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Association of Employment Status With Symptom Burden and Health-Related Quality of Life in People Living With Primary CNS Tumors

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Abstract

Background and Objectives

Financial toxicity significantly affects many patients, especially cancer survivors. We evaluated the association of unemployment as a major contributor to financial toxicity with patient-reported outcomes (PROs) assessing multiple illness experience domains in a primary CNS tumor (PCNST) cohort.

Methods

Patient and disease characteristics and PROs measuring symptom burden, interference, psychologic distress, functional impairment, and health-related quality of life (HRQOL) from participants enrolled in an institutional review board–approved observational study at the US NIH's Neuro-Oncology Branch were collected between September 2016 and December 2019. Descriptive statistics, tests of association, and comparison of group mean values were used to describe and evaluate PROs.

Results

Of the 277 participants diagnosed with a PCNST, 57% were male and 43% were female. Participants reported their race as White, non-Hispanic (78%); White, Hispanic/Latino (9%); Asian (7%); Black (4%); Native Hawaiian/Pacific Islander (1%); and other (2%) with 8% missing. The median age of the overall cohort was 45 years (range 18–74). Hispanic participants in the overall sample were 2.3 times more likely, and in the brain tumor group 3.2 times more likely, to report unemployment ($p = 0.043$, odds ratio [OR] 2.3, 95% CI 1.0–5.4 and $p = 0.008$, OR 3.2, 95% CI 1.3–7.9, respectively). 77 (28%) individuals unemployed due to tumor reported more functional impairment with walking, washing, dressing, and performing usual activities and reduced HRQOL ($p < 0.001$). More unemployed participants in the total sample reported moderate-to-severe depressive symptoms (25%) than those employed (8%) ($\chi^2(1) = 13.9$, $p < 0.001$, OR 3.7, 95% CI 1.8–7.8) and more moderate-to-severe anxiety symptoms (30%) than those employed (15%) ($\chi^2(1) = 7.8$, $p = 0.005$, OR 2.4, 95% CI 1.3–4.5). Unemployed participants with brain tumor reported on average 3 more symptoms as moderate-to-severe compared with those employed ($t(83) = -4.0$, 95% CI $\bar{x}_{\text{difference}}$ −5 to −2, $p < 0.001$, Hedge $g = 0.70$).

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From the Neuro-Oncology Branch (H.E.L., E.V., A. Christ, A.A., N.B., A. Choi, E.G., V.J., M.L., J.R., K.N.R., J.L.R., M.T., E.B., M.P.-P., V.P., L.P., B.J.T., J.W., M.R.G., T.S.A.), and Office of Information Technology (J.L.), Center for Cancer Research, National Cancer Institute, NIH, Bethesda; Leidos Biomedical Research (L.B., M.P.), Frederick National Laboratory for Cancer Research Sponsored by the National Cancer Institute, MD; Concentric Methods, LLC (N.L.), Manassas, VA; and Department of Neurology (B.J.T.), Uniformed Services University of the Health Sciences, Bethesda, MD.

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Glossary

EQ-5D-3L = 3-level EuroQol 5-dimensions; **HRQOL** = health-related quality of life; **KPS** = Karnofsky performance status; **MDASI-BT** = MD Anderson Symptom Inventory-Brain Tumor; **MDASI-SP** = MD Anderson Symptom Inventory-Spine Tumor; **NHS** = Natural History Study; **OR** = odds ratio; **PCNST** = primary CNS tumor; **PRO** = patient-reported outcome; **PROMIS** = Patient-Reported Outcomes Measurement Information System; **PROMIS-Anxiety** = PROMIS-Anxiety Short Form 8a; **PROMIS-Depression** = PROMIS-Depression Short Form 8a; **WHO** = World Health Organization.

Discussion

Being unemployed due to a PCNST strongly correlated with high symptom burden, functional impairment, psychological distress, and reduced HRQOL, which may be impediments to returning to work that warrant intervention. Lack of employer-based health insurance and reduced earnings are financial sequelae of unemployment superimposed on the physical, social, and cognitive effects of living with a PCNST. Innovations to screen for and address financial toxicity and its contributing factors are needed.

The financial consequences of receiving a cancer diagnosis and treatment are increasingly acknowledged as a significant issue among cancer survivors.[1-4] A comprehensive estimate of national patient economic burden associated with cancer care was projected to be $21.1 billion in 2019 alone.[5] Financial toxicity after a cancer diagnosis may arise because of increased spending and decreased earnings due to unemployment, underemployment, and/or ability to return to work.[4-6] People living with a primary CNS tumor (PCNST) concurrently experience symptoms related to cancer and its treatments and neurologic dysfunction.[7] From a personal economic perspective, an individual's health and ability to maintain employment may be significantly affected by a PCNST and its treatment.[8,9] Unemployment may result in financial distress and eliminate access to employer-based health insurance; these issues may be of particular importance for younger working-age individuals who may have less finance resources and health insurance options than older adults who have retired and qualify for Medicare.[5,10] The economic impact on nations and individuals leading to financial burden, loss of workplace productivity, and health care expenditures after diagnosis and treatment for several glioma subtypes have been previously reported.[8,9,11-16] This study aims to assess any differences in self-reported symptom burden, interference, psychological distress, functional impairment, and health-related quality of life (HRQOL) of those living with a PCNST based on current employment status.

Methods

This was a cross-sectional analysis using clinical, demographic, and patient-reported outcome (PRO) data at study entry from participants with complete data who enrolled on the Neuro-Oncology Branch Natural History Study (NHS) at the NIH, Bethesda, MD, between April 2017 and December 2019. The NHS is an observational study designed to longitudinally follow-up participants with PCNSTs from their first clinic visit throughout their disease course. Patients who are older than 18 years and diagnosed with a PCNST or with known genetic syndromes who are at high risk of developing CNS cancers are eligible. Participants were asked at study entry using a standardized intake form permitting single responses whether they were male or female, American Indian or Alaska Native, Asian, Black, or African American, Native Hawaiian or Pacific Islander, White, unknown, employed full-time, part-time, self-employed, unemployed due to tumor diagnosis, unemployed before tumor diagnosis, on medical leave, retired, or a student/volunteer.

Standard Protocol Approvals, Registrations, and Patient Consents

The NHS protocol 16-C-0151 (principal investigator: T.S. Armstrong; NCT02851706) was approved by the NIH institutional review board committee on human experimentation for any experiments using human participants. Written informed consent was obtained from all participants.

