Relationships between Census Tract-Level Social Determinants of Health and Cardiovascular Care Among Individuals Diagnosed with Breast Cancer

HSD21

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Introduction

- Individuals with breast cancer (BC) are at increased cardiovascular disease (CVD) risk compared to age-matched controls. Those receiving cardio-toxic treatment should be referred to a cardio-oncologist.
- Unfavorable social determinants of health (SDoH) are associated with poor cardiovascular care. However, this relationship is poorly understood in the BC population.
- We investigated the relationship among individuals diagnosed with BC who started cardio-toxic treatment and SDoH.

Objective

To identify the SDoH factors associated with cardiologist visits and time to visit after cancer treatment initiation among Medicare beneficiaries diagnosed with breast cancer.

Methods

- **Data source:** Surveillance, Epidemiology, and End Results-Medicare data linked with Census tract SDoH measures
- **Inclusion criteria:** Female patients with an incident diagnosis of invasive BC between 1/1/2007 and 12/31/2018 who received potential cardio-toxic treatment (i.e., radiation therapy, anthracyclines, or HER2-targeted therapy) within 12 months
- **SDoH variables selection:**
  - Guided by the Healthy People 2030 framework (Figure 1), 21 SDoH variables from five SDoH domains were selected.
  - Continuous SDoH variables were categorized into three groups based on quartiles (1=less than Q1 (reference) or 'low, 2=Q1 to Q3, 3=greater than Q3 or 'high').
  - Selected SDoH variables were reverse-coded to improve interpretability, ensuring that the reference group represented the least favorable conditions.
- **Study outcomes:**
  - Probability of a cardiologist visit within 90 days after initiating cardio-toxic treatment
  - Probability of a primary care physician (PCP) visit within 90 days after initiating cardio-toxic treatment
  - Time to cardiologist visit
  - Time to PCP visit
- **Statistical methods:**
  - Logistic regression with fixed effects was used to assess the probability of a physician visit. We reported covariate-adjusted odds ratios (aOR) and 95% confidence intervals (CI).
  - Exploratory factor analysis (EFA) was also conducted to identify the relationship and structure of SDoH variables.
  - Cause-specific Cox proportional hazards models were used to assess the timing of physician visits and address the competing risk of mortality. We reported adjusted hazard ratios (aHR) and their 95% CI.

Figure 1. Social Determinants of Health

Results

A total of 2,922 patients were included. Among them, 86% were White, 10% were Black and 4% were American Indian, Alaska Native, Asian or Pacific Islander (Table 1). The mean age was 71 years (SD=8).

Living in a low food access tract (aOR: 0.81, 95%CI: 0.66-0.99), primary care health professional shortage area (aOR: 0.70, 95%CI: 0.56-0.87) and a medium percentage of public transit trips for the Census tract (aOR: 0.79, 95%CI: 0.64-0.97) were associated with lower odds of a cardiologist visit. Statistically significant patient-level measures included comorbidity status and BC subtype (Table 2). There were no statistically significant tract-level variables in the 90-day PCP visit model.

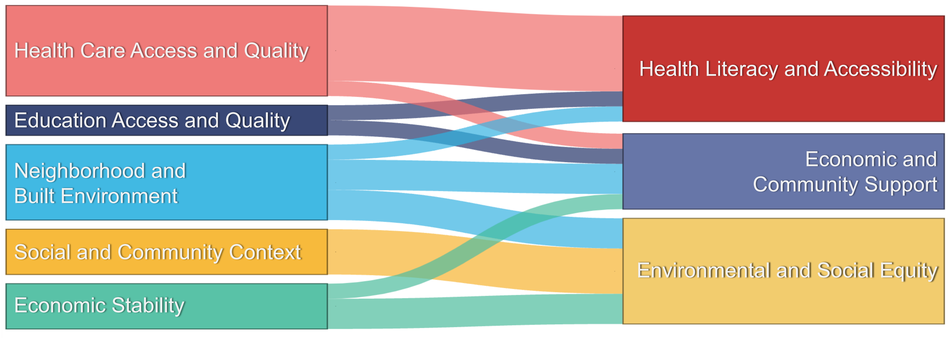
Table 2. Association between SDoH factors and cardiologist visit within 90 days

