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Published

2009

Journal Title

Brain Impairment

DOI

[10.1375/brim.10.2.149](https://doi.org/10.1375/brim.10.2.149)

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Brain Impairment / Volume 10 / Issue 02 / September 2009, pp 149 - 161
DOI: 10.1375/brim.10.2.149, Published online: 21 February 2012

Link to this article: http://journals.cambridge.org/abstract_S1443964600001820

How to cite this article:

Tamara Ownsworth, Laura Henderson, Suzanne Chambers and David Shum (2009). Functional Impairments and Caregiver Depressive Symptoms in the Context of Brain Tumour and Other Cancers: A Mediating Effect of Strain. *Brain Impairment*, 10, pp 149-161
doi:10.1375/brim.10.2.149

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Functional Impairments and Caregiver Depressive Symptoms in the Context of Brain Tumour and Other Cancers: A Mediating Effect of Strain

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This study aimed to examine the associations among functional impairments, strain and depressive symptoms for caregivers of individuals with brain tumour and other cancers. Sixty-three caregivers (71% female) of individuals with brain tumour ($n = 27$) and other cancers ($n = 36$) were recruited from community services. Participants rated their level of depressive symptoms and strain and the functional impairments of the individual with cancer. Overall, approximately 25% of the total caregiver sample was in the clinical range for depressive symptoms. For caregivers of individuals with brain tumour, strain was significantly related to depressive symptoms ($r = .57$) and the individual's functional impairments ($r = -.58$); however, level of depressive symptoms was not significantly related to functional impairments ($p > .05$). For caregivers of individuals with other cancer, level of depressive symptoms was significantly correlated with strain ($r = .50$) and their relatives' degree of cognitive, interpersonal and emotional difficulties ($r = -.36$ -.46), but not with activities of daily living ($p > .05$). In a multivariate analysis involving all the caregivers, strain predicted depressive symptoms ($R^2 = .32$, $p < .001$) after controlling for gender and cancer type. In addition, strain was found to significantly mediate the effects of the interpersonal and emotional difficulties of individuals with cancer on caregiver depressive symptoms. Overall, these findings highlight the need to develop and evaluate strategies for alleviating the role strain associated with supporting individuals with cancer.

Keywords: caregiver, cancer, brain tumour, functional impairments, strain, depressive symptoms

Every year in Australia the incidence of cancer increases while cancer mortality rates decrease (Australian Institute of Health and Welfare [AIHW], 2007). In 2004, 98,336 people in Australia were diagnosed with some form of cancer, with a higher number of men diagnosed (54,870) compared to women (43,466; AIHW). Functional impairments arising from most types of cancer (e.g., reduced physical function, cognitive difficulties and related activity restrictions)

can be due to the disease process itself or treatment side-effects (Cole, Scialla, & Bednarz, 2000; Jansen, Miaskowski, Dodd, Dowling, & Kramer, 2005; Marciniak, Sliwa, Heinemann, & Semik, 2001). Because brain tumours directly disrupt central nervous system (CNS) functioning, the associated functional impairments are generally more marked than those of other cancers (Klein, Taphoorn, Heimans, van der Ploeg, Vandertop et al., 2001; Lidstone, Butters, Seed, Sinnot, Beynon

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et al., 2003). Nonetheless, neurotoxic effects of treatment for other cancers have been demonstrated in neuropsychological and neuroimaging studies (e.g., Jansen, Miaskowski, Dodd, Dowling, & Kramer, 2005; Steffen-Smith, Wolters, Albert, Baker, Shimoda et al., 2008). The significance of functional impairments in cancer is being increasingly recognised for neuropsychological assessment and rehabilitation practices (Cole, Scialla, & Bednarz, 2000; Jansen et al., 2005; Marciniak, Sliwa, Heinemann, & Semik, 2001). However, the impact of cancer-related functional impairments on caregiver well-being has been largely overlooked in the literature.