PRO Instruments

The US Food and Drug Administration defines a PRO as a measurement based on report that comes directly from the patient about the status of a patient's health condition without amendment or interpretation of the patient's response by a clinician or anyone else.[17] HRQOL is a multidimensional concept, reflecting the impact of illness or treatment on physical, cognitive, social, and emotional functioning within an individual's overall quality of life.[17,18] Three-level EuroQol 5-dimensions (EQ-5D-3L) is validated in the general population to reliably assess overall health status/HRQOL using a visual analog scale ranging from 0 (worse imaginable health state) to 100 (best imaginable health state) and numeric scales (1–3; higher scores indicate higher severity) to assess mobility, self-care, usual activities, pain/discomfort, and anxiety/depression.[19-21] A global index score is calculated using population-based preference weight-scoring function with 1.0 describing health as perfect, 0.0 describing health as death-like, and <0 describing health worse than death. The estimated minimal clinically important difference for the index score is 0.06.[19]

Patient-Reported Outcomes Measurement Information System (PROMIS) item bank v1.0-Emotional Distress-Anxiety Short Form 8a (PROMIS-Anxiety) and -Depression Short Form 8a (PROMIS-Depression) are validated 8-item self-report instruments to assess symptoms of anxiety and depression, respectively, using a Likert scale (1–5; higher scores indicate higher severity).[22] The minimally important differences for PROMIS-Anxiety and PROMIS-Depression are 4 and 3.5 points, respectively.[23]

MD Anderson Symptom Inventory-Brain Tumor (MDASI-BT) and MD Anderson Symptom Inventory-Spine Tumor (MDASI-SP) modules are self-report instruments measuring symptom burden (reported as symptom severity) and interference caused by symptoms using a numeric scale (0–10; higher score indicates higher severity) for a set of symptoms occurring within the past 24 hours. Each instrument was specifically designed for adults living with a primary brain or spinal cord tumor, respectively, and has been validated.[24,25] The 28-item MDASI-BT measures 6 underlying symptom factors (affective, cognitive, neurologic, gastrointestinal-related, general disease, and treatment-related) and symptom interference in daily activities (activity-related interference subscale includes the following: general activity, work, and walking; mood-related interference subscale includes the following: mood, relations with others, and enjoyment of life). The 24-item MDASI-SP measures 4 underlying symptom factors (autonomic function, disease-related, constitutional/treatment related, and emotional) and symptom interference in the same manner as the MDASI-BT. For both instruments, symptom items rated ≥5 and interference items rated ≥2 are considered moderate to severe, and the minimally important difference is 1 point. Because MDASI module scale completion is determined by location within the CNS, symptom burden results are presented by tumor location.

Statistical Analysis

Participant and disease characteristics, PRO summary scores, and proportions were analyzed using descriptive statistics. Missing data (reported in Tables 1–4) were considered at random; data imputation was not undertaken. Due to their small sample sizes, demographic comparisons and PRO result correlations by employment status within the spinal cord tumor group and brain and spinal cord tumor group were not tested. Employment status was dichotomized into employed if participants indicated they worked full-time, part-time, or self-employed and unemployed due to tumor if "unemployed due to tumor diagnosis" was selected. Tumor diagnosis and grading were based on the 2016 World Health Organization (WHO) classification of CNS tumors. Tumor grade was dichotomized into low grade (WHO grades I–II) and high grade (WHO III–IV). Tumor diagnoses were grouped into those most common in this sample: astrocytoma, ependymoma, oligodendroglioma, a fourth group of glial and nonglial tumor diagnoses within the cohort, and those without tissue diagnosis comprise a fifth group; details in Table 1. Karnofsky performance status (KPS) is a clinician-reported assessment of a patient's daily functioning and ability to participate in work and activities of daily living, scored from 0 to 100 with higher scores indicating better functioning.[26] KPS scores were dichotomized into 90–100 and ≤80 based on associations of KPS scores ≤80 with higher symptom burden and increased daily activity interference.[24]

PRO scores were analyzed using established cutoffs or *t* scores and minimally important differences. EQ-5D-3L global index scores were calculated per the Shaw et al.[19] scoring algorithm with perfect health scored as 1.0. For PROMIS-Anxiety and PROMIS-Depression, scores 1 SD or higher above the mean (*t* score ≥60) are moderate to severe. The associations between and among group differences regarding employment status, tumor location (brain; spinal cord; and brain and spinal cord), and PROs were analyzed using chi-square tests of association with effect size reported as odds ratio (OR) or Cramer *V* and independent sample *t* tests with effect size reported as Hedge *g* with *p* value thresholds adjusted for multiple comparisons (Holm-Bonferroni method).

Data Availability

Data not provided in the article because of space limitations may be shared (anonymized) at the request of any qualified investigator for purposes of replicating procedures and results.

Results

Demographic and Clinical Characteristics

A total of 277 participants met study inclusion criteria with 77 (28%) reporting unemployment due to tumor and 200 (72%) reporting as employed; the demographics, clinical characteristics, and treatment history of the total sample and by tumor location group based on employment status are listed in Table 1. Overall, the median age was 45 years (range 18–74); most were non-Hispanic/Latino White (78%) males (57%) who were married (63%) and living with a high-grade (59%) tumor, predominately an astrocytoma (48%). The median time since diagnosis was 22 months (range 0–384 months), and 48% had been diagnosed with ≥1 tumor recurrence. Tumor treatment of most participants (51%) included surgery, radiation, and chemotherapy. Data were further subdivided for reporting purposes based on tumor location: 227 had tumor involving brain (82%); 38 had tumor involving spinal cord (14%); and 12 had tumor involving brain and spinal cord (4%).

