Original Research

Alcohol Outlet Availability and Excessive Alcohol Consumption in Breast Cancer Survivors

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Abstract

Background: Breast cancer survivors who consume alcohol excessively are at increased risk of recurrence and have worse prognosis. Because the environments in which people live shape many health behaviors, there has been increased attention to how neighborhood environments (eg, alcohol outlet availability) may influence alcohol consumption. The authors hypothesized that proximity to alcohol outlets increases the likelihood of excessive consumption (ie, more than 1 drink/day) among breast cancer survivors independent of their personal or neighborhood characteristics.
Methods: With the Missouri Cancer Registry, the authors conducted a cross-sectional study of 1047 female breast cancer survivors (aged 27-96 years) 1 year after diagnosis. Using telephone interviews, the authors obtained data regarding survivors' alcohol consumption during the past 30 days and several covariates of alcohol use. They also obtained street addresses of all licensed alcohol outlets in Missouri and calculated the road network distance between a participant's address of residence and the nearest alcohol outlet, using a geographic information system. Logistic regression was used to determine if distance was independently associated with excessive alcohol consumption.
Results: Eighteen percent of participants reported consuming more than 1 drink on average per day. Women who lived within 3 miles of the nearest outlet were more likely to report excessive alcohol consumption (odds ratio: 2.09; 95% confidence interval: 1.08, 4.05) than women who lived at least 3 miles from the nearest outlet in adjusted analysis.
Discussion: Opportunities exist to reduce excessive alcohol use among breast cancer survivors through policy (eg, restricting number of alcohol outlets) and behavioral (eg, counseling) interventions.

Keywords

community health, hazardous drinking, lifestyle change, neighborhood, primary care

In 2010, an estimated 207 090 women were diagnosed with breast cancer in the United States.[1] Because of improved prognosis due to early detection and better treatment, the number of breast cancer survivors is increasing. Many lifestyle behaviors adversely affect breast cancer prognosis, including physical inactivity, poor diet, and smoking. Recently, high alcohol consumption was also shown to increase the risk of breast cancer recurrence and death.[2] Alcohol has estrogenic effects, and even moderate alcohol use has been shown to increase levels of estrogen in normal postmenopausal women.[3] Since alcohol is a risk factor for breast cancer and for poorer breast cancer outcomes,[2,4,5] female cancer survivors who consume alcohol are generally urged to limit its use to 1 drink per day.[6] Alcohol consumption remains prevalent after breast cancer diagnosis[7] and is unlikely to differ from the general population.[8,9]

Because the environments in which people live can shape many health behaviors, there has been increased attention as to how neighborhood environments may influence alcohol consumption. While there are many determinants of alcohol use in the general population, recent attention has focused on physical availability of alcohol. Studies have produced mixed results with regard to the relationship between alcohol outlet density or distance to the nearest outlet and alcohol consumption in the general population.[10] In 24 New Orleans census tracts, neighborhood-level outlet density was related

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to drinking norms and consumption.[11] In New Zealand, greater density of outlets was associated with increased binge drinking and alcohol-related harm.[12] In contrast, an analysis of 82 neighborhoods in California[13] and across 4 US cities[14] did not find any association between alcohol availability and heavy drinking. Some have suggested that the relationship between neighborhood alcohol outlet density and alcohol consumption is complex and may vary due to differences in neighborhood design and travel patterns.[15] In sum, there is no conclusive evidence that availability of alcohol outlets increases alcohol consumption in the general population.

To our knowledge, no studies have investigated if breast cancer survivors specifically are adversely affected (ie, have increased alcohol use) by living near alcohol outlets. Since the population of breast cancer survivors is growing and faces many health challenges resulting from its treatment, we sought to examine this association in a population-based sample of survivors. We hypothesized that living in proximity to alcohol outlets would increase the likelihood of excessive alcohol use among breast cancer survivors independent of their personal and neighborhood characteristics.

