilization[10, 11]. Despite increased utilization, there are groups, such as disadvantaged health populations (e.g., racial/ethnic minorities, those of lower socioeconomic position [SEP], those with lower educational attainment, those with chronic conditions, etc.) that under-utilize routine healthcare during cancer survivorship[12, 13]. Although cancer survivors have an increased risk of recurrence[14, 15], this risk is overtaken by pertinent barriers to preventive cancer care, unfortunately leading to increases in cancer-oriented morbidity and mortality among these groups[16, 17]. Healthcare utilization, therefore, relies on access, with cancer survivors noting barriers in communication, transportation, financial hardships, and social influences[18-21], as well as care quality[22-25]. Few studies have focused on the impact and resonance of cancer on perceived health as well as healthcare utilization and access among women from disadvantaged health populations on a national level[26].

Objectives

The current study aims to determine the association between being a cancer survivor vs cancer-free individual (control) and a number of health-related outcomes (i.e., perceived health status, presence of routine healthcare, type of place visited for routine healthcare, hospitalizations in the last year, seeing a mental health provider in the last year), adjusting for covariates. Secondarily, we hope to determine such associations between survivor/control status and the health-related outcomes listed above stratified by FPL, education, race/ethnicity, and comorbidity status.

Materials And Methods

NHANES Data and Sample

The current study utilized publicly available data from the continuous National Health and Nutrition Examination Survey (NHANES, administered and collected by the National Center for Health Statistics (NCHS) from the Centers for Disease Control and Prevention (CDC). NHANES is national program that assesses the health of adults and children in the US. Since 1999, this survey is collected on 2-year continuous cycles of the civilian, noninstitutionalized population, providing information on the health of the US population. Participants are recruited through a four-stage, complex stratified probability clustered sampling design[27-29], where approximately 7,000 US residents from 15 counties are randomly contacted for participation yearly. Data are collected via interviews, laboratory tests, and physical examinations with sample weights assigned to each participant based upon the number of people that the participant represents within the US Census population[27-29]. The entire description of NHANES, annual data collection, participants, and its ancillary studies are available on the NHANES website[30]. For the purposes of the current study, NHANES interview data collected from 1999 to 2016 were combined and weighted appropriately.

The NHANES was approved by the NCHS Research Ethics Review Board and written informed consent was obtained from all participants[28]. The current cross-sectional study analyzed 27,607 women from the NHANES from 1999 to 2016. Inclusion criteria included completing the NHANES questionnaire, being female, age (NHANES adult age is 20 years or older) and reporting whether a cancer or malignancy was ever diagnosed in the past (see Figure 1). Analyses were limited to adult age (≥20 years) because questions relating to the current study including questions about smoking and alcohol intake were only asked of that age group and cancers were more common within this group.

Model Variables

Predictor variable. Participants were stratified into groups of those reporting a history of any type of cancer and those without a history of cancer according to the question, "Have you ever been told you had cancer or malignancy?"[30]. This variable was binary (0=control, 1= cancer survivor) and expressed survivor/control status. Those who did not report whether a cancer or malignancy or those who reported a previous non-melanoma skin cancer history were diagnosed in the past were removed from analysis.

Outcome assessment. According to NHANES[30], the Hospital Utilization and Access to Care section (HUQ) provides respondent-level self-reported health status and access to healthcare questions. The current study utilized five outcomes from the NHANES HUQ section of the in-home interview to determine overall health and healthcare utilization: 1) general health perception (missing 12.5%), 2) routine place to go for healthcare (missing 0.01%), 3) type of place most often go for healthcare (missing 11.6%), 4) hospitalized in the past year (missing 0.1%), and 5) seen mental health professional in past year (missing 0.1%)[30]. The sixth NHANES HUQ outcome (time since last healthcare visit) was removed from the current analyses due to high missingness (86.0%).

Original polynomial response options were transformed to binary outcomes for the purposes of analysis. General health perception, set upon a five-point Likert scale ranging from one (excellent) to five (poor), was dichotomized (0=excellent/very good/good, 1=fair/poor). Having a routine place to go for healthcare presented with three response options (1=yes, 2=there is no place, 3=there is more than one place) but was transformed (0=no, 1=yes or more than one place). The type of place most often went for healthcare was only analyzed from individuals who had identified as having one or more routine place for healthcare. The original variable had six response options (clinic/healthcare center, doctor's office/health management organization [HMO], hospital emergency room [ER], hospital outpatient department, some other place, doesn't go to one place most often) which was dichotomized based upon whether the response was urgent/no one place or other types of care (0=clinic/healthcare center, ER, or no care; 1=doctor's office/HMO, hospital outpatient department, some other place). The last two outcomes, hospitalized within the last year and seen mental health professional within the last year, were both originally dichotomous (1=yes, 2=no) but were recoded for the ease of analysis (0=no, 1=yes), with "no" as the referent group.