Demographic and clinical characteristics were assessed for potential correlations with employment status for the overall sample and the brain tumor group. Hispanic participants in the overall sample were 2.3 times more likely, and in the brain tumor group 3.2 times more likely, to report unemployment (p = 0.043, OR 2.3, 95% CI 1.0–5.4 and p = 0.008, OR 3.2, 95% CI 1.3–7.9, respectively). Significantly more participants whose annual household income was <$25,000 were

Table 1 Patient Demographics and Clinical Characteristics

	Total (N = 277)			Brain (n = 227 [82%])		Brain and spine (n = 12 [4%])		Spine (n = 38 [14%])	
	Total (N = 277)	Total sample employed (n = 200)	Total sample unemployed (n = 77)	Brain, employed (n = 164)	Brain. unemployed (n = 63)	Brain + spinal cord employed (n = 7)	Brain + spinal cord unemployed (n = 5)	Spinal cord employed (n = 29)	Spinal cord unemployed (n = 9)
Age, y									
Median	45	45	45	46	44	26	29	41	46
Range	18–74	18–74	22–67	18–74	22–67	21–53	24–48	22–60	39–60
Mean (SD)	45 (12.4)	45 (13)	44 (11)	46 (13)	44 (11)	31 (11)	34 (10)	41 (10)	47 (6)
Sex, n (%)									
Female	118 (43)	82 (41)	36 (47)	63 (38)	29 (46)	5 (71)	0 (0)	14 (48)	7 (78)
Male	159 (57)	118 (59)	41 (53)	101 (62)	34 (54)	2 (29)	5 (100)	15 (52)	2 (22)
Race, n (%)									
Asian	20 (7)	17 (9)	3 (4)	15 (9)	1 (2)	2 (29)	0 (0)	0 (0)	2 (22)
Black/African American	12 (4)	6 (3)	6 (8)	5 (3)	5 (8)	0 (0)	0 (0)	1 (3)	1 (11)
Native Hawaiian/ Pacific Islander	2 (1)	1 (1)	1 (1)	1 (1)	1 (2)	0 (0)	0 (0)	0 (0)	0 (0)
White	217 (78)	161 (81)	56 (73)	130 (79)	45 (71)	4 (57)	5 (100)	27 (93)	6 (67)
Other	5 (2)	5 (3)	0 (0)	4 (2)	0 (0)	1 (14)	0 (0)	0 (0)	0 (0)
Missing	21 (8)	10 (5)	11 (14)	9 (5)	11 (17)	0 (0)	0 (0)	1 (3)	0 (0)
Ethnicity, n (%)									
Hispanic/Latino	25 (9)	14 (7)	11 (14)	11 (7)	11 (17)	1 (14)	0 (0)	2 (7)	0 (0)
Marital status, n (%)									
Single	67 (24)	44 (22)	23 (30)	35 (21)	17 (27)	2 (29)	2 (40)	7 (24)	4 (44)
Married	175 (63)	133 (67)	42 (55)	109 (67)	35 (56)	3 (43)	3 (60)	21 (72)	4 (44)
Divorced/separated/ widowed	20 (7)	12 (6)	7 (9)	10 (6)	7 (11)	1 (14)	0	1 (3)	1(11)
Missing	15 (5)	11 (6)	5 (6)	10 (6)	4 (6)	1 (14)	0	0	0
Annual household income, n (%)									
<$25,000	19 (7)	7 (4)	17 (22)	7 (4)	12 (19)	0 (0)	1 (20)	0 (0)	4 (45)
$25,000–$49,999	28 (10)	18 (9)	11 (14)	13 (8)	8 (13)	1 (14)	2 (40)	4 (14)	1 (11)
$50,000–$149,999	79 (29)	56 (28)	25 (32)	47 (29)	22 (35)	0 (0)	1 (20)	9 (31)	2 (22)
≥$150,000	49 (18)	47 (24)	2 (3)	37 (23)	2 (3)	2 (29)	0 (0)	8 (28)	0 (0)
Declined	92 (33)	72 (36)	22 (29)	60 (37)	19 (30)	4 (57)	1 (0)	8 (28)	2 (22)
Highest education level, n (%)									
High school or below	36 (13)	21 (11)	15 (19)	17 (11)	15 (24)	2 (29)	0 (0)	2 (7)	0 (0)
Some college/ bachelor's degree	151 (55)	99 (50)	52 (68)	76 (46)	42 (67)	4 (58)	4 (80)	19 (66)	6 (67)
Professional/graduate degree	88 (32)	79 (40)	9 (12)	70 (43)	6 (10)	1 (14)	1 (20)	8 (28)	2 (22)
Missing	2 (0)	1 (1)	0 (0)	1 (1)	0	0	0	0	1 (11)
Tumor grade, n (%)									
WHO grades I–II	89 (32)	66 (33)	23 (30)	41 (28)	15 (24)	5 (71)	1 (20)	20 (80)	7 (100)
WHO grades III–IV	162 (59)	111 (56)	51 (66)	104 (72)	47 (76)	2 (29)	4 (80)	5 (20)	0 (0)

Continued

Table 1 Patient Demographics and Clinical Characteristics *(continued)*

	Total (N = 277)			Brain (n = 227 [82%])		Brain and spine (n = 12 [4%])		Spine (n = 38 [14%])	
	Total (N = 277)	Total sample employed (n = 200)	Total sample unemployed (n = 77)	Brain, employed (n = 164)	Brain. unemployed (n = 63)	Brain + spinal cord employed (n = 7)	Brain + spinal cord unemployed (n = 5)	Spinal cord employed (n = 29)	Spinal cord unemployed (n = 9)
Tumor diagnosis, n (%)									
Astrocytoma	132 (48)	94 (47)	38 (49)	93 (57)	34 (54)	0 (0)	0 (0)	1 (3)	4 (44)
Ependymoma	49 (18)	38 (19)	11 (14)	10 (6)	5 (8)	5 (72)	3 (60)	23 (79)	3 (33)
Oligo-dendroglioma	22 (8)	16 (8)	6 (8)	16 (10)	6 (10)	0 (0)	0 (0)	0 (0)	0 (0)
Other[a]	53 (19)	33 (17)	20 (26)	30 (18)	18 (29)	2 (28)	2 (40)	1 (3)	0 (0)
No histologic diagnosis	21 (8)	19 (10)	2 (3)	15 (9)	0 (0)	0 (0)	0 (0)	4 (14)	2 (22)
KPS, n (%)									
90–100	189 (68)	160 (81)	29 (37)	135 (82)	27 (43)	4 (57)	0 (0)	21 (72)	2 (22)
≤80	87 (31)	40 (21)	45 (59)	29 (18)	36 (57)	3 (43)	5 (100)	8 (28)	6 (66)
Time since diagnosis, mo									
Median (range)	22 (0–384)	16 (0–339)	38 (1–384)	13 (0–273)	34 (1–264)	131 (91–242)	152 (49–280)	22 (0–339)	40 (9–384)
Recurrence, n (%)									
0	145 (52)	117 (59)	28 (36)	100 (61)	23 (37)	0 (0)	0 (0)	17 (59)	5 (56)
1	64 (23)	42 (21)	22 (29)	37 (23)	19 (30)	2 (29)	1 (20)	3 (10)	2 (22)
≥2	68 (25)	41 (21)	27 (35)	27 (17)	21 (33)	5 (71)	4 (80)	9 (31)	2 (22)
Treatment, n (%)									
Surgery only	63 (23)	50 (25)	13 (17)	39 (24)	10 (16)	0 (0)	0 (0)	11 (38)	3 (33)
Chemotherapy	2 (0)	1 (1)	1(1)	1 (1)	1 (2)	0 (0)	0 (0)	0 (0)	0 (0)
Radiation only	52 (19)	37 (19)	15 (20)	24 (15)	14 (22)	3 (43)	0 (0)	10 (35)	1 (11)
Radiation and chemotherapy	140 (51)	94 (47)	46 (60)	86 (52)	38 (60)	4 (57)	5 (100)	4 (14)	3 (33)
No treatment	20 (7)	18 (9)	2 (3)	14 (9)	0 (0)	0 (0)	0 (0)	4 (14)	2 (22)

