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Economic Impact of Benign and Malignant Brain Tumors in the United States: 1996-2014 Medical Expenditure Panel Survey

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Introduction

-The Central Brain Tumor Registry of the United States (CBTRUS) estimates there will be 79,270 new primary brain tumors diagnosed in the US during 2017 (1)

-Few studies have evaluated overall healthcare expenditures for patients with brain tumors

Objective

To study per-user healthcare expenditures for benign and malignant brain tumors related to emergency, inpatient, outpatient, and pharmaceutical services

Methods

-Data comes from the Medical Expenditure Panel Survey (MEPS)

-Medical expenditures related to brain tumors were identified using self-reported medical conditions converted to ICD-9-CM codes

-Inflation-adjusted per-user expenditures were determined for:

- Emergency department (ER) visits
- Inpatient stays
- Outpatient visits
- Prescription medications

-Linear regression analyses were used to examine inflation-adjusted per-user expenditures for patients with benign and malignant brain tumors while controlling for:

- Age
- Sex
- Marital status
- Race
- Education
- Region of the country
- Insurance status
- Healthcare utilization

Table 1. Descriptive statistics for healthcare expenditures and utilization among patients with benign and malignant brain tumors

Variable	Overall Sample (n=52,142)	Benign Tumor (n=21,503)	Malignant Tumor (n=30,639)	P-Value
Emergency Room				
# of Patients with an Event	10894	1724	9170	
Proportion of Patients with an Event	20.89%	8.02%	29.93%	
Mean # of Events per Patient (SE)	0.35 (0.07)	0.16 (0.07)	0.49 (0.10)	0.0011
Estimated Total # of Events	18425	3508	14917	
Mean Expenditures Per Patient	255.69 (38.02)	119.85 (21.53)	304.17 (49.51)	0.0005
Inpatient				
# of Patients with an Event	18695	3371	15324	
Proportion of Patients with an Event	35.85%	15.68%	50.01%	
Mean # of Events per Patient (SE)	0.72 (0.05)	0.22 (0.07)	1.07 (0.08)	<0.0001
Estimated Total # of Events	37570	4810	32760	
Mean Expenditures Per Patient	15386 (3805.98)	5714.49 (2474.08)	18837 (5062.95)	0.0068
Outpatient				
# of Patients with an Event	51507	21073	30435	
Proportion of Patients with an Event	98.78%	98.00%	99.34%	
Mean # of Events per Patient (SE)	12.78 (0.91)	10.70 (0.37)	14.24 (1.56)	<0.0001
Estimated Total # of Events	666276	230052	436224	
Mean Expenditures Per Patient	2613.58 (768.42)	1172.98 (60.22)	3624.63 (1303.62)	0.0093
Prescription				
# of Patients with an Event	47886	19923	27963	
Proportion of Patients with an Event	91.84%	92.65%	91.27%	
Mean # of Events per Patient (SE)	21.56 (1.02)	23.34 (1.47)	20.32 (1.36)	<0.0001
Estimated Total # of Events	1124279	501833	622447	
Mean Expenditures Per Patient	2288.91 (163.29)	2893.89 (168.46)	1864.33 (155.97)	<0.0001
Mean Total Expenditures Per Patient	24273 (3614.01)	11494 (2104.55)	33241 (5865.07)	0.0002

Table 2. Linear regression models for healthcare expenditures among patients with benign and malignant brain tumors