Methods

Study Sample

After we obtained Institutional Review Board approval, Missouri women aged 25 or older who were diagnosed with a first primary breast cancer from June 2006 through June 2008 were identified from the statewide Missouri Cancer Registry. Women were recruited by mail to participate in this cross-sectional study; up to 15 follow-up phone calls were made to nonrespondents. Trained interviewers administered computer-assisted telephone interviews 1 year after diagnosis to women who provided written informed consent.

Alcohol Use

Questions about alcohol consumption during the past 30 days were drawn from the widely used Behavioral Risk Factor Surveillance System.[16] Self-reported data on alcohol use are highly accurate under conditions of confidentiality and privacy.[17] We examined alcohol consumption 3 ways. First, we categorized consumption as more than 1 drink (beer, wine, malt beverage, or liquor) per day versus 1 drink or less per day during the past 30 days. Although no universally agreed-on recommendations exist for alcohol consumption in cancer survivors, there is some agreement that female survivors who consume alcohol should limit its use to 1 drink per day.[6] We also analyzed as continuous variables the average number of drinks each day among those who consumed at least 1 drink during the past 30 days and the number of times that a woman consumed 4 or more drinks on an occasion (binge drinking).

Alcohol Outlet Availability

We defined an alcohol outlet is a setting where alcohol may be sold legally for either on-premises or off-premises consumption. On-premises settings include, for example, restaurants, bars, and ballparks; off-premises settings (ie, for consumption elsewhere) include grocery and convenience stores, liquor stores, and gas stations. The license types included are as follows: 5% by drink, 5% by drink wine, original package liquor 5% beer, domestic wine, Missouri wine by drink, original package liquor, retail liquor by the drink, retail liquor by the drink exempt, and retail liquor by the drink resort. We obtained the street address of all alcohol outlets in Missouri as licensed by the Division of Alcohol and Tobacco Control during our baseline data collection period (ie, outlets in operation in 2007, 2008, and/or 2009).

Because there is no standard measurement of availability of alcohol outlets, we tested several measurements. We computed the road network distance in miles between the residential location of breast cancer survivors and alcohol outlets as a measure of proximal access to alcohol outlets by breast cancer survivors using ArcGIS Network Analyst 9.3.1 (ESRI Inc, Redlands, California). Because assuming a linear relationship between distance to the nearest alcohol outlet and alcohol use may be too restrictive, we categorized this distance as less than 1 mile, 1 to < 2 miles, 2 to < 3 miles, and at least 3 miles, which was the reference group. Similar to other studies,[18] we also calculated alcohol outlet density by dividing the number of outlets by the land mass in square miles for the participants' census tract and the number of outlets per census tract population. We used the road network distance to the nearest outlet as the main access measure because outlet density measures use artificial administrative boundaries and are less reliable when based on a small number of outlets.

Covariates Associated With Alcohol Use

We examined 7 categories of potential confounders (Table 1). Covariates in the analysis were based on other studies of cancer survivors, determinants of alcohol use, and alcohol outlet availability and included self-reported data, calculated data using a geographic information system, clinical data from the Missouri Cancer Registry, and census-based measures.

First, sociodemographic factors included race, age group, Hispanic origin, income, educational attainment, employment, marital status, urbanicity, home ownership, length of time (in years) at current residence, food security, income adequacy, and percentage of households without a car in the census tract of residence. Food security was based on whether participants reported having been concerned

Table 1. Selected Characteristics by Distance and Unadjusted Association With Excessive Alcohol Use[a]