Abbreviation: WHO = World Health Organization.
[a] Anaplastic meningioma, astroblastoma, atypical meningioma, atypical teratoid rhabdoid tumor, central neurocytoma, diffuse midline glioma, dysembryoblastic neuroepithelial tumor, ganglioglioma, glioneuronal tumor, gliosarcoma, hemangiopericytoma, high-grade glioma, high-grade neuroepithelial tumor, high-grade pleomorphic sarcoma, low-grade glioma, medulloblastoma, meningioma, multinodular vacuolating neuronal tumor, multiple primary tumors, oligoastrocytoma, papillary glioneuronal tumor, papillary tumor of the pineal region, pineal parenchymal tumor, pineoblastoma, pituitary carcinoma, and rhabdoid meningioma.

unemployed than employed in the overall sample ($p < 0.001$, Cramer $V = 0.39$) and the brain tumor group ($p < 0.001$, Cramer's V = 0.34). Conversely, more participants with brain tumor whose annual household income was >$150,000 were employed than unemployed ($p < 0.001$, Cramer $V = 0.34$). Furthermore, more participants without recurrence in the overall cohort and the brain tumor group were employed than unemployed ($p < 0.001$, Cramer $V = 0.34$). Significantly more participants with KPS ≤80 were unemployed than employed in the total sample ($p < 0.001$, Cramer $V = 0.46$) and brain tumor group ($p < 0.001$, Cramer $V = 0.440$). Last, the median time since diagnosis in the overall sample was significantly associated with being unemployed ($t(275) = -2.2$, 95% CI $\bar{x}_{difference}$ −40.8 to −2.5, $p = 0.027$, Hedge $g = 0.30$) with a median time since diagnosis of nearly 2 years. Nonsignificant correlations within the overall sample and brain tumor group include age, sex, race, marital status, tumor grade, and treatment modalities.

Patient-Reported Outcomes

EQ-5D-3L

Overall Sample Results

The HRQOL of 276 participants was assessed using EQ-5D-3L, reported in Table 2. Unemployed participants' global index scores assessing overall HRQOL were 0.13 points lower compared with those of employed participants ($t(108) = 4.7$, 95% CI $\bar{x}_{difference}$ 0.1–0.2, $p < 0.001$, Hedge $g = 0.73$), more than twice the minimal clinically important difference

Table 2 EQ-5D-3L Results

	Total sample employed[a] (n = 199)	Total sample unemployed (n = 77)	Brain employed[a] (n = 163)	Brain unemployed (n = 63)	Brain + spinal cord employed (n = 7)	Brain + spinal cord unemployed (n = 5)	Spinal cord employed (n = 29)	Spinal cord, unemployed (n = 9)
Mobility, n (%)								
No problems walking about	136 (68)	17 (35)	120 (74)	26 (41)	3 (43)	1 (20)	13 (45)	0 (0)
Some problems walking about	63 (32)	49 (64)	43 (26)	37 (59)	4 (57)	4 (80)	16 (55)	8 (89)
Confined to bed	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (11)
Self-care, n (%)								
No problems with self-care	178 (89)	48 (39)	150 (92)	42 (67)	6 (86)	3 (60)	22 (76)	3 (33)
Some problems with self-care	16 (8)	26 (34)	9 (6)	19 (30)	0 (0)	2 (40)	7 (24)	5 (56)
Unable to wash or dress	5 (3)	3 (4)	4 (2)	2 (3)	1 (14)	0 (0)	0 (0)	1 (11)
Usual activities, n (%)								
No problems with usual activities	119 (60)	21 (27)	104 (64)	20 (32)	3 (43)	1 (20)	12 (41)	0 (0)
Some problems with usual activities	76 (38)	49 (64)	56 (34)	37 (59)	4 (57)	4 (80)	16 (55)	8 (89)
Unable to perform usual activities	4 (2)	7 (9)	4 (2)	6 (10)	0 (0)	0 (0)	1 (3)	1 (11)
Pain/discomfort, n (%)								
No pain or discomfort	123 (62)	31 (40)	112 (69)	29 (46)	3 (43)	2 (40)	8 (28)	0 (0)
Moderate pain or discomfort	68 (34)	36 (47)	47 (29)	28 (44)	3 (43)	3 (60)	18 (62)	5 (56)
Extreme pain or discomfort	8 (4)	10 (13)	4 (2)	6 (10)	1 (14)	0 (0)	3 (10)	4 (44)
Anxiety/depression, n (%)								
Not anxious or depressed	117 (59)	37 (48)	95 (58)	32 (51)	5 (71)	1 (20)	17 (59)	4 (44)
Moderately anxious or depressed	78 (39)	32 (42)	66 (40)	25 (40)	2 (29)	4 (80)	10 (34)	3 (33)
Extremely anxious or depressed	4 (2)	8 (10)	2 (1)	6 (10)	0 (0)	0 (0)	2 (7)	2 (22)
Global index score								
Mean	0.83	0.69	0.85	0.72	0.73	0.73	0.73	0.48
SD	0.16	0.23	0.15	0.21	0.23	0.12	0.17	0.29
Minimum, maximum			0.26, 1.00	0.17, 1.00	0.40, 1.00	0.60, 0.84	0.26, 1.00	−0.11, 1.00
25th quartile			0.80	0.57	0.45	0.60	0.69	0.29
50th quartile			0.84	0.78	0.83	0.77	0.78	0.60
75th quartile			1.00	0.84	0.86	0.83	0.84	0.73