Supporting someone with cancer is typically a very stressful experience due to the uncertain prognosis, often prolonged treatment regime, risk of recurrence and functional deterioration related to cancer progression or treatment effects (Biegel, Sales, & Schulz, 1991; Marciniak, Sliwa, Spill, Heinemann, & Semik, 1996). Depending on the type of cancer, prognosis and stage of illness, demands on the caregiver can range from occasional support through to full-time palliative care (Hwang, Alejandro, Davis, Srinivas, Chang et al., 2003; Rose, 1998). Family members are typically viewed as the most valued form of support by the person with cancer (O'Donnell, 2005) and, considering the significant costs of formal care, family caregivers have an integral role in society. However, caregivers themselves often experience poor physical and mental health and have unmet needs (Janda, Eakin, Bailey, Walker, & Troy, 2006; Nijboer, Triemstra, Tempelaar, Sanderman, & van den Bos, 1999; Siegel, Raveis, Houts, & Mor, 1991). While relatively few studies have investigated factors related to caregiver emotional adjustment in the context of cancer more generally, there is a specific lack of empirical research on caregivers of individuals with brain tumour.

A number of theoretical frameworks highlight the various factors potentially impacting on caregivers' emotional wellbeing in cancer (e.g., Nijboer, Triemstra, Tempelaar, Sanderman, & van den Bos, 1999; Schumacher, Dodd, & Paul, 1993; Sherwood, Given, Given, Schiffman, Murman et al., 2004). In the model by Schumacher et al., which focuses on depression in caregivers of people receiving chemotherapy for cancer, primary stressors include the cancer prognosis and the functional ability of the person with cancer. Primary stressors are proposed to generate secondary stressors, which include caregiver role strain and lifestyle adjustments. The perceived adequacy of social support and effective use of coping strategies are proposed to mediate or mod-

erate the impact of these variables on caregiver emotional depressive symptoms. In a similar model focusing on the stress response of caregivers of individuals with brain tumour, Sherwood et al. (2004) placed particular emphasis on caregivers' appraisal of functional deficits arising from brain tumour, which influence the nature of care and support required. Caregivers' internal and external resources are proposed to mediate or moderate the impact of care demands on their stress response.

There is preliminary empirical support for particular components of these models. Specifically, Schumacher et al. (1993) found that physical status (self-rated by the people with mixed cancer types) was associated with strain and that strain was associated with caregiver depressive symptoms. However, neither physical status nor strain predicted depressive symptoms of caregivers after controlling for age, gender and cancer recurrence. There is empirical support concerning moderating and mediating effects of caregiver preparedness and mastery in the relationship between strain and depressive symptoms in both general cancer and brain tumour research (Nijboer, Tempelaar, Triemstra, van den Bos, & Sanderman, 2001; Schumacher, Stewart, & Archbold, 2007; Sherwood, Given, Given, Schiffman, Murman et al., 2007). Overall, the associations between the functional ability of the person with cancer, caregiver role strain, and depressive symptoms have received little empirical attention, with existing research focusing on physical status rather than a broader range of functional areas, which may be impacted by brain tumour and other forms of cancer.

Functional impairments typically relate to, but do not necessarily equate with symptom severity in cancer (Cole et al., 2000). Individuals experiencing cancer symptoms (e.g., fatigue and pain) may vary considerably in the extent that these symptoms interfere with everyday function, including activities of daily living (ADLs), social interaction and the ability to organise and manage one's daily schedule. Symptoms and functional impairments have typically been measured simultaneously in the literature. For example, in a comparison of eight cancer groups ($n = 480$), Lidstone, Butters, Seed, Sinnott, Beynon et al. (2003) found that individuals with lung cancer reported the highest degree of symptoms and functional difficulties on a problem checklist. However, individuals with malignant brain tumour reported greater difficulties with fatigue, concentration/memory problems, and activity restrictions. In a study investigating rehabilitation outcomes of patients

with cancer, Marciniak et al. (1996) reported that individuals with CNS cancers were most typically referred for cognitive and sensory impairments while those with non-CNS cancers were mainly referred for physical deconditioning and related activity restrictions (albeit 18% were referred for cognitive impairments). In addition to physical and cognitive impairments, emotional distress and behavioural changes have been well documented in the cancer literature. These include anxiety and depressive symptoms, anger, confusion, and social withdrawal (see review by Redd, DuHamel, Vickberg, Johnson Vickberg, Ostroff et al., 2001). According to the models by Schumacher et al. (1993) and Sherwood et al. (2004), the nature and degree of cancer-related functional impairments are likely to influence the level of role strain or demands placed on caregivers, thus influencing their emotional wellbeing.