Characteristic	Distance to Nearest Alcohol Outlet			Association With Alcohol Use	
	< 1 mi (n = 678)	1.0-2.9 mi (n = 254)	≥ 3 mi (n = 115)	Odds Ratio	95% Confidence Interval
Sociodemographics					
Race*					
White	89.7	96.9	96.5	1.00	
African American	8.1	1.6	1.7	0.46	0.20, 1.09
Other	2.2	1.6	1.7	0.44	0.10, 1.92
Age	59.2 ± 11.9	55.4 ± 10.6	56.3 ± 10.2	0.96	0.94, 0.97
Education*					
Less than high school	4.9	2.0	6.1	0.60	0.25, 1.45
High school	29.4	23.2	41.7	1.00	
More than high school	65.8	74.8	52.2	0.67	0.47, 0.97
Home ownership*					
Own (purchasing)	83.8	95.5	94.8	1.00	
Renting	13.0	1.2	4.4	1.02	0.60, 1.75
Other	3.2	2.4	0.9	0.92	0.35, 2.45
Length of residence in years	15.2 ± 12.7	14.1 ± 11.0	16.2 ± 13.4	0.98	0.96, 0.99
Income group*					
< $25 000	5.5	5.5	3.5	0.30	0.18, 0.52
$25 000-$74 999	21.1	10.2	12.2	0.49	0.35, 0.69
$75,000 ≤	46.3	41.3	63.5	1.00	
Unknown	27.1	42.9	20.9	0.44	0.20, 0.98
Employed (vs not)*	52.5	61.8	55.7	2.17	1.56, 3.04
Income adequacy*					
Comfortable	58.7	69.7	53.9	1.00	
Just enough	28.2	22.4	37.4	0.78	0.54, 1.12
Not enough	12.4	7.5	7.8	0.61	0.34, 1.08
Unknown	0.7	0.4	0.9	0.66	0.08, 5.50
Concerned about food security (vs not)*	8.1	5.1	4.4	0.87	0.48, 1.56
Census tract poverty rate*					
< 10.0%	59.6	67.7	44.4	1.00	
10.0%-19.9%	28.6	27.6	47.0	1.87	1.29, 2.73
20.0% ≤	11.8	4.7	8.7	2.14	1.14, 4.02
Urbanicity (urban vs rural)*	72.0	71.7	36.5	1.43	1.01, 2.04
Access to medical care					
No health insurance (vs yes)	2.8	2.4	6.1	1.02	0.42, 2.52
Unable to see Dr because of cost (vs not)	5.6	3.5	2.6	0.90	0.44, 1.83
Does not have primary care provider (vs does)	1.9	2.4	0.9	1.11	0.37, 3.35
Perceived neighborhood conditions					
At least 1 day of fear (vs 0 days)	3.1	2.8	3.5	1.02	0.42, 2.52
Social disorder	12.8 ± 4.0	12.3 ± 3.2	12.9 ± 3.4	0.94	0.90, 0.99
Physical disorder*	8.1 ± 2.7	7.4 ± 2.0	7.8 ± 2.1	0.91	0.84, 0.97
Collective efficacy*	2.0 ± 0.4	2.0 ± 0.3	2.0 ± 0.3	0.72	0.46, 1.11
Psychosocial factors					
Depressed mood (vs not)*	21.8	17.3	28.7	0.98	0.67, 1.44
Cohen stress scale	7.4 ± 3.2	7.3 ± 2.9	7.9 ± 3.2	1.02	0.97, 1.07
Personal stress scale*	4.6 ± 1.8	4.7 ± 1.8	5.1 ± 2.0	1.01	0.93, 1.10
Social support*	4.4 ± 0.7	4.5 ± 0.5	4.3 ± 0.7	1.13	0.89;1.44
Cancer-related behavior					

(continued)

Table 1. (continued)