Abbreviation: EQ-5D-3L = 3-level EuroQol 5-dimensions.
[a] Missing EQ-5D-3L data of 1 participant from the employed brain tumor group.

threshold of 0.06, indicating unemployed participants rated their overall HQOL significantly lower and to a clinical meaningful degree compared with employed participants. Furthermore, highly significant differences in mobility, self-care, usual activities, pain/discomfort, and anxious/depression based on employment status were found. More unemployed participants reported some problems with usual activities (64%) or inability to perform usual activities (9%) compared with employed participants (38% and 2%, respectively) ($\chi^2(2) = 26.5$, $p < 0.001$, Cramer $V = 0.31$), and twice as many unemployed participants reported some problems walking (64%) than those employed (32%) ($\chi^2(2) = 26.5$, $p < 0.001$, Cramer $V = 0.31$). In addition, more than 4 times as many unemployed participants reported some problem washing and/or dressing themselves (34%) than employed participants (8%) ($\chi^2(2) = 26.9$, $p < 0.001$, Cramer $V = 0.33$). Regarding symptoms, many unemployed participants reported more moderate pain/discomfort (47%) or extreme pain/discomfort (13%) compared with employed participants (34% and 4%, respectively) ($\chi^2(2) = 13.8$, $p = 0.001$, Cramer $V = 0.22$). Five times more unemployed participants in the total sample reported extreme anxiety/depression (10%) than employed participants (2%) ($\chi^2(2) = 9.1$, $p = 0.008$, Cramer $V = 0.19$).

Results by Tumor Location

The mean global index score difference between the employed and unemployed spinal cord group participants (0.25) was 4 times higher than the minimal clinically important difference threshold, and more than twice this threshold between brain tumor group participants (0.13). In addition, more unemployed participants in each tumor location group reported impairment within all 5 dimensions. Notably, more unemployed participants reported impairment with self-care activities (33% brain, 40% brain and spinal cord, and 67% spinal cord) than their employed counterparts (8% brain, 24% spinal cord, and 14% brain and spinal cord). In addition, more unemployed participants reported mobility problems (59% brain, 100% spinal cord, and 80% brain and spinal cord) compared with employed participants (26% brain, 55% spinal cord, and 57% brain and spinal cord). Furthermore, functional impairment with usual activities was reported by 100% of unemployed participants with spinal cord tumor, 80% of unemployed participants with brain and spinal cord tumor, and 69% of unemployed participants with brain tumor compared with 58%, 36%, and 57% of their respective employed counterparts. Pain and discomfort were reported at the moderate or extreme level by more unemployed participants (54% brain, 100% spinal cord, and 60% brain and spinal cord)

Table 3 PROMIS-Anxiety and PROMIS-Depression Results

	Total sample employed[a] (n = 199)	Total sample unemployed (n = 77)	Brain employed[a] (n = 163)	Brain unemployed (n = 63)	Brain + spinal cord employed (n = 7)	Brain + spinal cord unemployed (n = 5)	Spinal cord employed (n = 29)	Spinal cord unemployed (n = 9)
PROMIS-Anxiety *t* score								
Mean	51.1	53.0	50.6	52.1	49.2	56.7	53.9	57.4
SD	9.2	10.7	9.0	10.9	12.0	7.4	9.7	9.5
Median			51.3	52.5	48.1	58.4	53.4	58.4
Minimum			37.1	37.1	37.1	37.1	37.1	37.1
Maximum			78.8	75.7	72.3	66.7	73.9	68.0
n (%) moderate-severe	30 (15)	23 (30)	20 (12)	19 (30)	1 (14)	1 (20)	9 (31)	3 (33)
PROMIS-Depression *t* score								
Mean	48.7	52.5	48.8	52.2	44.6	53.3	49.1	54.4
SD	8.5	10.0	8.5	10.7	8.8	4.3	8.6	6.9
Median			49.2	53.1	44.5	55.4	50.2	54.7
Minimum			37.4	38.2	38.2	46.7	38.2	44.5
Maximum			75.1	73.7	63.0	56.7	67.2	64.7
n (%) moderate-severe	16 (8)	19 (25)	12 (7)	17 (27)	1 (14)	0 (0)	3 (10)	2 (22)

Abbreviation: PROMIS = Patient-Reported Outcomes Measurement Information System.
[a] Missing data from 1 participant from the employed brain tumor group.

Table 4 Brain Tumor Group MDASI-BT Moderate-to-Severe Patient-Reported Symptom Factors

	Brain employed[a] (n = 163) (%)	Brain unemployed (n = 63) (%)	OR[b]	95% CI for OR	*p* Value
Affective					
Fatigue	36	55	2.1	1.2–3.9	0.011
Disturbed sleep	21	34	1.9	1.0–3.7	0.042
Feeling distressed	21	39	2.4	1.3–4.5	0.006
Feeling sad	14	29	2.5	1.2–5.0	0.010
Irritability	15	29	2.3	1.1–4.5	0.020
Cognitive					
Difficulty understanding	9	19	2.4	1.0–5.4	0.036
Difficulty remembering	18	40	3.1	1.6–6.0	<0.001[c]
Difficulty speaking	10	24	2.7	1.3–5.9	0.008
Difficulty concentrating	13	32	3.2	1.6–6.5	0.001[c]
Neurologic					
Seizure	6	13	2.3	0.9–6.0	0.015
Weakness on 1 side of the body	10	40	5.8	2.8–11.9	<0.001[c]
Numbness or tingling	12	24	2.4	1.1–5.1	0.019
Pain	16	31	2.3	1.2–4.6	0.014
Treatment-related					
Dry mouth	9	21	2.8	1.2–6.4	0.011
Drowsiness	20	42	2.8	1.5–5.4	0.001[c]
Lack of appetite	9	24	3.1	1.4–6.9	0.003[c]
General disease					
Change in appearance	7	23	3.7	1.6–8.5	0.001[c]
Change in vision	14	37	3.6	1.8–7.1	<0.001[c]
Change in bowel pattern (diarrhea or constipation)	9	24	3.1	1.4–6.9	0.003[c]
Shortness of breath	4	13	3.3	1.1–9.5	0.033
Gastrointestinal					
Nausea	10	18	2.0	0.9–4.5	0.102
Vomiting	4	11	2.8	1.0–8.5	0.066

Abbreviations: MDASI-BT = MD Anderson Symptom Inventory-Brain Tumor; OR = odds ratio.
[a] Missing data from 1 participant in the employed brain tumor group.
[b] Employed group is the reference for OR.
[c] Significant after Holm-Bonferroni multiple comparison adjustment with significance threshold ≈0.0033.

compared with employed participants (31% brain, 72% spinal cord, and 57% brain and spinal cord). In summary, unemployed participants rated their overall HRQOL significantly worse than employed participants in the setting of reporting significant functional limitations performing usual activities, walking, washing, and dressing and significantly more pain, discomfort, anxiety, and depression. This cumulatively resulted in clinically meaningful reductions in physical and psychosocial functioning and psychological well-being, with a higher percentage of patients with the involvement of the spine reporting these effects.