Covariates and stratifications. The following variables were accounted for and included as covariates across all models: age at interview in years, education, marital status, FPL, BMI status, smoking status, alcoholic drinks per day, health insurance status, and exercise. Age at interview and alcoholic drinks per day were treated as continuous. Polynomial categorical variables were dichotomized into the following variables: education (0=no college, 1=some college or more), marital status (0=not married, 1=married), BMI status categorized from height/weight body measures (0=underweight/normal, 1=overweight/obese), smoking status (0=never smoked, 1=former/current smoker), health insurance status (0=no, 1=yes), current exercise (0=no, 1=yes), poverty status (0=below FPL, 1=at or above FPL), race/ethnicity (0=non-Hispanic white, 1=minority ethnicity/race), and comorbidity status (0=no comorbidities, 1=comorbidities). Smoking status was combined from the NHANES cigarette smoking (SMD) variables, currently smoke cigarettes and time since quitting cigarettes. Participants were considered current smokers if they had answered current smoking status as 'every day' or 'some days' and considered former smokers if they had reported any amount of time since quitting. Exercise status was determined from a number of NHANES physical activity (PAQ) variables outlining low/walking-, moderate-, and/or vigorous-intensity physical activity (PA). The transformed variable (no/yes) was affirmative if the participant denoted participating in any form of the above PA. Analyses were stratified by several variables: education (0=no college, 1=some college), FPL, race/ethnicity, and comorbidity status (0=no comorbidities, 1=comorbidities). Participant comorbidity status was determined defined using NHANES medical condition (MCQ) variables denoting several chronic conditions in addition to cancer (e.g., asthma, hay fever, anemia, obesity, blood transfusions, arthritis, gout, heart disease, stroke, lung diseases, thyroid issues, liver disease, jaundice, etc.). If participants answered affirmatively to any of the chronic conditions presented, they were considered to have a comorbidity and only used in stratified analyses.

Statistical Methods

The NHANES uses a complex, multistage sampling design with stratification, applying weights per participant to statistically represent a proportion of individuals in the general population using interview weighting mechanisms[30]. All analyses were performed using IBM SPSS complex survey sampling software, version 27[31], and Stata statistical software, version 16[32], following applicable NHANES analytic guidelines[33]. The Stata svyset code and SPSS Complex Sampling feature allows the inclusion of all sampling design elements, stratification, clusters, and appropriate weights[27].

All study variables were evaluated using descriptive statistics and graphical techniques to assess distributional assumptions. In preliminary analyses to identify confounders of interest, demographic, and other variables collected from NHANES were assessed via univariate analyses using Chi-square tests for categorical variables and t-tests for continuous variables. Adjusted odds ratios (aORs) and 95% confidence intervals (CIs) were calculated with multivariable logistic regression models to measure the association between predictors and outcomes, while adjusting for covariates. Statistical significance was indicated if p-values or p-interaction terms were below 0.05.

Results

Characteristics of the study sample

A total of 27,607 women with and without a history of cancer meeting inclusion criteria were included in the study population from the continuous NHANES (1999 to 2016). A total of 2,415 women (9.4%), aged 20 to 85 years (M=63.2, SD=15.9, range=20-85 years), reported a history of cancer with breast cancer being the most common site (n=704, 29.2%). Most survivors were non-Hispanic white (68.4%), had some college education (51.2%), and were not married (50.7%) (Table 1). Survivors reported an average of 12.2 years since initial cancer diagnosis (SD=11.8, range=0.0-84). The characteristics among the women without cancer (n=25,192, 91.1%) differed from survivors. The majority of survivors were more educated, not married, lived above the FPL, never smoked, had health insurance, exercised, had many comorbid conditions, were non-Hispanic white, and were older (M=63.2, SD=15.9, range=20-85 years). There were statistically significant differences between survivors and control groups for all covariates (e.g., age, education, marital status, FPL, smoking status, health insurance coverage, current exercise, race/ethnicity, comorbidity status), except BMI category, and all of the study outcomes. See Table 1 for detailed information.

Table 1. Participant covariate, predictor, and outcome characteristics – National Health and Nutrition Examination Survey, years 1999 – 2016, females only

Characteristics	Survivors (n= 2415) No. (%)	Controls (n= 25192) No. (%)	p-value	Total female sample (N = 27607) No. (%)
Education				
No college education (HS/GED or lower)	1176 (48.8)	13542 (53.9)	.000	14736 (53.4)
Some college education (college classes or above)	1235 (51.2)	11593 (46.1)		12840 (46.6)
Marital status				
Not married	1211 (50.7)	11319 (46.9)	.000	12550 (47.3)
Married or living as married	1179 (49.3)	12815 (53.1)		14005 (52.7)
Poverty status based on FPL*				
Below FPL	411 (18.9)	5611 (24.6)	.000	6029 (24.1)
At or above FPL	1765 (81.1)	17190 (75.4)		18973 (75.9)
Obesity				
Normal or underweight	694 (31.4)	7810 (33.2)	.086	8513 (33.1)
Overweight or obese	1515 (68.6)	15706 (66.8)		17238 (66.9)
Smoking status				
Never smoked	1268 (52.5)	15322 (65.0)	.000	16608 (63.8)
Former or current smoker	1145 (47.5)	8259 (35.0)		9416 (36.2)
Covered by health insurance&				
No insurance coverage	199 (8.3)	5157 (20.6)	.000	5366 (19.5)
Insurance coverage	2207 (91.7)	19856 (79.4)		22084 (80.5)

Current exercise

No	1047 (43.4)	8520 (33.8)	.000	9587 (34.7)
Yes	1368 (56.6)	16660 (66.2)		18040 (65.3)

Race/ethnicity

Mexican American	224 (9.3)	4957 (19.7)	.000	5186 (18.8)
Other Hispanic	142 (5.9)	2234 (8.9)		2380 (8.6)
Non-Hispanic white (NHW)	1653 (68.4)	10284 (40.8)		11951 (43.2)
Non-Hispanic Black	293 (12.1)	5576 (22.1)		5877 (21.3)
Other (including multi-racial)	103 (4.3)	2141 (8.5)		2245 (8.1)

Comorbidity status

No comorbid conditions	352 (14.6)	10668 (42.3)	.000	11029 (39.9)
Comorbid conditions	2063 (85.4)	14524 (57.7)		16610 (60.1)

General health perception

Excellent/very good/good	1491 (69.1)	16769 (76.2)	.000	18273 (75.5)
Fair/poor	666 (30.9)	5243 (23.8)		5924 (24.5)

