

Social determinants of health predict 90-day mortality among brain tumor patients

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Introduction

- Within Neurosurgical literature, there has been little research on the effect of larger structural and socioeconomic factors on postoperative outcomes in brain tumor patients.
- Broad-scale disparities encompassing factors such as (1) economic stability, (2) educational access and quality, (3) health care access and quality, (4) neighborhood and the built environment, and (5) social and community context have only recently been investigated in non-neurosurgical subspecialties and may influence neurosurgical outcomes.

Objectives

To determine the effects of social determinants of health disparities (SDOH) on hospital postoperative complications, LOS, nonroutine discharge, 90-day readmission, and 90-day mortality following brain tumor surgery.

Materials and Methods

Patient Population

- 2,519 patients who received surgical resection for brain tumor at a single institution between January 1st, 2017 and December 31st, 2019.

Classification of SDOH-related disparities

- the U.S. Department of Health and Human Services organized SDOH-related disparities into 5 primary domains:
 - Economic stability, educational access and quality, health care access and quality, neighborhood and the built environment, and social and community context
 - We used ICD-9 and -10 codes used to determine whether patients experienced an SDOH-related disparity prior to surgery (Table 1)

Statistical Analysis

- The Mann-Whitney U test was used for bivariate analysis of continuous variables and Fisher's exact test was used for bivariate analysis of categorical variables
- Outcomes that demonstrated a significant association with SDOH-disparity status in bivariate analysis were further analyzed using multivariate analysis

Results

Table 1
International Classification of Diseases (ICD) 9 & 10 codes utilized to identify disparities in the Economic and Social Context Domains of Social Determinants of Health

Economic factors	Educational factors	Social context	Health access	Food insecurity
V62.0, V60.5, V60.2, V69.1, E90.41, E90.42, 9942, 9943, 99552, 99584, E40, E41, E42, E43, E44.0, E44.1, E45, E46, E51.11, E51.12, E51.9, E52, E53.0, E53.1, E53.8, E53.9, E54, E55.0, E55.9, E60, E61.0, E61.1, E61.2, E61.3, E61.4, E61.5, E61.6, E61.7, E61.8, E61.9, E63.0, E63.1, E63.8, E63.9, E64.0, E64.1, E64.2, E64.3, E64.8, E64.9, T73.0XXA, T73.0XXD, T73.0XXS, T73.1XXA, T73.1XXD, T73.1XXS, T73.8XXA, T73.8XXD, T73.8XXS, T73.9XXA, T73.9XXD, T73.9XXS, T73.0, T73.1, Z59.4, T73.8, T73.9, X58, Z72.4, Z56.0, Z56.9, Z59.5, Z59.6, Z91.120, Z59.7	V62.3, Z55.0, Z55.1, Z55.2, Z55.3, Z55.4, Z55.8, Z55.9	V60.3, V60.4, V61.3, V61.8, V61.9, V62.4, V62.5, V62.9, V69.2, V69.3, V69.4, V69.8, V69.9, V61.01, V61.02, V61.03, V61.04, V61.05, V61.06, V61.07, V61.08, V61.09, V61.41, V61.42, V61.49, V62.81, V62.82, V62.82, V62.89, F43.9, Z60.0, Z60.2, Z60.3, Z60.4, Z60.5, Z60.8, Z60.9, Z62.4, Z63.0, Z63.1, Z63.4, Z63.5, Z63.6, Z63.7, Z63.8, Z63.9, Z65.0, Z65.1, Z65.2, Z65.3, Z65.8, Z65.9, Z72.8, Z73.2, Z73.8, Z63.32, Z63.72, Z63.79, Z72.89, Z73.89	V63.8, V63.9, Z74.8, Z75.4, Z75.9, Z75.3	E90.41, E90.42, V60.2, V69.1, 9942, 9943, 99552, 99584, T73.0, T73.1, E63.0, E63.1, E63.8, E63.9, Z59.4, T73.8, T73.9, X58, Z72.4, Z73.0, T73.0XXA, T73.0XXD, T73.0XXS, T73.1XXA, T73.1XXD, T73.1XXS, T73.8XXA, T73.8XXD, T73.8XXS, T73.9XXA, T73.9XXD, T73.9XXS, E40, E41, E42, E43, E44.0, E44.1, E45, E46, E51.11, E51.12, E51.9, E52, E53.0, E53.1, E53.8, E53.9, E54, E55.0, E55.9, E56.0, E56.1, E56.8, E56.9, E58, E59, E60, E61.0, E61.1, E61.2, E61.3, E61.4, E61.5, E61.6, E61.7, E61.8, E61.9, E63.0, E63.1, E63.8, E63.9, E64.0, E64.1, E64.2, E64.3, E64.8, E64.9