PROMIS-Depression and PROMIS-Anxiety

Overall Sample Results

A total of 276 participants were assessed for self-report of anxiety and depression using PROMIS instruments, reported in Table 3. The PROMIS-Depression mean *t* scores of

Table 5 Spinal Cord Tumor Group MDASI-SP Moderate-to-Severe Symptom Factors

	Spinal cord employed (n = 29) (%)	Spinal cord unemployed (n = 9) (%)	OR[a]	95% CI for OR	*p* Value
Disease-related					
Fatigue	48	89	8.6	0.9–77.6	0.052
Disturbed sleep	24	67	6.3	1.2–32.0	0.040
Drowsiness	24	56	3.9	0.8–18.8	0.108
Radiating spine pain	38	56	2.0	0.5–9.3	0.450
Pain	48	89	8.6	0.9–77.6	0.052
Weakness in arms and/or legs	41	100	Incalculable	—	0.002[b]
Numbness or tingling	38	56	13.1	1.4–119.3	0.450
Treatment-related					
Shortness of breath	10	22	2.5	0.3–17.8	0.574
Nausea	10	22	2.5	0.3–17.8	0.574
Vomiting	6.9	22	3.9	0.5–32.4	0.233
Dry mouth	14	33	3.1	0.5–17.8	0.322
Lack of appetite	10	45	6.9	1.2–41.0	0.041
Difficulty remembering	10	45	6.9	1.2–41.0	0.041
Emotional distress					
Feeling distress	28	67	5.3	1.1–26.2	0.052
Feeling sad	14	45	5.0	0.9–27.0	0.071
Autonomic function					
Sexual function	24	22	0.9	0.2–5.4	1.000
Loss of bladder or bowel control	21	44	3.1	0.6–15.1	0.250
Change in bowel function (diarrhea or constipation)	35	56	2.4	0.5–10.9	0.436

Abbreviations: MDASI-SP = MD Anderson Symptom Inventory-Spine Tumor; OR = odds ratio.
[a] Employed group is the reference for OR.
[b] Significant after Holm-Bonferroni multiple comparison adjustment with significance threshold ≈0.0027.

unemployed participants were 3.8 points higher than their employed counterparts ($t(121) = -3.0$, 95% CI $\bar{x}_{\text{difference}}$ −6.4 to −1.3, $p = 0.004$ Hedge $g = 0.43$), exceeding the clinically meaningful difference score. More unemployed participants in the total sample reported moderate-to-severe depressive symptoms (25%) than those employed (8%) ($\chi^2(1) = 13.9$, $p < 0.001$, OR 3.7, 95% CI 1.8–7.8). While in the overall sample, PROMIS-Anxiety mean *t* scores did not significantly differ between the employment groups, more of those unemployed reported moderate-to-severe anxiety symptoms (30%) than those employed (15%) ($\chi^2(1) = 7.8$, $p = 0.005$, OR 2.4, 95% CI 1.3–4.5).

Results by Tumor Location

PROMIS-Depression mean *t* scores of unemployed participants in each of the tumor location groups were higher than their respective employed counterparts: 3.4 points higher in the brain tumor group, 5.3 point higher in the spinal cord tumor group, and 8.7 points higher in the brain and spinal cord tumor group. The mean *t* score difference in the spinal cord group was 1.5 times higher, and in the brain and spinal cord tumor group nearly 2.5 times, than the clinically meaningful threshold. In addition, more unemployed participants with brain tumor and spinal cord tumor reported moderate-to-severe depressive symptoms (27% and 22%, respectively) than those employed (7% and 10%, respectively).

PROMIS-Anxiety mean *t* scores of unemployed participants in each tumor location group were higher than their respective employed counterparts: 1.5 points higher in the brain tumor group; 3.5 points higher in the spinal cord tumor group; and 7.5 points higher in the brain and spinal cord tumor group, which is nearly 2 times the minimal clinical difference of 4. More unemployed participants reported moderate-to-severe anxiety symptoms (30% brain tumor; 33% spinal cord tumor;

and 20% brain and spinal cord tumor) than those employed (12% brain; 31% spinal cord; and 14% brain and spinal cord tumor). Participants unemployed due to tumor reported clinically and significantly worse depressive symptoms, with unemployed participants with brain tumor nearly 5 times more likely and participants with spinal cord tumor 3 times more likely to report moderate-to-severe depression symptoms. Although anxiety was not statistically different between the overall unemployed and employed groups, unemployed participants with brain tumor were 3 times more likely to report moderate-to-severe anxiety symptoms than employed participants.

MDASI-BT

Overall Mean Symptom Analysis Results

Of the 225 participants with brain tumor who self-reported using MDASI-BT, 62 (28%) were unemployed and scored 1.2 points higher in overall symptom burden compared with 162 (72%) employed participants ($t(86) = -3.9$, 95% CI $\bar{x}_{\text{difference}}$ −1.7 to −0.6, $p < 0.001$, Hedge $g = 0.67$). All symptom factors except the gastrointestinal symptom factor grouping were significantly different in the unemployed compared with the employed group. Patients who reported being unemployed due to tumor scored 1.5 points higher in the cognitive symptom factor compared with those employed ($t(88) = -4.1$, 95% CI $\bar{x}_{\text{difference}}$ −2.3 to −0.8, $p < 0.001$, Hedge $g = 0.69$); 1.2 points higher in the neurologic symptom factor ($t(89) = -3.6$, 95% CI $\bar{x}_{\text{difference}}$ −1.9 to −0.5, $p < 0.001$, Hedge $g = 0.61$); 1.2 points higher in the general disease symptom factor ($t(82) = -3.8$, 95% CI $\bar{x}_{\text{difference}}$ −1.9 to −0.5, $p < 0.001$, Hedge $g = 0.68$); 1.1 points higher in the affective symptom factor ($t(90) = -2.7$, 95% CI $\bar{x}_{\text{difference}}$ −1.8 to −0.3, $p = 0.008$, Hedge $g = 0.46$); and 1.0 point higher in the treatment-related symptom factor ($t(88) = -3.0$, 95% CI $\bar{x}_{\text{difference}}$ −1.7 to −0.3, $p = 0.004$, Hedge $g = 0.50$). In summary, unemployed participants with brain tumor reported a significantly higher symptom burden than their employed counterparts, reporting a greater number of symptoms that were not only neurologic, cognitive, and psychological in nature but also cancer related and treatment related. Furthermore, each comparison exceeded the minimally important difference threshold of 1 point, supporting the clinical meaningfulness of these differences.