Routine place for healthcare

No	109 (4.5)	3085 (12.2)	.000	3197 (11.6)
Yes or more than one place	2306 (95.5)	22105 (87.8)		24440 (88.4)

Type of place for routine healthcare[¥]

Routine care (other)	1848 (80.1)	15920 (72.0)	.000	17787 (72.8)
Urgent or no care (ER, urgent clinic, no place)	458 (19.9)	6180 (28.0)		6648 (27.2)

Hospitalized in the last year

No	1879	21708	.000	23612 (85.5)

	(77.9)	(86.2)		
Yes	534 (22.1)	3471 (13.8)		4012 (14.5)
Seen a mental health provider in the last year				
No	2164 (89.6)	23143 (91.9)	**.000**	25335 (91.7)
Yes	250 (10.4)	2036 (8.1)		2290 (8.3)
	Mean (*SD*)	Mean (*SD*)	*p*-value	Mean (*SD*)
Age at NHANES interview	63.2 (15.9)	45.7 (19.2)	**.000**	47.3 (19.6)
Years since diagnosis	12.2 (11.8)	-	-	-
Alcoholic drinks per day	1.30 (20.3)	1.44 (19.1)	.749	1.43 (19.2)

*FPL = federal poverty line, as reported by NHANES interview

&Covered by health insurance at the time of NHANES interview

♯Minority status is comprised of any of the following:

¥Only asked if participant answered "yes" or "more than one place" to the question pertaining to routine place for healthcare; ER=emergency room

Bolded font indicates significant *p*-value (<.05)

Overall health and hospital utilization by survivor/control status and stratifications

Table 2 depicts the associations between survivor/control status and odds of reporting poor health status. Overall, survivors had 1.28 times the odds of reporting fair or poor perceived health compared to controls without cancer (95% CI, 1.09-1.50). Among women at or above the FPL, survivors had 1.12 greater odds of reporting fair or poor perceived health than controls (95% CI, 0.93-1.36); however, among women below the FPL, survivors exhibited 2.17 greater odds of reporting fair or poor perceived health than controls (95% CI, 1.54-3.05; *p*-interaction=0.001). There were no other significant interactions with these distinctions by education, ethnicity/race, or comorbidity status.

Table 2. Multivariable adjusted odds ratios and 95% confidence intervals for general health perception associated with survivor/control status, overall and stratified among women in NHANES 1999-2016

Stratifications	Controls (*n*=25,192)			Survivors (*n*=2,415)			*p*–interaction
	N	aOR	95% CI	N	aOR	95% CI	
Overall	22,012	1.00	Reference	2,157	**1.28**	**1.09 – 1.50**	
FPL							
At or above	15,297	1.00	Reference	1,607	1.12	.930 – 1.36	**.001**
Below	4,805	1.00	Reference	355	**2.17**	**1.54 – 3.05**	
Education							
Some college	10,178	1.00	Reference	1,127	1.24	.963 – 1.61	.696
No college	1,415	1.00	Reference	1,027	**1.32**	**1.10 – 1.57**	
Ethnicity/race							
Minority status	12,836	1.00	Reference	654	**1.61**	**1.22 – 2.12**	.323
Non-Hispanic white	9,176	1.00	Reference	1,503	**1.37**	**1.14 – 1.66**	
Comorbidity							
Have comorbidities	12,896	1.00	Reference	1,851	**1.23**	**1.03 – 1.46**	.926
No comorbid conditions	9,116	1.00	Reference	306	1.26	.772 – 2.06	

Bold font indicates statistically significant with corresponding *p*<.05.

p-interaction indicates interaction between survivors and controls upon stratification.

General health perception was dichotomous (0=excellent/very good/good; 1=fair/poor)

Table 3 shows the relationship between survivor/control status and odds of having no one place for routine healthcare. There was no association between survivor status and presence of routine healthcare overall (aOR, 1.07, 95% CI, 0.83-1.40). However, race/ethnicity did modify the association between survivor/control status and the presence of routine healthcare. Survivors who reported being racial/ethnic minorities had 1.77 times the odds of not having a place for routine healthcare (95% CI, 1.15-2.72),

whereas non-Hispanic white survivors were less likely to report not having a place for routine healthcare (aOR, 0.94; 95% CI, 0.70-1.26; *p*-interaction=0.014). There were no other statistically significant interactions with this association in predicting having at least one place for routine healthcare.

Table 3. Multivariable adjusted odds ratios and 95% confidence intervals for having a place for routine healthcare associated with survivor/control status, overall and stratified among women in NHANES 1999-2016

Stratifications	Controls (*n*=25,192)			Survivors (*n*=2,415)			*p*-interaction
	N	aOR	95% CI	N	aOR	95% CI	
Overall	25,190	1.00	Reference	2,415	1.07	.827 – 1.40	
FPL							
At or above	17,189	1.00	Reference	1,765	.983	.733 – 1.31	.067
Below	5,610	1.00	Reference	411	**1.59**	**1.02 – 2.48**	
Education							
Some college	11,593	1.00	Reference	1,235	.983	.699 – 1.38	.428
No college	13,540	1.00	Reference	1,176	1.22	.808 – 1.84	
Race/ethnicity							
Minority status	14,906	1.00	Reference	762	**1.77**	**1.15 – 2.72**	**.014**
Non-Hispanic white	10,284	1.00	Reference	1,653	.938	.695 – 1.26	
Comorbidity							
Have comorbidities	14,523	1.00	Reference	2,063	1.07	.808 – 1.43	.548
No comorbid conditions	10,667	1.00	Reference	352	.898	.527 – 1.52	

Bold font indicates statistically significant with corresponding *p*<.05.

p-interaction indicates interaction between survivors and controls upon stratification.