Characteristic	Distance to Nearest Alcohol Outlet			Association With Alcohol Use	
	< 1 mi (n = 678)	1.0-2.9 mi (n = 254)	≥ 3 mi (n = 115)	Odds Ratio	95% Confidence Interval
No physical activity (vs any)*	29.1	16.9	34.8	0.75	0.52, 1.08
Current smokers (vs former/never)	11.7	6.3	12.2	2.70	1.76, 4.15
Health status					
Self-rated health (fair-poor vs good-excellent)*	16.7	9.1	18.3	2.37	1.36, 4.13
Body mass index					
< 25.0	29.7	32.3	27.8	1.00	
25.0-29.9	33.6	35.8	37.4	0.97	0.67, 1.41
30.0-34.9	19.5	19.7	16.5	0.77	0.49, 1.21
35.0 ≤	16.4	11.4	17.4	0.45	0.25, 0.79
Comorbidity*					
0	63.1	74.0	69.6	1.00	
1	18.3	15.4	10.4	0.58	0.36, 0.73
2+	18.6	10.6	20.0	0.44	0.27, 0.73
Physical functioning*	72.9 ± 25.8	77.6 ± 21.8	70.2 ± 24.6	1.02	1.01, 1.03
Clinical characteristics					
Stage at diagnosis*					
In situ/localized (vs regional/distant)	76.0	68.9	70.4	1.06	0.74, 1.52
Type of surgery*					
Mastectomy	28.9	34.7	40.9	1.00	
Breast conserving	60.6	53.5	48.7	1.12	0.79, 1.59
Both	8.1	7.1	7.8	0.72	0.36, 1.43
Neither	2.4	4.7	2.6	0.89	0.33, 2.40
Lymph node(s) removed (vs not)	23.6	20.5	13.9	1.24	0.86, 1.79
Chemotherapy received (vs not)	42.5	48.4	48.7	0.78	0.57, 1.06
Radiotherapy received (vs not)	72.4	70.1	65.2	0.83	0.58, 1.18
Hormonal therapy received (vs not)	66.8	69.7	69.6	1.12	0.80, 1.56
Surgical side effects*	8.1 ± 3.3	8.1 ± 3.0	9.3 ± 4.3	0.96	0.91, 1.01

[a]Excessive use: > 1 drink/day. Sample: Missouri breast cancer survivors 1 year after diagnosis.
*$P < .05$ (across categories of distance).

about having enough food in the past month. Income adequacy was measured by asking participants whether they felt their household income was comfortable, enough to make ends meet, or not enough to make ends meet. After geocoding the street address of the study participants, we used the census tract–based rural-urban commuting codes to classify the location of residence into 2 groups: urban (urban core, other urban) or rural (large rural core, other large rural, small rural core, other small rural, and isolated rural census tracts).[19] Census tract poverty rate was obtained using data from the 2000 census. Poverty was selected because it is a robust indicator of area-level socioeconomic status.[20] Poverty rate was determined using data on the percentage living in poverty in the residents' census tract and classified into 3 categories: 0%-9.9%, 10%-19.9%, and ≥ 20%. Because data about a woman's car ownership were not available, we included the percentage of households without a car at the census tract level.

Second, lack of access to medical care consisted of having no health care insurance at the time of the interview, being unable to see a doctor during the previous 12 months because of cost, and not having a place to go when sick or needing advice about health. All questions were from the Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System, the largest ongoing health-related telephone survey in the world (available at http://www.cdc.gov/brfss/). Women who affirmed any of these conditions to be true were considered to have reduced access to medical care.

Third, self-reported neighborhood conditions were measured using 4 scales. Perceived neighborhood disorder was measured with the 15-item Ross-Mirowsky Scale.[21] Collective

efficacy was based on informal social control and social cohesion and trust.[22] Neighborhood fear measured the number of days in the previous week during which the respondents feared violent or criminal activities or were afraid to leave their homes.[23]

Fourth, psychosocial factors consisted of social support using the Medical Outcomes Study Social Support Survey,[24] 2 measures of perceived stress,[25,26] and depressed mood using the validated 11-item version of the Center for Epidemiologic Studies Depression Scale.[27]

Fifth, cancer-related behaviors consisted of current smoking status and participation in any physical activity in the past month using questions from the Behavioral Risk Factor Surveillance System.

Sixth, health status consisted of self-rated health, comorbidity, and body mass index. Self-rated health was based on a single question from RAND's 36-item Health Survey, dichotomized as *fair* or *poor* versus all other categories, following common practice.[28-30] Comorbid conditions were measured using Katz's validated interview adaptation of the Charlson comorbidity index.[31] Body mass index was calculated from self-reported questions about height and weight from the Behavioral Risk Factor Surveillance System and categorized as normal weight (body mass index ≤ 25.0), overweight (25.1-29.9), and obese (≥ 30.0).[16] The RAND 36-item Health Survey Physical Functioning Scale also was included as a measure of functioning.