Moderate-to-Severe Symptom Analysis Results

Symptoms reported at the moderate-to-severe level (scores ≥5) for participants with brain tumor who are unemployed or employed are summarized in Table 4 with their respective ORs and p values. Notably, symptoms of difficulty remembering, hemibody weakness, change in vision, change in appearance, and change in bowel pattern were significant after multiple comparison adjustment. Unemployed participants with brain tumor reported on average 3 more symptoms as moderate to severe compared with employed participants with brain tumor ($t(83) = -4.0$, 95% CI $\bar{x}_{\text{difference}}$ −5 to −2, $p < 0.001$, Hedge $g = 0.70$). Among unemployed participants with brain tumor, the top symptoms reported as moderate to severe were fatigue (55%), feeling drowsy (42%), difficulty remembering (40%), and weakness on 1 side of the body (40%), when compared with employed participants with brain tumor where fatigue (36%), disturbed sleep (21%), and feeling distressed (21%) were most common. The top symptoms reported as moderate to severe by employed participants with brain and spinal cord tumor were fatigue (86%), feeling drowsy (71%), disturbed sleep (57%), and difficulty remembering (57%), whereas feeling distressed (60%) was the only moderate to severe symptom reported by those unemployed. These data indicate unemployed participants with brain tumor were 2–3 times more likely to report most symptoms as moderate to severe and nearly 6 times more likely to report hemibody weakness than their employed counterparts.

Symptom Interference Analysis Results

Unemployed and employed brain tumor group participants had significantly different overall symptom interference scores. The unemployed brain tumor group scored 2.2 points higher in overall interference compared with employed patients ($t(89) = -5.2$, 95% CI $\bar{x}_{\text{difference}}$ −3.1 to −1.42, $p < 0.001$, Hedge $g = 0.88$). The scores reported for each subscale were significantly different based on employment: the unemployed group scored 2.4 points higher in activity-related interference ($t(94) = -5.4$, 95% CI $\bar{x}_{\text{difference}}$ −3.3 to −1.6, $p < 0.001$, Hedge $g = 0.89$) and 2.0 points higher in mood-related interference compared with the employed group ($t(85) = -4.5$, 95% CI $\bar{x}_{\text{difference}}$ −2.9 to −1.1, $p < 0.001$, Hedge $g = 0.78$). Unemployed participants with brain tumor reported significantly more physical functioning and mood interference in their daily lives due to their symptoms compared with employed participants brain tumor with each comparison at least 2 times above the clinical meaningfulness threshold.

MDASI-SP

Overall Mean Symptom Analysis Results

Unemployed spinal cord tumor group participants scored 2.3 points higher in overall symptom burden compared with employed spinal tumor participants ($t(36) = -2.6$, 95% CI $\bar{x}_{\text{difference}}$ −4.2 to −0.5, $p = 0.014$, Hedge $g = 0.98$). Furthermore, unemployed spinal cord tumor participants scored 3.2 points higher in the disease-related symptom factor (includes fatigue, disturbed sleep, drowsiness, radiating spine pain, pain, weakness in arms and/or legs, and numbness or tingling) compared with those employed ($t(36) = -3.1$, 95% CI $\bar{x}_{\text{difference}}$ −4.2 to −0.5, $p = 0.004$, Hedge $g = 1.2$). Thus, unemployed spinal cord tumor participants reported significantly greater symptom burden due to pain, neurologic dysfunction, fatigue, and sleep disturbance rated at levels 2–3 times above the minimally important difference threshold than those employed.

Moderate-to-Severe Symptom Analysis Results

Unemployed spinal cord tumor participants reported on average 5 more symptoms as moderate to severe compared with their employed counterparts ($t(36) = -2.7$, 95% CI $\bar{x}_{\text{difference}}$ −9 to −1, $p = 0.010$, Hedge $g = 1.0$) (Table 5). The top moderate-to-severe symptoms reported by those unemployed were weakness in arms and/or legs (100%), pain (89%), fatigue (89%), and numbness/tingling (89%). Among those employed, their top moderate-to-severe symptoms were pain (48%), fatigue (48%), and weakness in arms and/or legs (41%). Among participants with brain and spinal cord tumor, the top moderate-to-severe symptom reported by those unemployed was weakness in arms and/or legs (80%), whereas their employed counterparts reported fatigue (57%) and drowsiness (57%). This analysis reflects those unemployed participants living with spinal cord tumor reported higher symptom severity than their employed counterparts and that these moderate-to-severe symptoms localize to the CNS or are cancer related and/or treatment related.

Symptom Interference Analysis Results

Unemployed participants with spinal cord tumor scored 2.3 points higher in overall interference compared with those employed ($t(36) = -2.4$, 95% CI $\bar{x}_{\text{difference}}$ −4.4 to −0.3, $p = 0.024$, Hedge $g = 0.90$). In addition, those unemployed scored 2.5 points higher in mood-related interference compared with their employed counterparts ($t(36) = -2.4$, 95% CI $\bar{x}_{\text{difference}}$ −4.5 to −0.4, $p = 0.020$, Hedge $g = 0.83$). Unemployed spinal cord tumor group participants reported significantly more symptoms interfering with their daily lives, especially regarding mood, relationship with others, and enjoyment of life, which well-exceeded the clinically meaningfulness threshold, compared with their employed counterparts.