Having a place for routine healthcare was dichotomous (0=yes or having more than one place; 1=no one place)

Table 4 presents the association between survivor/control status and odds of utilizing urgent or no care for routine healthcare. Overall, there was a borderline significant association between survivor/control status and type of place of routine healthcare (aOR, 0.86, 95% CI, 0.73-1.01). Among women living at or above the FPL, survivors had lower odds of reporting utilizing no urgent healthcare than controls (aOR, 0.61, 95% CI, 0.46-0.81; p-interaction=0.011); whereas no association was observed among women living below the FPL. A similar pattern was observed for education where among women with some college, survivorship was associated with lower odds of no/urgent healthcare compared to controls (aOR, 0.70, 95% CI, 0.56-0.87; p-interaction=0.034) but no association was observed for women with no college.

Table 4. Multivariable adjusted odds ratios and 95% confidence intervals for type of routine healthcare associated with survivor/control status, overall and stratified among women in NHANES 1999-2016

Stratifications	Controls (*n*=25,192)			Survivors (*n*=2,415)			*p*–interaction
	N	aOR	95% CI	N	aOR	95% CI	
Overall	22,100	1.00	Reference	2,306	.863	.733 – 1.01	
FPL							
At or above	15,457	1.00	Reference	1,690	**.614**	**.464 – .812**	**.011**
Below	4,622	1.00	Reference	384	.935	.780 – 1.12	
Education							
Some college	10,465	1.00	Reference	1,178	**.704**	**.565 – .877**	**.034**
No college	11,582	1.00	Reference	1,124	1.00	.799 – 1.27	
Ethnicity/race							
Minority status	12,685	1.00	Reference	722	.868	.673 – 1.12	.704
Non-Hispanic white	9,415	1.00	Reference	1,584	.925	.759 – 1.12	
Comorbidity							
Have comorbidities	13,495	1.00	Reference	1,992	.903	.758 – 1.07	.285
No comorbid conditions	8,605	1.00	Reference	314	.718	.484 – 1.06	

Bold font indicates statistically significant with corresponding *p*<.05.

p-interaction indicates interaction between survivors and controls upon stratification.

Type of place for routine healthcare (0=routine care; 1=urgent or no care)

Table 5 depicts the relationship between survivor/control status and odds of seeing a mental health professional within the last year. Overall, survivors reported 1.37 greater odds (95% CI, 1.12-1.66) of seeing a mental health provider within the last year versus controls. While FPL, education, and comorbidity status were not significant modifiers of the association between survivor/control status and

seeing a mental health provider within the last year, ethnicity/race did significantly modify this association (*p*-interaction=0.019). Among racial/ethnic minorities, survivors had higher odds of seeing a mental health professional than controls (aOR, 1.23, 95% CI, 0.98-1.54) whereas the association was stronger among non-Hispanic white women (aOR, 1.98, 95% CI, 1.42-2.75).

Table 5. Multivariable adjusted odds ratios and 95% confidence intervals for seeing a mental health provider in the last year associated with survivor/control status, overall and stratified among women in NHANES 1999-2016

Stratifications	Controls (*n*=25,192)			Survivors (*n*=2,415)			*p*–interaction
	N	aOR	95% CI	N	aOR	95% CI	
Overall	25,179	1.00	Reference	2,414	**1.37**	**1.12 – 1.66**	
FPL							
At or above	17,183	1.00	Reference	1,764	**1.36**	**1.09 – 1.70**	.930
Below	5,609	1.00	Reference	411	1.39	.924 – 2.10	
Education							
Some college	11,589	1.00	Reference	1,234	**1.45**	**1.12 – 1.87**	.365
No college	13,534	1.00	Reference	1,176	1.20	.887 – 1.63	
Ethnicity/race							
Minority status	14,901	1.00	Reference	762	1.23	.987 – 1.54	**.019**
Non-Hispanic white	10,278	1.00	Reference	1,652	**1.98**	**1.42 – 2.75**	
Comorbidity							
Have comorbidities	14,514	1.00	Reference	2,062	**1.28**	**1.04 – 1.56**	.398
No comorbid conditions	10,665	1.00	Reference	352	1.60	.974 – 2.63	

Bold font indicates statistically significant with corresponding *p*<.05.

p-interaction indicates interaction between survivors and controls upon stratification.

Seen a mental health provider in the last year (0=no; 1=yes)

Lastly, survivors had 1.61 times the odds (95% CI, 1.40-1.86) of reporting hospitalizations within the last year compared to controls (p<0.001). However, there were no significant interactions by FPL, education, ethnicity/race, or comorbidity status with this association with hospitalizations (data not shown).

Discussion

Among women residing in the US, we examined the associations between having a history of cancer and odds of reporting several health-related outcomes overall and stratified by sociodemographic factors. Not surprisingly, among cancer survivors, breast cancer was the most common site, mirroring the recent NCI-reported trends[2]. The majority of the current sample was educated and lived above the FPL, which may account for the self-reported higher quality health-related outcomes, as these individuals are more likely to have continuous health insurance coverage and access to quality healthcare when needed[34, 35]. Despite the similarity of patterns among sociodemographic factors, survivor/control groups were differed on all characteristics except for obesity status. On average, unfavorable health perceptions, no place for routine care, and ER usage for such care were reported more often by controls, which was an interesting finding, but perhaps is because cancer survivors utilize healthcare, and more specialized healthcare, more often[36]. Survivors were more likely to report being hospitalized and seeing a mental health provider within the past year, all of which coincides with past literature's high utilization[37, 38]. Regardless, it appears as though despite the low indications of poor health outcomes within the current sample, disparities remain between female cancer survivors and female population-based controls.