Seventh, clinical data consisted of collaborative stage at diagnosis from the Missouri Cancer Registry, breast surgery–associated side effects, and types of treatment received. Given the literature[32] and surgeons' anecdotal reports of patients' complaints after surgery, we developed a 5-item measure of breast surgery–associated side effects, with higher scores indicating more severe side effects (α = 0.74).[33] Treatment received consisted of type of surgery, axillary lymph node removal, receipt of chemotherapy, receipt of radiotherapy, and taking hormonal therapy at the time of the interview. Self-reported treatment is accurate relative to medical record review.[34]

Statistical Analysis

First, we assessed the association between categorized distance to the nearest alcohol outlet and alcohol use using a χ^2 test. Next, we used logistic regression models to determine the association of the categorized distance to the nearest alcohol outlet and all other covariates with alcohol use risk. We used multilevel regression when examining census tract poverty rate. If the *P* value for the likelihood ratio test was less than 0.15, this variable was considered for further inclusion in the model. Next, we added distance to the nearest alcohol outlet variables to the model and all covariates that met the inclusion criterion and calculated the odds ratio and 95% confidence intervals. The final model contained only variables with *P* values < .05 to increase parsimony and statistical power and to reduce overfitting. We used the GLIMMIX macro in SAS 9.1 to construct the multilevel models.

In a sensitivity analysis, we weighted the data to account for potential response bias using the following procedure. We estimated a multivariable logistic regression model of whether or not participants were included in the analytic sample, and we computed their predicted probability of inclusion based on age, race, and stage at diagnosis using Missouri Cancer Registry data. We determined the probability of participation (ie, inclusion in the analytic sample), and we used the inverse to reweight the data. This method gives greater weight to participants included in the analytic sample who are similar to women who were not included in the sample.[35] The total of the weighted participants reflects the actual number of women interviewed, implying that some women received weights that were greater than 1 while others received weights that were less than 1.

Results

During the study period, 675 women of the 4020 eligible women with first primary breast cancer were unable to be contacted. Of the remaining women, 1164 women completed the telephone interview for a participation rate of 34.8%. Nonparticipants were on average 4.9 years older (*P* < .001) and more likely to be African American (11.9% vs 6.1%, *P* < .001) than women who participated in the study. There was no difference in stage at diagnosis and rural versus urban location between study participants and nonparticipants. Seventy women were excluded because of high scores on the Orientation-Memory-Concentration test. Forty-seven women were excluded because of missing data on 1 or more of the covariates of interest, and the street address of 26 breast cancer survivors could not be geocoded, leaving 1047 women available for analysis.

Outlet Availability

During 2007, 2008, and 2009, there were 10 453, 10 546, and 10 452 licensed alcohol outlets in Missouri, respectively. In each year, a few (< 0.1%) could not be geocoded or were not located in Missouri, leaving 10 432, 10 524, and 10 430 outlets available for analysis in 2007, 2008, and 2009, respectively. A total of 8.8% of alcohol outlets were geocoded to their zip code centroid. There was 1 outlet for every 6.6 square miles in Missouri. The average distance to the nearest alcohol outlet by study participants was 1.3 miles (range: 0.0-14.6, median: 0.7). There was an average of 2.0 outlets per 1000 population (range: 0.0-32.7, median: 1.4) in the 621 census tracts that contained at least 1 study participant. The average number of outlets was 3.1 per square mile (range: 0.0-104.5, median: 1.0) in census tracts with at least 1 study participant.