Discussion

The financial impact of a PCNST diagnosis encompasses not only health care system expenditures but also the costs to the individual. Loss of income after diagnosis and treatment can substantially contribute to excess financial burden leading to deleterious effects on well-being, referred to as financial toxicity.[27,28] Furthermore, people with cancer face physical, cognitive, emotional, social, and financial effects from cancer and its treatment.[29] This study demonstrates severe neurologic, cognitive, and psychological distress symptoms due to CNS cancer concurrent with cancer-related and treatment-related symptoms, and functional impairments may potentiate the illness burden of PCNT survivors, reduce their HRQOL, and impede their ability to maintain employment. Studies evaluating unemployment among cancer survivors have largely been in breast, prostate, and colorectal cancer populations[6] with 20%–45% not returning to work post-diagnosis and treatment, especially low-income and minority survivors.[30-34] Five studies reporting on adults with a PCNST found postdiagnosis employment rates were reduced to 37%–64%.[8,15,16,35,36] In this study, the overall unemployment rate was 28%; unemployment rates were similar among participants with high-grade tumors (32%) and low-grade (26%) tumors, but the rate was higher (42%) among those with brain and spinal cord tumors. Thus, unemployment rates within our cohort are comparable with previous reports and highlight the significant impact of tumor involvement of both the brain and spinal cord.

Physical limitation can contribute to cancer survivors not returning to work.[31,33,35] In this study, unemployed participants with brain tumor were nearly 6 times more likely to report moderate-to-severe hemibody weakness ($p < 0.001$), and 100% of unemployed participants with spinal cord tumor reported moderate-to-severe limb weakness compared with 41% of their employed counterparts. In addition, unemployed participants with brain tumor were nearly 2.5 times more likely to report symptoms interfered with their ability to engage in general activity, perform any work including inside the home, and walk than those employed. Correspondingly, a significantly greater number of unemployed participants reported more functional limitations in their ability to walk, wash, and dress themselves and perform usual activities than their employed counterparts. These disparities in physical functioning between unemployed and employed participants represent opportunities for therapeutic interventions. Physical medicine and rehabilitation and physical and occupational therapies are key specialties in addressing physical function and limitations in daily activities. Their interventions may be beneficial at times other than after initial surgery.[37] While physical rehabilitation may be crucial to improving function, it alone has been insufficient in enabling return to work,[38] whereas person-oriented multidisciplinary interventions facilitating return to work have been demonstrated to be effective for people living with a chronic condition such as psychiatric or neurologic disease[39] and cancer survivors[38,40,41] including those with brain cancer[42] or brain injury.[43]

Other factors contributing to not returning to work could include psychological distress, self-perceived cognitive issues, and pain. Psychological distress is highly prevalent among cancer survivors, especially among those living with cancer of the lung or brain.[44] Unemployed participants in this cohort reported more depressive symptoms and a higher severity depressive and anxiety symptoms. These results, in conjunction with the findings of the cognitive and mood symptom factors and mood-related interference, indicate that self-perceived cognitive dysfunction and psychological distress were more prevalent and severe in the setting of greater psychological distress–related interference in daily functioning among those unemployed compared with those employed. Other researchers have similarly identified a confluence of psychological distress, particularly anxiety, and pain with higher self-perceived cognitive dysfunction in adult primary brain tumor survivors.[45] Indeed, depression, pain, and fatigue are well-recognized for their high prevalence and severity among cancer survivors[46] and reaffirm the need for

clinicians to routinely assess for and treat identified unrelieved symptoms and conditions with evidence-based management such as referral to palliative care, rehabilitation medicine, physical and/or occupational therapies, and multidisciplinary care teams.[47] These findings highlight the importance of offering routine screening and therapeutic interventions for cognition and mood disturbances, especially to those unemployed due to their tumor diagnosis and the importance of conducting efficacy studies. Studies using PROs in other cancer populations have revealed conflicting results: employed lung cancer survivors reported more emotional problems, greater symptom burden, and a lower quality of life,[48] whereas unemployed breast cancer survivors reported worse physical, psychological, social role, cognitive and financial problems, and worse quality of life,[49] highlighting the large variance in contextual factors across study populations. This study and other cross-sectional studies cannot exclude unemployment as a cause of psychological distress.

Sex, race, ethnicity, and median age within each respective tumor location group were similar whether participants were employed or unemployed due to tumor. Unlike other cancer patient populations, the overall PCNST patient population does not reflect the ethnoracial diversity of the US population due to its predominance of White individuals similar to that of this study's cohort.[6,50] This low ethnoracial representation precluded substantive analysis of diverse PCNST survivors' employment status and illness burden, yet we found Hispanic participants were significantly more likely to be unemployed due to tumor. More unemployed participants were divorced, widowed, or single than married, refuting the notion that dual income might predispose cancer survivors to declaring unemployment due to tumor. Significantly more brain tumor participants reporting an annual household income ≥$150,000 were employed—a manifestation of occupation and education moderating the effect of cancer on employment.[35] These prominent findings within our single-institution study support the need for community-based studies with evaluations of social determinates of health and neighborhood disadvantage to better estimate the magnitude of the issue. Unemployed participants had been diagnosed a median of 18–21 months longer than their employed counterparts. Among brain tumor participants, particularly, the unemployment rate was higher for those who received more treatment than surgery alone; plausible explanations are physiologic deterioration over time and cumulative treatment toxicities causing a greater impact on symptom burden, function, and HRQOL.

Although this study contains a comprehensive symptom assessment using validated PROs with high-quality patient and tumor characteristics data in a large cohort of diverse PCNST types, it has some limitations. These include its cross-sectional design and its inability to detect individual changes; selection bias due to participants receiving care and enrolling in research studies at the NIH; limitations of self-report data; risk of confounding; and not accounting for unmeasured but measurable and unmeasurable confounders within socially and economically complex topics. And while these correlative testing findings from this cross-sectional analysis are compelling and hypothesis generating, they are not conclusive, and more studies are needed, ideally using a longitudinal design.

The aim of this study was to explore the impact of illness burden as assessed by PROs on employment in a large cohort of PCNST survivors because loss of employment can be a major contributor to financial toxicity. Being unemployed due to tumor was strongly correlated with very high illness burden, high functional impairment, particularly with walking, performing any work including inside the home and general activity, and psychological distress, implicating multiple limitations could be factors impeding employment. Innovations to screen for and address financial toxicity in PCNST survivors may be facilitated through better understanding its contributing factors. Targeted interdisciplinary return-to-work programs for PCNST survivors merit further evaluation.

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Appendix *(continued)*

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Appendix *(continued)*

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