Association of Social Determinants of Health and Neurotoxicity in Cancer Survivors

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Introduction/Background:

- Breast Cancer (BC) & Colorectal Cancer (CRC) are among the most common cancers & patient numbers continue to increase.
- Many BC and CRC often receive neurotoxic chemotherapy that result in chemotherapy-induced neuropathy (CIPN) and chemotherapy-related cognitive impairment (CRCI) in many survivors.
- The burden of chemotherapy-induced neurotoxicity (both CIPN and CRCI) will increase in the future, and socioeconomically disadvantaged patients may suffer the most. However, the relationships among potentially modifiable social determinant of health (SDOH) factors common to low socioeconomic populations and neurotoxicity severity have not been explored.

Purpose:

The purpose of this study was to examine the association of SDOH factors and neurotoxicity in a national sample of breast and colorectal cancer survivors.

Framework:

This study was based on the Social Determinants of Health Framework.

Methods:

This study was a secondary data analysis of a large national cross-sectional study of BCS & CRC recruited nationally via directed online advertisements (e.g., Dr. Susan Love Foundation, Colorectal Cancer Alliance, etc.) and Institutional Review Board of a large Midwest Comprehensive Cancer Center (NCT04611620).

Eligibility of Parent Study:

BCS & CRC survivors who completed survey questionnaires included:

- Female, ≥21 years of age
- Self-reported cognitive impairment
- ≥ 6 months post-treatment including surgery, radiation, and/or chemotherapy, and a first diagnosis of breast cancer

Eligibility of Current Study:

BCS & CRC survivors who received chemotherapy completed survey questionnaires of interest.

Instruments:

The following questionnaires were used:

- Demographic Characteristics
  - **Education**
  - **Income**
  - **Employment**
  - **National Area Depravation Index - ADI**
  - **Walkability** - was from a 2010 block group linkage to the US Environmental Protection Agency National Walkability Index, calculated from street intersection density, proximity to transit stops, and diversity of land uses https://efaidnbmnnnibpcajpcglclefindmkaj/https://www.epa.gov/sites/default/files/2021-06/documents/national_walkability_index_methodology_and_user_guide_june2021.pdf
  - **Rural/Urban** - estimated with census tract linkages to the 201 Rural-urban commuting area codes (RUCA), https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes
- PROMIS Neuropathic Pain Quality (version 2.0) – 5 item
- PROMIS Cognitive Abilities (version1.0) – 8 item
- PROMIS Cognitive Concerns (version1.0) – 8 item

Results:

- A total of 611 BCS (536, 88.1%) & CRCs (73, 11.9%) completed the study.
- The participants were, on average, 55.2 (SD = 9.9) years of age.
- The majority of the participants were White (89.7%), married (70.2%) highly educated (62.8% college or higher), employed – full or part-time (58.7%) and live in an urban area (68.7%)

Table 1. Association of SDOH and Neurotoxicity in Cancer

	Neuropathy			Applied Cognitive Abilities			Applied Cognitive General Concerns		
	Mean	SD	P	Mean	SD	P	Mean	SD	P
Race									
Non-Hispanic White	10.56	5.64		20.13	6.75		27.78	7.31	
Non-Hispanic Black	10.50	5.27	0.932	18.50	5.63	0.330	26.22	8.49	0.637
Hispanics	10.38	6.51		18.00	7.61		27.50	8.90	
Other	9.57	4.86		20.07	5.98		29.64	8.21	
Ethnicity									
Non-Hispanic	10.53	5.60	0.900	20.07	6.69	0.119	27.77	7.36	0.855
Hispanic	10.38	6.51		18.00	7.61		27.50	8.90	
Currently Married/partnered									
No	11.30	6.08	0.033	19.52	6.67	0.322	28.30	7.86	0.296
Yes	10.19	5.45		20.14	6.76		27.58	7.25	
Education									
High school or associate degree or lower	12.43	6.27	**<.001**	18.83	6.76	**0.002**	28.53	7.39	0.057
BA or higher	9.40	4.92		20.64	6.66		27.32	7.42	
Income									
$50k	12.21	6.24	**<.001**	18.30	6.65	**0.001**	28.65	7.64	0.106
$50-100k	10.68	5.58		20.22	6.90		27.54	7.43	
$100k+	9.26	4.93		20.90	6.48		26.93	7.39	
Employment									
Full time	9.47	5.03		20.43	6.30		27.41	6.62	
Part time	10.84	5.65	**<.001**	19.75	6.75	**<.001**	28.05	8.50	**<.001**
Unemployed	11.27	5.66		15.94	6.75		32.37	7.43	
Other (Homemaker/retired/unknown)	11.64	6.19		20.54	7.01		26.85	7.60	
ADI National Rank 2019									
1st quartile (rank 1-21)	9.52	4.98		20.12	6.80		27.78	7.76	
2nd quartile (rank 22-39)	9.65	5.50	**<.001**	20.81	6.90	0.266	26.81	7.51	0.282
3rd quartile (rank 40-59)	11.71	6.22		19.55	6.53		27.99	7.10	
4th quartile (rank 60+)	11.47	5.64		19.35	6.72		28.50	7.25	
Walkability									
1st quartile (NatWalkInd = 1)	10.19	5.79		19.80	6.49		27.75	7.51	
2nd quartile (NatWalkInd = 2-5)	11.41	6.18	0.175	20.26	7.06	0.731	27.68	7.48	0.971
3rd quartile (NatWalkInd = 6-7)	10.29	5.10		19.73	6.62		28.02	7.20	
4th quartile (NatWalkInd =8-9)	10.10	5.18		20.60	7.16		27.57	7.67	
Rural/Urban									
Urban	10.20	5.51	**0.023**	20.37	6.77	0.057	27.66	7.53	0.563
Non-urban	11.46	5.96		19.11	6.78		28.08	7.21	

Results Summary:

Neuropathic Pain and Cognitive Function (assessed via the PROMIS Cognitive Abilities Survey) were worse in patients who had lower education (p<.001 and p=0.002) and lower incomes (p<.001 and p=0.001).

Neuropathic Pain and Cognitive Function (assessed with both PROMIS Cognitive Abilities and Applied Cognitive General Concerns) were worse in those who were unemployed (p<.001).

Neuropathic Pain was worse in those that were not married (p=0.033), experienced higher (worse) Area Deprivation (assessed via the National Area Deprivation Index-ADI) (p<.001) and who lived in rural communities (p=0.023).

Walkability was not associated with neuropathic pain or cognitive function.

Discussion/Conclusion:

- Findings suggest that disparities in SDOH may exist all along the cancer survivorship continuum and impact outcomes
- Socioeconomic factors (lower income, unemployed & worse ADI) were associated with neurotoxicity in BCS & CRCs and need further investigation
- Limitations – Although this was a large national sample, this study was limited by its cross-sectional design (not predictive), failure to identify chemotherapy type (neurotoxic or not), unknown neuropathic pain etiology, and failure to assess objective CIPN & CRCI.
- More work is needed to fully understand neurotoxicity predictors in patients who commonly receive neurotoxic chemotherapy.

References: Available upon request