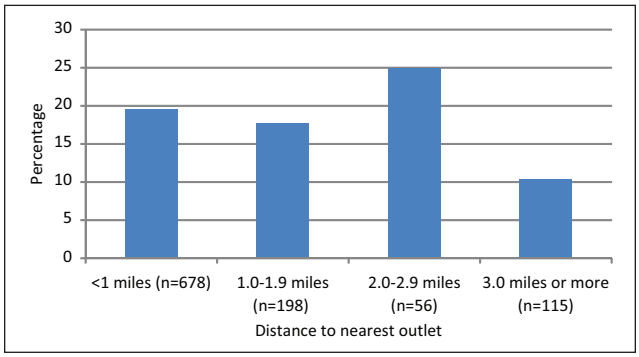

Figure 1. Prevalence of > 1 drink per day among breast cancer survivors by distance to nearest alcohol outlet.

Availability and Alcohol Use

Among the study participants, 51.5% reported having at least 1 drink in the past 30 days, and 18.4% reported having more than 1 drink per day. Various characteristics that varied by distance to the nearest alcohol outlet were associated with increased odds of excessive alcohol use, including being employed, living in a census tract with at least 10% of the population below poverty, and being a current smoker. Characteristics that were associated with lower odds of alcohol use included older age, having more than a high school education, increasing number of years at the same residence, lower income, greater social and physical disorder, and having at least one comorbid condition (Table 1).

Excessive alcohol use varied by distance categories (Figure 1, $P = .0428$). Based on logistic regression, the unadjusted odds of alcohol use was higher among participants who lived within 1 mile of the nearest alcohol outlet (odds ratio [OR]: 2.08; 95% confidence interval [CI]: 1.11, 3.89) or who lived between 2 and 3 miles of an outlet (OR: 2.86; 95% CI: 1.22, 6.71) compared to women who lived at least 3 miles away (Table 2). Women who lived between 1 and 2 miles from the nearest outlet were neither more nor less likely than women who lived at least 3 miles away to report excessive alcohol consumption. The final model contained age, perceived income adequacy, smoking, and census tract poverty rate and demonstrated that women who lived within 1 mile of the nearest alcohol outlet had 2.2 higher odds of alcohol use and that those who lived between 2 and 3 miles had 2.68 times higher odds of excessive alcohol use compared to those who lived at least 3 miles away. When distance was dichotomized, women who lived within 3 miles of the nearest outlet had 2.09 higher adjusted odds of excessive alcohol use (95% CI: 1.08, 4.05) than those who lived at least 3 miles of the nearest outlet. Persons living 0.5 miles or less to the nearest outlet had 2.52 (95% CI: 1.26, 5.07) higher adjusted odds of excessive alcohol use compared to those living at least 3 miles away. This result was similar to living within 1 mile of the nearest outlet. There was no significant association between excessive alcohol use and either the number of outlets per square mile ($P = .6007$) or the number of outlets per population ($P = .8114$).

Among persons who reported having at least 1 drink in the past month, 16.0% reported at least 1 episode of binge drinking—that is, having at least 4 or more drinks on 1 or more occasions. Among persons who reported having at least 1 drink in the past month, none of the 3 outlet availability measures was associated with the likelihood of having at least 4 or more drinks on 1 or more occasions. Using a weighting variable based on age, race, and stage at diagnosis to examine potential selective recruitment did not change the parameter estimates, suggesting that selection bias due to these characteristics was unlikely to adversely affect our findings

Discussion

Our study showed that breast cancer survivors who lived within 3 miles of an alcohol outlet 1 year after their diagnosis had 2 times higher odds of consuming more than 1 drink per day on average independent of their personal and neighborhood characteristics. Our findings show a threshold effect rather than a linear association. The number of outlets per 1000 population or per square mile did not affect likelihood of excessive alcohol consumption. Several studies have shown that excessive alcohol consumption and related harms increased with greater alcohol outlet density.[18] To date, research on the impact of retail alcohol density has focused mainly on regional or local assessments in urban areas, operationalizing outlet density as the number of outlets per population or per square mile.[36] Our study extended this approach by using a statewide sample of urban and rural breast cancer survivors using road network distance to the nearest outlet as the main access measure, based on the assumption that individuals travel along roadway networks, encountering alcohol and other establishments. Ecological and multilevel studies of outlet availability based on population density data within census tracts or other administrative boundaries may make interpretation of findings difficult because individuals often cross administrative boundaries that are somewhat artificial. Distance measures that were used in our study do not suffer from this limitation. For example, a study participant may be living on the east side of a road that is the boundary of a census tract with an outlet located across the street on the west side of the road but in a different census tract. While the road distance to this outlet may be very, very short, a participant's census tract may not have any alcohol outlets, erroneously suggesting that she lives in an area with little or no accessibility to outlets.