Characteristic	SDOH disparity cohort (n=187)	non-SDOH disparity cohort (n=2332)	p-value
Mean age ± SD (years)	57.16 ± 13.83	55.12 ± 15.24	0.089
Sex			
Male	74 (39.6)	1100 (47.2)	0.048*
Female	113 (60.4)	1232 (52.8)	
Race			
White or Caucasian	115 (61.5)	1658 (71.1)	Reference
Black or African-American	49 (26.2)	370 (15.9)	<0.001*
Asian	10 (5.3)	137 (5.9)	0.86
Other	13 (7.0)	167 (7.2)	0.64
Ethnicity			
Hispanic/Latino	6 (3.2)	115 (4.9)	0.37
Not Hispanic/Latino	181 (96.8)	2217 (95.1)	
Marital status			
Married	105 (56.1)	1552 (66.6)	0.0049*
Not married	82 (43.9)	780 (33.4)	
Insurance			
Private	113 (60.4)	1523 (65.3)	Reference
Medicare	56 (29.9)	660 (28.3)	0.44
Medicaid	18 (9.6)	149 (6.4)	0.083
Diagnosis			
Metastatic brain cancer	42 (22.5)	304 (13.0)	Reference
High grade glioma	22 (11.8)	493 (21.1)	<0.0001*
Vestibular schwannoma	12 (6.4)	183 (7.8)	0.026*
Meningioma	42 (22.5)	574 (24.6)	0.0061*
Pituitary tumor	31 (16.6)	331 (14.2)	0.14
Low grade glioma	19 (10.2)	207 (8.9)	0.17
Other	18 (9.6)	240 (10.3)	0.039*
Mean mFI-5 score ± SD	0.98 ± 0.91	0.75 ± 0.81	<0.001*
Mean ASA score ± SD	2.79 ± 0.58	2.63 ± 0.58	0.0012*

Table 2
Demographic and clinical characteristics of patients with and without SDOH disparities

Outcome	SDOH disparity cohort (n=187)	non-SDOH disparity cohort (n=2332)	p-value
Mean hospital LOS ± SD (days)	7.36 ± 10.52	5.34 ± 6.55	0.0036*
Postoperative complications			
Yes	19 (10.2)	216 (9.3)	0.69
No	168 (89.8)	2116 (90.7)	
Specific complications			
PE or DVT	11 (5.9)	155 (6.6)	-
Physiological or metabolic derangement	5 (2.7)	15 (0.6)	-
Respiratory failure	4 (2.1)	30 (1.3)	-
Sepsis	4 (2.1)	34 (1.5)	-
Discharge disposition			
Routine	144 (77.0)	1973 (84.6)	0.0092*
Nonroutine	43 (23.0)	359 (15.4)	
Mean hospital charges ± SD (U.S. dollars)	\$50,198.08 ± \$45,744.69	\$43,890.06 ± \$30,866.90	0.16
90-day readmission			
Yes	25 (13.4)	291 (12.5)	0.73
No	162 (86.6)	2041 (87.5)	
90-day mortality			
Yes	14 (7.5)	65 (2.8)	0.0016*
No	173 (92.5)	2267 (97.2)	

Table 3
Bivariate analysis of postoperative outcomes among patients with and without SDOH disparities

Outcome	Odds ratio/Coefficient	95% confidence interval	p-value
Hospital LOS	1.23	0.24 – 2.23	0.015*
Discharge disposition			
Nonroutine	1.36	0.91 – 2.01	0.13
Routine			
90-day mortality			
Yes	2.24	1.13 – 4.19	0.015*
No			

Table 4 : Multivariate analysis of the effect of SDOH disparities on postoperative outcomes

Conclusion

- When controlling for demographic factors, tumor diagnosis, and mFI-5 and ASA scores, we found that SDOH-related disparities are significantly and independently associated with increased hospital LOS and 90-day mortality in brain tumor patients who underwent surgical resection.
- Our work may be useful in reducing postoperative morbidity and mortality in brain tumor patients with SDOH-related disparities.