	Estimate	SD	p value	aOR* (95%CI)
Tract Level: Food and Nutrition				
Food access tracts				
Low Access Tract vs Non-Low Access Tract	-0.21	0.10	0.04	0.81 (0.66 - 0.99)
Tract Level: Healthcare System				
Primary Care Health Professional Shortage Area status				
HPSA vs. Non-HPSA	-0.36	0.11	0.00	0.70 (0.56 - 0.87)
Tract Level: Neighborhood and Physical Environment				
Workers who commuted to work using public transit				
Low vs High	-0.08	0.14	0.59	0.93 (0.70 - 1.23)
Medium vs High	-0.23	0.11	0.03	0.79 (0.64 - 0.97)

*Adjusted for demographics and individual-level risk factors

Exploratory factor analysis (EFA) with varimax rotation was used on the 19 SDoH factors: a 3-factor solution was chosen. Factor 1 contained 7 items that represented health literacy and access and accounted for 42.5% of the variance. Factor 2 contained 5 items that represented economic and community support and accounted for 30% of the variance. Factor 3 contained 7 items that represented environment and social equity and accounted for 27.5% of the variance (Figure 2).

Figure 2. EFA Results: From Framework-based Domains (left) **to Empiric Domains** (right)



We incorporated these newly established factors as SDoH domains into our models. No significant association was found between new SDoH domains and the odds of cardiologist visits or PCP visits. Similarly, no significant change was observed in the time to cardiologist visit. However, living in a tract that was ranked higher on the economic and community domain was statistically significantly associated with time to primary care visits (aHR: 1.15, 95%CI: 1.04-1.27), indicating that better economic and community support leads to earlier care from primary care. (Table 3)

Table 3. Association between SDoH domains and days to cardiologist visit

	Estimate	SD	p value	aHR* (95%CI)
Tract Level				
Domain 2: Economic and Community Support	0.14	0.05	0.01	1.15 (1.04 - 1.27)

*Adjusted for demographics and individual-level risk factors

Table 1. Baseline characteristics

	n	%
Age (Mean/SD)	71.43	8.33
<65	326	10.9%
65-69	857	28.6%
70-74	814	27.2%
75-79	543	18.1%
80-84	305	10.2%
85+	147	4.9%
Race		
White	2563	85.7%
Black	294	9.8%
American Indian / Alaska Native / Asian / Pacific Islander	124	4.1%
Other/Unknown	11	0.4%
AJCC stage		
Stage 1	548	18.3%
Stage 2	426	14.2%
Stage 3	236	7.9%
Stage 4	72	2.4%
Unknown	1710	57.2%
Hormone receptor status		
HER2+/HR+	312	10.4%
HER2+/HR-	147	4.9%
HER2-/HR+	1363	45.6%
Triple Negative	264	8.8%
Unknown	906	30.3%
HFA-ICOS risk assessment		
Congestive Heart Failure	996	33.3%
Myocardial infarction	292	9.8%
Arrhythmia	129	4.3%
Hypertension	2691	89.9%
Chronic kidney disease	834	27.9%
Diabetes mellitus	1486	49.7%
Obesity	1163	38.9%
Smoking	1243	41.5%
Elixhauser Comorbidity Index (Mean / SD)	10.97	4.61
CHA_2DS_2-VASc score (Mean / SD)	4.22	1.34
Any prior cardiovascular medications use	2168	72.5%

Abbreviation: AJCC, American Joint Committee on Cancer; HR, hormone receptor; HER2, human epidermal growth factor receptor 2; HFA-ICOS, Heart Failure Association-International Cardio-Oncology Society

Conclusion

- Three SDoH variables were associated with lower odds of a cardiologist visit among individuals diagnosed with BC.
- EFA revealed overlaps among SDoH factors from different domains within the original framework, underscoring the need for data-informed decisions regarding the specification of SDoH factors in regression models.
- One SDoH domain was associated with time to PCP visits, highlighting the critical role of SDoH and potential barriers to accessing care following initial treatment.
- Additional research is needed to determine how these contextual factors shape cardio-oncology outcomes.

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** References are available upon request*