Based on our findings, there may be policy and behavioral opportunities to improve prognosis by reducing alcohol use among breast cancer survivors. The US Preventive

Table 2. Association Between Road Network Distance to Nearest Alcohol Outlet and Excessive Average Alcohol Use[a]

Model	Distance to Nearest Alcohol Outlet			
	< 1 mi (n = 678)	1-1.9 mi (n = 198)	2-2.9 mi (n = 56)	≥ 3 mi (n = 115)
Unadjusted	2.08 (1.11, 3.89)	1.84 (0.91, 3.72)	2.86 (1.22, 6.71)	1.00 (referent)
Multivariable[a]	2.22 (1.14, 4.34)	1.57 (0.74, 3.32)	2.68 (1.08, 6.67)	1.00 (referent)

[a]Adjusted odds ratio (95% confidence interval). Excessive use: > 1 drink/day.
[b]Covariates included age, perceived income adequacy, smoking, and census tract poverty rate.

Services Task Force, the World Health Organization, and the Substance Abuse and Mental Health Services Administration found sufficient evidence of a positive association between outlet density and excessive alcohol consumption and related harms to recommend limiting alcohol outlet density through the use of regulatory authority (eg, licensing and zoning) as a means of reducing or controlling excessive alcohol consumption and related harms.[37-39] Additionally, evidence-based counseling about alcohol use by primary care physicians and oncologists, particularly to breast cancer survivors who live within 3 miles of alcohol outlets, may be warranted.[40] The US Preventive Services Task Force recommends screening and behavioral counseling interventions to reduce alcohol misuse by primary care providers.[41] However, alcohol screening and counseling currently are delivered infrequently in primary care offices.[42]

Our study was limited by the low response rate, increasing the likelihood for selection bias. We have attempted to reduce the effect of selection bias by using a weighting model described above. It is difficult to determine the direction of potential bias based on the data available to us. If there were no difference in participation rates by alcohol outlet availability or alcohol consumption, then the effect of our low participation rate would be negligible. It is only when differential misclassification exists that the observed odds ratio could have overestimated the actual risk. Since we did not have any information about the participation rates by alcohol outlet availability and alcohol consumption, we weighted the data to reduce the effect of potential selection bias. Also, generalizabilty is limited in older and African American breast cancer survivors. It is also possible that the alcohol outlet data misclassified some establishments and that we may have counted establishments as retailers when they in fact were not (eg, some gas stations and convenience stores may not have sold alcohol even though they legally could have). This likely underestimated our findings. Also, the use of potential access indicators, as assessed by distance measures, should be interpreted in consideration of the possibility that women may choose to frequent alcohol outlets that are not closest to their homes for various reasons. Finally, our findings are based on cross-sectional observational data; thus, we cannot infer causal relationships. Nevertheless, the strengths of our study included our use of a statewide sample of urban and rural breast cancer survivors, multiple ways of classifying alcohol outlet availability using a geographic information system, the extensive list of predictors of alcohol consumption that were examined, and the multilevel analytic approach.

In conclusion, breast cancer survivors who lived within 3 miles of an alcohol outlet had 2 times higher odds of excessive alcohol consumption independent of their personal and neighborhood characteristics. Excessive alcohol consumption among breast cancer survivors, with its potential for adverse prognostic effects, is an important public health concern. Opportunities exist to reduce excessive alcohol use through policy and behavioral interventions.

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