	Mean Expenditures Per Patient									
Variable	Emergency Room	P-Value	Inpatient	P-Value	Outpatient	P-Value	Prescription	P-Value	Total Healthcare	P-Value
Brain Tumor Type										
Benign	Reference		Reference		Reference		Reference		Reference	
Malignant	-0.14 (0.63)	0.86	3.41 (0.89)	0.16	4.16 (1.74)	0.14	0.86 (1.44)	0.61	0.50 (0.05)	0.008
Age	0.06 (0.01)	0.14	0.03 (0.02)	0.42	-0.07 (0.08)	0.46	0.12 (0.02)	0.02	0.01 (0.001)	0.002
Sex										
Male	Reference		Reference		Reference		Reference		Reference	
Female	-3.03 (1.05)	0.21	-0.23 (1.41)	0.90	1.00 (2.76)	0.75	-1.02 (0.49)	0.17	0.17 (0.02)	0.01
Marital Status										
Married	Reference		Reference		Reference		Reference		Reference	
Non-Married	-2.59 (2.14)	0.44	4.86 (2.47)	0.30	-7.70 (5.21)	0.28	1.50 (1.04)	0.29	-0.32 (0.10)	0.09
Race										
White	Reference		Reference		Reference		Reference		Reference	
Other	1.94 (0.42)	0.13	-2.13 (0.19)	0.06	2.64 (1.76)	0.27	3.45 (0.93)	0.07	0.10 (0.07)	0.27
Education										
< High School	Reference		Reference		Reference		Reference		Reference	
High School/GED	-1.95 (0.23)	0.08	-6.69 (0.05)	0.005	1.42 (2.60)	0.64	0.92 (1.21)	0.53	-0.13 (0.08)	0.25
> High School	0.72 (0.50)	0.39	-1.70 (0.89)	0.31	-4.92 (2.09)	0.14	-0.19 (0.48)	0.73	-0.40 (0.03)	0.007
Region										
Northeast	Reference		Reference		Reference		Reference		Reference	
Midwest	-4.51 (0.09)	0.01	1.51 (0.27)	0.11	-2.94 (3.04)	0.44	-2.44 (2.13)	0.37	-0.14 (0.11)	0.32
South	1.45 (0.71)	0.29	-3.32 (0.31)	0.06	3.14 (2.24)	0.30	0.53 (0.94)	0.63	0.06 (0.10)	0.60
West	-3.36 (0.10)	0.02	-0.26 (0.14)	0.31	-2.71 (2.19)	0.34	-2.04 (1.88)	0.39	0.32 (0.07)	0.04
Insurance										
Any Private	Reference		Reference		Reference		Reference		Reference	
Public Only	3.73 (0.32)	0.05	5.39 (0.65)	0.08	-4.49 (0.16)	0.001	1.59 (0.06)	0.001	-0.02 (0.05)	0.73
Uninsured	2.70 (1.31)	0.29	1.08 (1.47)	0.60	-10.49 (1.40)	0.02	-18.27 (0.84)	0.002	-1.40 (0.01)	<0.0001
# ER Visits	8.37 (0.23)	0.02	0.08 (0.11)	0.59	-3.61 (1.08)	0.08	0.37 (0.11)	0.08	0.05 (0.05)	0.39
# Inpatient Stays	3.62 (0.02)	0.004	12.43 (0.002)	0.0001	6.86 (0.41)	0.004	0.71 (0.05)	0.005	0.76 (0.01)	0.0004
# Outpatient Visits	-0.02 (0.01)	0.25	0.19 (0.004)	0.01	-0.04 (0.03)	0.31	0.10 (0.03)	0.06	0.02 (0.003)	0.02
# Prescriptions	0.05 (0.004)	0.05	-0.11 (0.001)	0.006	0.11 (0.005)	0.003	0.06 (0.01)	0.03	0.01 (0.001)	0.008
R-Squared	0.86		0.89		0.35		0.57		0.71	
Adjusted R-Squared	0.76		0.81		0.09		0.39		0.60	

Results

-There were an estimated 52,142 persons with 21,503 (41.24%) benign and 30,639 (58.76%) malignant brain tumors within the MEPS between 1996-2014

-Mean total healthcare expenditures per patient were $24,273.00

-In univariate analysis, patients with malignant brain tumors had higher per-user expenditures for:

- ER visits ($304.17 vs. $119.85; p<.001)
- Inpatient stays ($18,837.00 vs. $5,714.49; p<.001)
- Outpatient visits ($3,624.63 vs. $1,172.98; p<.001)
- Total expenditures ($33,241.00 vs. $11,494.00; p<.001)

-In univariate analysis, patients with benign brain tumors had higher per-user expenditures for:

- Prescription medications ($2,893.89 vs. $1,864.33; p<.001)

-In multivariable analysis, only total per-user healthcare expenditures were higher for patients with malignant brain tumors when compred to those with benign brain tumors (beta: 0.50; SE: 0.05; p<.01)

Conclusions

This study is one of the first to investigate healthcare expenditures for brain tumors within a nationally representative sample. After controlling for covariates, the total per -user healthcare expenditures for patients with malignant brain tumors were substantially higher than those with benign brain tumors.

References

(1) Quinn T. Ostrom, Haley Gittleman, Jordan Xu, Courtney Kromer, Yingli Wolinsky, Carol Kruchko, and Jill S. Barnholtz-Sloan, CBTRUS Statistical Report: Primary Brain and Central Nervous System Tumors Diagnosed in the United States in 2009–2013, Neuro Oncol (2016) 18 (suppl 5): v1-v75 doi: 10.1093/neuonc/nov207.