The perception of quality of healthcare, and access to such care, remains an important aspect of the cancer survivorship experience[39-43], as well as US females of the general population. Our study showed that female cancer survivors had an increased likelihood of perceiving poorer health, were more likely to be hospitalized and were more likely to visit a mental health provider when compared to cancer-free women. A strong consensus exists that most cancer survivors acclimate well to life post-treatment[44-48], but often depends on the individual and their biopsychosocial response to the cancer experience[49]. Recent literature shows that some cancer survivors may engage in better health behaviors (e.g., following physicians' recommendations) immediately after diagnosis, but the majority of survivors have been shown to have worse perceived health than individuals without cancer[50]. It may be possible, for instance, that cancer survivors may perceive their health status as poor due to their previous diagnosis or number of comorbid conditions[37]. This remains a possibility given the results; however, there has been support for a bidirectional relationship between health perception and psychological wellbeing[51], which is imperative for successful survivorship and disease management[52]. When stratified by sociodemographic factors, we found that survivors below the FPL exhibited greater chances of poor perceived health compared with controls. This often leads to lapses in quality and access to medical care[53], indicative of worsening health over time, coupled with cancer treatment toxicities and multimorbidity[54-56].

Cancer survivors also experience adverse psychological issues with ranging severities regarding fear of recurrence[44, 57] as well as anxiety, depression, and post-traumatic stress[58, 59] whose severity varies, and

therefore, are more likely to see a mental health provider for assistance, mirroring current findings[60-63]. The current study highlighted that non-Hispanic white and minority survivors are more likely to see a mental health provider than non-Hispanic white and minority controls, respectively. This finding coincides with past literature, showing that minority populations, specifically minority cancer survivors, are less likely than non-Hispanic white survivors, to seek mental health services during their survivorship or at diagnosis[64, 65]. Kaul and colleagues[66] found that survivors reported not being able to afford mental health care more often than controls, which fits in pattern with mental healthcare being an access and financial problem, not one of need. Additionally, minority cancer survivors within the current study were more likely to not have one continuous place for routine healthcare. This finding mirrors past literature, as cancer care into survivorship is often a financial hardship for those with less access to healthcare, such as those from minority populations[34].

Research has shown that cancer survivors, on average, are living longer, due to the increase in screening and technology associated with early detection and treatment[67]. Clinically, there exists a potential to preemptively discuss physical and psychosocial health with cancer patients prior to survivorship, aligning a care plan with those at most risk for poor perceived physical and mental health prior to treatment ending. Healthcare providers should continue to promote regular healthcare practices during survivorship, focusing on the overall health of the individual, not solely on cancer-related care. Conversations regarding quality of continued cancer care, for both physical and psychosocial aspects of survivorship, including educating their patients about the late health effects of cancer treatment to attenuate these risks, and maintaining such care is imperative among this population.

Study strengths. The current study has several strengths. Our study utilized the continuous NHANES (from 1999-2016) and included over 25,000 women, allowing for generalizability to the adult female population in the US, both with a history of cancer and those without. We were also able to compare associations with healthcare utilization patterns among women with a history of cancer to cancer-free women. Because NHANES collects numerous lifestyle, sociodemographic, and health related variables, we were able to adjust and stratify associations by numerous variables, which few studies have done previously[68, 69].

Limitations. The current study's findings should be considered in light of its limitations. Overall, while the current study provided a large sample, the data was still cross-sectional and self-reported, which may have misclassification or recall bias. While self-report was used to gauge healthcare utilization and access within the current analyses, future studies can focus on more concrete variables of perceived health and access, such as utilizing medical record abstraction and/or insurance claims. The NHANES are also collected in two year cycles, which disallows longitudinal analyses and distinct changes over time. Lastly, it is possible that dichotomizing outcome variables lead to the loss of detailed information. It is possible that dichotomizing could be approached in a different manner or conducting different analyses with original variables may be beneficial for future studies. We did not have information

regarding pain, hospitalization records, stage at diagnosis, time since cancer treatment(s), or type of cancer treatment(s) to control for in our analyses.

Conclusions

Our study focused on the impact and resonance of cancer on perceived health status and health care utilization among women and focused on subgroups of women from disadvantaged health populations. Our results indicate that cancer survivors were more likely to perceive their health to be worse, were more likely to report being hospitalized, and were more likely to report visiting a mental health provider. The current study provides important information to inform future cancer survivorship care and discerns the importance of evaluating the effects of comprehensive healthcare among disadvantaged health populations, particularly among racial/ethnic minorities and among individuals living in poverty.

Declarations

Conflicts of interest/Competing interests: Dr. Kate Dibble has no conflicts of interest to disclose.

Dr. Maneet Kaur has no conflicts of interest to disclose. Junrui Lyu has no conflicts of interest to disclose. Dr. Avonne Connor has no conflicts of interest to disclose.

Availability of data and material: The datasets generated during and/or analyzed during the current study are available via the National Center for Health Statistics (NCHS) website at https://wwwn.cdc.gov/nchs/nhanes/Default.aspx

Code availability: Syntax coding is available upon reasonable request from the corresponding author.

Author Contributions

Kate E Dibble: Conception/design, data acquisition, data analysis and interpretation, drafted and revised the article, and approved the final version.

Maneet Kaur: Data analysis and interpretation, revised the article, and approved the final version.

Junrui Lyu: Revised the article and approved the final version.

Avonne E Connor: Conception/design, data interpretation, drafted and revised the article, and approved the final version.

Ethics approval: This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the NCHS Research Ethics Review.

Consent to participate: Informed consent was obtained from all individual participants included in the study.