A review of empirical research in both the cancer and brain injury literature largely supports the link between the functional ability of individuals with cancer and brain injury and caregiver wellbeing. For example, Weitzner, McMillan and Jacobsen (1999) reported that functional ability significantly predicted caregiver wellbeing after controlling for stage of the cancer (i.e., curative or palliative stage). Given, Wyatt, Given, Sherwood, Devoss et al. (2004) found that an increased number of ADLs for which individuals in the palliative stage of care required assistance was a significant predictor of caregiver depressive symptoms. Further, Grunfeld, Coyle, Whelan, Clinch, Reyno et al. (2004) reported that level of physical impairment following breast cancer significantly predicted caregiver anxiety. In the only known empirical study of emotional wellbeing in caregivers of individuals with brain tumour, Sherwood and colleagues (2007) found that degree of behavioural problems in the individual with brain tumour had both a direct and an indirect effect on caregiver depressive symptoms. Specifically, greater behavioural impairment was related to poorer caregiver mastery, which in turn contributed to higher level of depressive symptoms. Given the lack of caregiver research in the brain tumour literature, the findings of caregiver research in the context of brain injury are also pertinent.

Forsberg-Warley, Moller and Blomstrand (2004) found associations between the functional dependency of individuals with stroke and caregiver depressive symptoms at both 1 week and 1 year poststroke. Using a similar longitudinal design ($n = 69$), Marsh, Kersel, Havill and Sleight (2002) examined the impact of physical, cognitive, emotional and social impairments following

traumatic brain injury (TBI) on caregiver strain and depressive symptoms at 6 months and 12 months postinjury. Functional impairments were related to strain, but did not significantly predict caregiver depressive symptoms (Marsh et al., 2002). At 6 months postinjury caregiver strain was significantly related to the physical and social deficits in the person with TBI, while at 12-months postinjury cognitive, behavioural and social deficits had significant associations with strain (Marsh et al., 2002). Therefore, physical deficits did not appear to have a long-term impact on caregiver strain.

Caregivers of people with cancer have been found to experience increased levels of strain as compared to the general population (Cameron, Franche, Cheung, & Stewart, 2002). A higher level of strain was found to be related to increased caregiver depressive symptoms in a number of studies in the cancer literature (Cameron et al., 2002; Nijboer et al., 1999; Grunfeld et al., 2004). Research by Schumacher et al. (1993) with caregivers of women with breast cancer ($n = 75$) found that emotional adjustments were the most commonly reported type of role strain (77%) on the Caregiver Strain Index (Robinson, 1983). Interestingly, physical or financial strain was reported by less than a third of the caregiver sample. Consistent with the cancer literature, higher levels of strain have been found to predict increased emotional distress for caregivers following TBI (Machamer, Temkin, & Dikmen, 2002; Sander et al., 1997).

Overall, the literature supports that the functional impairments of the individual with cancer contribute to strain, and that both variables are related to depressive symptoms in caregivers. Theoretical perspectives (Schumacher et al., 1993) and empirical findings (Marsh et al., 2002) suggest that level of functional impairment may contribute to depressive symptoms through its effect on strain, although this is yet to be investigated.

The Present Study

Overall, there is a paucity of research on caregiver emotional wellbeing in the context of brain tumour. Further, although factors related to caregiver depressive symptoms have received more attention in the broader cancer literature, it is noteworthy that most studies have focused on the impact of physical impairments, ADLs or self-care dependency. The present study aimed to extend the literature by examining a range of functional domains, including ADLs, cognitive, emotional and interpersonal functions, which are potentially relevant to individuals with brain

tumour and other cancers. The main objective of this study was, first, to examine associations among functional impairment, strain, and caregiver depressive symptoms; and second, to investigate the potential mediating effects of strain on functional impairments and depressive symptoms.

It was hypothesised that greater functional impairment would be associated with higher strain, and that greater levels of both functional impairment and strain would be related to increased depressive symptoms for caregivers of individuals with brain tumour and other types of cancer. Additionally, it was hypothesised that strain would mediate the relationship between functional impairment and depressive symptoms. As a more exploratory component, the study also aimed to identify the patterns of association between different functional impairment domains, strain and caregiver depressive symptoms. Specific hypotheses were not developed in relation to this aim.