Consent for publication: Not applicable

References

1. American Cancer Society (ACS). Cancer treatment and survivorship facts and Figs. 2019–2021. ACS (2021) https://www.cancer.org/research/cancer-facts-statistics.html

2. National Cancer Institute (NCI). Cancer statistics. NCI (2021) https://www.cancer.gov/about-cancer/understanding/statistics

3. Mayo Clinic (2021) Cancer survivors: Late effects of cancer treatment. Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/cancer/in-depth/cancer-survivor/art-20045524

4. Fowler H, Belot A, Ellis L et al. Comorbidity prevalence among cancer patients: A population-based cohort study of four cancers. BMC Cancer. 2020; 20(2). https://doi.org/10.1186/s12885-019-6472-9

5. Sullivan J, Snider JT, van Eijndhoven E, Okoro T, Batt K, DeLeire T (2018) The well-being of long-term cancer survivors. Am J of Manag Care 24(4):188–195. https://pubmed.ncbi.nlm.nih.gov/29668209/

6. National Cancer Institute (NCI). Cancer control continuum. National Institute of Health (NIH) (2021) https://cancercontrol.cancer.gov/about-dccps/about-cc/cancer-control-continuum

7. Lebel S, Tomei C, Feldstain A, Beattie S, Mccallum M (2013) Does fear of cancer recurrence predict cancer survivors' health care use? Support Care Cancer 21(3):901–906. https://doi.org/10.1007/s00520-012-1685-3

8. Otto AK, Soriano EC, Siegel SD, Losavio ST, Laurenceau JP (2018) Assessing the relationship between fear of cancer recurrence and health care utilization in early-stage breast cancer survivors. J Cancer Surviv 12(6):775–785. https://doi.org/10.1007/s11764-018-0714-8

9. Doubeni CA, Field TS, Ulcickas Yood M et al (2006) Patterns and predictors of mammography utilization among breast cancer survivors. Cancer 106(11):2482–2488. https://doi.org/10.1002/cncr.21893

10. Mols F, Helfenrath KA, Vingerhoets AJJM, Coebergh JWW, Van De Poll-Franse LV (2007) Increased health care utilization among long-term cancer survivors compared to the average Dutch population: A population-based study. Int J Cancer 121(4):871–877. https://doi.org/10.1002/ijc.22739

11. Rajotte EJ, Heron L, Syrjala KL, Baker KS (2016) Health care utilization among long-term cancer survivors. J Clin Oncol 34(3):22–23. https://pubmed.ncbi.nlm.nih.gov/29668209/

12. Halpern MT, Mccabe MS, Burg MA. The Cancer Survivorship Journey: Models of Care, Disparities, Barriers, and Future Directions. American Society of Clinical Oncology Educational Book. 2016; (36):231–239. https://doi.org/10.1200/edbk_156039

13. Earle CC, Neville BA (2004) Under use of necessary care among cancer survivors. Cancer 101(8):1712–1719. https://doi.org/10.1002/cncr.20560

14. Edgington A, Morgan MA (2011) Looking beyond recurrence: Comorbidities in cancer survivors. Clin J Oncol Nurs 15(1):E3–E12. https://pubmed.ncbi.nlm.nih.gov/29668209/

15. American Cancer Society (ACS) (2021) Can I do anything to prevent cancer recurrence? ACS. https://www.cancer.org/treatment/survivorship-during-and-after-treatment/understanding-recurrence/can-i-do-anything-to-prevent-cancer-recurrence.html

16. White-Means S, Osmani A (2018) Affordable Care Act and disparities in health services utilization among ethnic minority breast cancer survivors: Evidence from longitudinal medical expenditure panel surveys 2008–2015. Int J Env Res Pub Health 15(9):1860. https://doi.org/10.3390/ijerph15091860

17. Treanor C, Donnelly M (2012) An international review of the patterns and determinants of health service utilisation by adult cancer survivors. BMC Health Serv Res 12(1):316. https://doi.org/10.1186/1472-6963-12-316

18. Roundtree AK, Giordano SH, Price A, Suarez-Almazor ME (2011) Problems in transition and quality of care: Perspectives of breast cancer survivors. Support Care Cancer 19(12):1921–1929. https://doi.org/10.1007/s00520-010-1031-6

19. Kenzik KM, Kvale EA, Rocque GB et al (2016) Treatment summaries and follow-up care instructions for cancer survivors: Improving survivor self-efficacy and health care utilization. Oncologist 21(7):817–824. https://doi.org/10.1634/theoncologist.2015-0517

20. Field TS, Doubeni CA, Fox MP et al (2007) Under utilization of surveillance mammography among older breast cancer survivors. J Gen Internl Med 23(2):158–163. https://doi.org/10.3390/ijerph15091860

21. Johansson BBK, Holmberg L, Berglund G, Glimelius S, Glimelius BLG (2004) Determinants of cancer patients' utilization of hospital care within two years after diagnosis. Acta Oncol 43(6):536–544. https://doi.org/10.1080/02841860410015631

22. Parikh-Patel A, Morris CR, Kizer KW (2017) Disparities in quality of cancer care: The role of health insurance and population demographics. Med 96(50):e9125. https://doi.org/10.1097/md.0000000000009125

23. Lisovicz N, Wynn T, Fouad M, Partridge EE (2008) Cancer health disparities: What we have done. Am J Med Sci 335(4):254–259. https://doi.org/10.1097/MAJ.0b013e31816a43ad

24. Kaufman M, Cruz A, Thompson J et al (2019) A review of the effects of healthcare disparities on the experience and survival of ovarian cancer patients of different racial and ethnic backgrounds. J Cancer Met Treat 5:13. https://doi.org/10.20517/2394-4722.2018.25

25. Grann VR (2007) Inequality of care and cancer survival. AMA J Ethics 9(1):48–51. https://doi.org/10.1001/virtualmentor.2007.9.1.pfor3-0701

26. Smith JL, Hall IJ (2015) Advancing health equity in cancer survivorship: Opportunities for public health. Am J Prev Med 49(605):S477–S482. https://doi.org/10.1016/j.amepre.2015.08.008

27. Saylor J, Friedman E, Lee HJ (2012) Navigating complex sample analysis using national survey data. Nurs Res 61(3):231–237. https://doi.org/10.1097/nnr.0b013e3182533403

28. National Center for Health Statistics (NCHS). Survey participants: Why I was selected. The National Health and Nutrition Examination Survey (NHANES). https://www.cdc.gov/nchs/nhanes/participant/participant-selected.html

29. National Center for Health Statistics (NCHS). Analytic and reporting guidelines. The National Health and Nutrition Examination Survey (NHANES). https://wwwn.cdc.gov/nchs/nhanes/AnalyticGuidelines.aspx

30. National Center for Health Statistics (NCHS). NHANES questionnaires, datasets, and related documentation. National Health and Nutrition Examination Survey (NHANES). https://wwwn.cdc.gov/nchs/nhanes/Default.aspx

31. IBM SPSS Statistics for Windows. Version 27.0. 2020

32. Stata Statistical Software: Release 16. Version 16. 2019

33. National Center for Health Statistics (NCHS). NHANES module 3: Weighting. The National Health and Nutrition Examination Survey (NHANES). https://wwwn.cdc.gov/nchs/nhanes/tutorials/module3.aspx

34. Yabroff KR, Gansler T, Wender RC, Cullen KJ, Brawley OW (2019) Minimizing the burden of cancer in the United States: Goals for a high-performing health care system. CA Cancer J Clin 69(3):166–183. https://doi.org/10.3322/caac.21556

35. Arpey NC, Gaglioti AH, Rosenbaum ME. How socioeconomic status affects patient perceptions of health care: A qualitative study. J Prim Care Comm Health. 2017-07-01 2017;8(3):169–175. https://doi.org/10.1177/2150131917697439

36. Iadeluca L, Mardekian J, Chander P, Hopps M, Makinson G (2017) The burden of selected cancers in the US: Health behaviors and health care resource utilization. Cancer Manag Res 9:721–730. https://doi.org/10.2147/cmar.s143148

37. Mayer DK, Nasso SF, Earp JA (2017) Defining cancer survivors, their needs, and perspectives on survivorship health care in the USA. Lancet Oncol 18(1):e11–e18. https://doi.org/10.1016/s1470-2045(16)30573-3

38. Guy GP, Yabroff KR, Ekwueme DU et al (2015) Healthcare expenditure burden among non-elderly cancer survivors, 2008–2012. Am J Prev Med 49(6):S489–S497. https://doi.org/10.1016/j.amepre.2015.09.002

39. Schmidt ME, Wiskemann J, Ulrich CM, Scheeweiss A, Steindorf K (2017) Self-reported physical activity behavior of breast cancer survivors during and after adjuvant therapy: 12 months follow-up of two randomized exercise intervention trials. Act Oncol 56(4):618–627. https://doi.org/10.1080/0284186x.2016.1275776

40. Neil-Sztramko S, Winters-Stone KM, Bland KA, Campbell KL (2019) Updated systematic review of exercise studies in breast cancer survivors: Attention to the principles of exercise training. Br J Sports Med 53:504–512. https://doi.org/10.1136/bjsports-2017-098389

41. Dieli-Conwright CM, Courneya KS, Demark-Wahnefried W et al (2018) Aerobic and resistance exercise improves physical fitness, bone health, and quality of life in overweight and obese breast cancer

survivors: A randomized controlled trial. Breast Cancer Res 20:124. https://doi.org/10.1186/s13058-018-1051-6

42. Dibble KE, Bellizzi KM, Taxel P et al (2020) Physical activity and health-related quality of life among postmenopausal women with breast cancer treated with aromatase inhibitors. Support Care Cancer 29(5):2385–2394. https://doi.org/10.1007/s00520-020-05741-1

43. Connor AE, Baumgartner RN, Pinkston CM, Boone SD, Baumgartner KB (2016) Obesity, ethnicity, and quality of life among breast cancer survivors and women without breast cancer: The long-term quality of life follow-up study. Cancer Causes Control 27(1):115–124. https://doi.org/10.1007/s10552-015-0688-z

44. Stanton AL (2012) What happens now? Psychosocial care for cancer survivors after medical treatment completion. J Clin Oncol 30(11):1215–1220. https://doi.org/10.1200/jco.2011.39.7406

45. Mitchell AJ, Ferguson DW, Gill J, Paul J, Symonds P (2013) Depression and anxiety in long-term cancer survivors compared with spouses and healthy controls: A systematic review and meta-analysis. Lancet Oncol 14(8):721–732. https://doi.org/10.1016/s1470-2045(13)70244-4

46. Andersen BL, Derubeis RJ, Berman BS et al (2014) Screening, assessment, and care of anxiety and depressive symptoms in adults with cancer: An American Society of Clinical Oncology Guideline adaptation. J Clin Oncol 32(15):1605–1619. https://ascopubs.org/doi/10.1200/jco.2013.52.4611

47. Stanton AL, Rowland JH, Ganz PA (2015) Life after diagnosis and treatment of cancer in adulthood: Contributions from psychosocial oncology research. Am Psychol 70(2):159–174. https://doi.apa.org/doi/10.1037/a0037875

48. Nakash O, Levav I, Aguilar-Gaxiola S et al (2014) Comorbidity of common mental disorders with cancer and their treatment gap: Findings from the World Mental Health Surveys. Psycho-Oncol 23(1):40–51. https://doi.org/10.1002/pon.3372

49. Recklitis CJ, Syrjala KL (2017) Provision of integrated psychosocial services for cancer survivors post-treatment. Lancet Oncol 18(1):e39–e50. https://doi.org/10.1016/s1470-2045(16)30659-3

50. Lemasters TJ, Madhavan SS, Sambamoorthi U, Kurian S (2014) Health behaviors among breast, prostate, and colorectal cancer survivors: A US population-based case-control study, with comparisons by cancer type and gender. J Cancer Surviv 8(3):336–348. https://doi.org/10.1007/s11764-014-0347-5

51. Leite Â, Ramires A, Moura AD, Souto T, Marôco J (2019) Psychological well-being and health perception: Predictors for past, present and future. Arch Clin Psychiatry (São Paulo) 46(3):53–60. http://dx.doi.org/10.1590/0101-60830000000194

52. Leykin Y, Thekdi SM, Shumay DM, Muñoz RF, Riba M, Dunn LB (2012) Internet interventions for improving psychological well-being in psycho-oncology: review and recommendations. Psycho-Oncol 21(9):1016–1025. https://doi.org/10.1002/pon.1993

53. Palmer NRA, Weaver KE, Hauser SP et al (2015) Disparities in barriers to follow-up care between African American and White breast cancer survivors. Support Care Cancer 23(11):3201–3209. https://doi.org/10.1007/s00520-015-2706-9

54. De Souza JA, Wong Y-N (2013) Financial distress in cancer patients. J Med Person 11(2):73–77. https://doi.org/10.1007/s12682-013-0152-3

55. Tucker-Seeley RD, Yabroff KR (2016) Minimizing the "financial toxicity" associated with cancer care: Advancing the research agenda. J Natl Cancer Inst 108(5):djv410. https://doi.org/10.1093/jnci/djv410

56. Yousuf Zafar S (2016) Financial toxicity of cancer care: It's time to intervene. J Natl Cancer Inst 108(5):djv370. https://doi.org/10.1093/jnci/djv370

57. Runowicz CD, Leach CR, Henry NL et al (2016) American Cancer Society/American Society of Clinical Oncology Breast Cancer Survivorship Care Guideline. J Clin Oncol 34(6):611–635. https://doi.org/10.3322/caac.21319

58. Yi JC, Syrjala KL (2017) Anxiety and depression in cancer survivors. Med Clin North Am 101(6):1099–1113. https://doi.org/10.1016/j.mcna.2017.06.005

59. Götze H, Friedrich M, Taubenheim S, Dietz A, Lordick F, Mehnert A (2020) Depression and anxiety in long-term survivors 5 and 10 years after cancer diagnosis. Support Care Cancer 28(1):211–220. https://doi.org/10.1007/s00520-019-04805-1

60. Sarkar S, Sautier L, Schilling G, Bokemeyer C, Koch U, Mehnert A (2015) Anxiety and fear of cancer recurrence and its association with supportive care needs and health-care service utilization in cancer patients. J Cancer Surviv 9(4):567–575. https://doi.org/10.1007/s11764-015-0434-2

61. Whitney RL, Bell JF, Bold RJ, Joseph JG (2015) Mental health needs and service use in a national sample of adult cancer survivors in the USA: Has psychosocial care improved? Psycho-Oncol 24(1):80–88. https://doi.org/10.1002/pon.3569

62. Li C, Li C, Forsythe L, Lerro C, Soni A (2015) Mental health services utilization and expenditures associated with cancer survivorship in the United States. J Cancer Surviv 9(1):50–58. https://doi.org/10.1007/s11764-014-0392-0

63. Warner DF, Schiltz NK, Stange KC et al. Complex multimorbidity and health outcomes in older adult cancer survivors. Fam Med Comm Health. 2017;5(2):129–138.

64. Costas-Muñiz R, Hunter-Hernández M, Garduño-Ortega O, Morales-Cruz J, Gany F (2017) Ethnic differences in psychosocial service use among non-Latina white and Latina breast cancer survivors. J Psychosoc Oncol 35(4):424–437. https://doi.org/10.1080/07347332.2017.1310167

65. Costas-Muñiz R, Garduño-Ortega O, Hunter-Hernández M, Morales J, Castro-Figueroa EM, Gany F (2020) Barriers to psychosocial services use for Latina versus non-Latina white breast cancer survivors. Am J Psychotherapy 74(1):13–21. https://doi.org/10.1176/appi.psychotherapy.20190036

66. Kaul S, Avila JC, Mutambudzi M, Russell H, Kirchhoff AC, Schwartz CL (2017) Mental distress and health care use among survivors of adolescent and young adult cancer: A cross-sectional analysis of the National Health Interview Survey. Cancer 123(5):869–878. https://doi.org/10.1002/cncr.30417

67. Hulvat MC (2020) Cancer incidence and trends. Surg Clin 100(3):469–481. https://doi.org/10.1016/j.suc.2020.01.002

68. Gathirua-Mwangi WG, Zollinger TW, Murage MJ, Pradhan KR, Champion VL (2015) Adult BMI change and risk of breast cancer: National Health and Nutrition Examination Survey (NHANES) 2005–2010. Breast Cancer 22(6):648–656. https://doi.org/10.1007/s12282-015-0638-3

69. Akinkugbe AA, Garcia DT, Brickhouse TH, Mosavel M (2020) Lifestyle risk factor related disparities in oral cancer examination in the U.S: A population-based cross-sectional study. BMC Pub Health 20(1):153. https://doi.org/10.1186/s12889-020-8247-2

Figures

Image not available with this version

Figure 1

Inclusion criteria included completing the NHANES questionnaire, being female, age (NHANES adult age is 20 years or older) and reporting whether a cancer or malignancy was ever diagnosed in the past.