Method

Participants

The participants of this study included 63 caregivers of individuals with cancer. This group comprised 27 caregivers of people with brain tumour and 36 caregivers of people with other types of cancer (referred to as the 'general cancer caregiver group' in this study). The inclusion criteria for both caregiver samples were that individuals were over

the age of 18 and were the primary caregiver for an adult (18 years or older) with cancer at the time of the study. The demographic characteristics of both samples are summarised in Table 1. A comparison between the samples revealed that there was a significantly higher proportion of females in the general cancer caregiver group than in the brain tumour caregiver group ($\chi^2 = 16.86, p < .005$). Further, participants in the general cancer caregiver group were significantly less likely to be working than those in the brain tumour caregiver group ($\chi^2 = 8.97, p < .005$). However, the samples did not differ in age, relationship type or education ($p < .05$).

Brain Tumour Caregiver Sample

As shown in Table 1, there were slightly more males (55.6%) than females in this group. The majority of participants (85.2%) were the spouse or partner of the individual with brain tumour. Of the individuals with brain tumour, 52% had been diagnosed with a benign tumour, with subtypes including meningioma ($n = 5$), pituitary adenoma ($n = 3$), astrocytoma ($n = 2$), colloid cyst ($n = 1$), craniopharyngioma ($n = 1$), acoustic neuroma ($n = 1$) and oligodendroglioma ($n = 1$). The remaining 48% were diagnosed with a malignant tumour with subtypes including glioblastoma multiforme ($n = 4$), oligodendroglioma ($n = 4$), metastatic melanoma ($n = 1$), lymphoma ($n = 1$), multiple brain tumours ($n = 1$) and an unknown tumour of malignant type ($n = 1$). The majority of individuals with brain tumour had

TABLE 1

Demographic Characteristics of Caregivers of Individuals with Brain Tumour and General Cancer

Characteristics	Caregivers		
	Brain tumour (N = 27)	General cancer (N = 36)	Total (N = 63)
Age (years)			
Mean (SD)	56.93 (12.34)	62.47 (10.67)	60.10 (11.65)
Range	27-79	26-78	26-79
Education (years)			
Mean (SD)	12.89 (2.94)	12.05 (2.92)	12.46 (2.93)
Range	9-18	7-19	7-19
Gender			
Female	12 (44.4%)	33 (91.7%)	45 (71.4%)
Relationship			
Spouse/partner	23 (85.2%)	33 (91.7%)	56 (88.8%)
Parent	3 (11.1%)	0	3 (4.8%)
Child	1 (3.7%)	2 (5.5%)	3 (4.8%)
Sibling	0	1 (2.8%)	1 (1.6%)
Current employment			
Full time	6 (22.2%)	3 (8.3%)	9 (14.3%)
Part time/casual	10 (37.1%)	5 (13.9%)	15 (23.8%)
Unemployed/retired/volunteer	11 (40.7%)	28 (77.8%)	39 (61.9%)

undergone multiple treatments (*viz.*, surgery, chemotherapy and/or radiation; 66.7%), with few having a single treatment such as surgery (25.9%), radiation (3.7%) and cyber knife (3.7%). On average, individuals were diagnosed with a brain tumour 5.24 years ago ($SD = 5.97$), with a range of 1 month to 22 years.

General Cancer Caregiver Sample

Similar to the brain tumour caregiver sample, the majority of participants in this sample were the spouse or partner of the individual with cancer (88.8%); however, a much higher proportion of this sample was female (91.7%, $p < .005$). The most common types of cancer were prostate cancer ($n = 12$) and leukaemia ($n = 12$), followed by skin ($n = 3$), lung ($n = 2$), breast ($n = 1$), oesophageal ($n = 1$), throat ($n = 1$) and mouth ($n = 1$) cancer. Three additional caregivers reported that their relative had multiple cancer diagnoses (e.g., bowel cancer and leukaemia). The majority of individuals with cancer had undergone multiple treatments (63.9%). Single treatments included chemotherapy (13.9%), surgery (11.1%), radiation (8.3%) and hormone therapy (2.8%). Individuals in the general cancer group were diagnosed, on average, 3.59 years ago ($SD = 7.61$; range: 1 month–38 years), which did not significantly differ to individuals in the brain tumour caregiver sample ($t = 0.932$, $p < .05$).

Measures

Depressive Symptoms Anxiety Stress Scales (DASS)

The DASS (Lovibond & Lovibond, 1995) is a self-report measure consisting of 42 items. It is divided into three domains which assess symptoms of depression, anxiety and stress. Although the entire DASS was administered to participants, only the depression scale was used in data analysis (note: this scale was highly correlated [$r > .70$] with the anxiety and stress scales). Each item is rated from 0, *Did not apply to me at all*, to 3, *Applied to me very much*, with higher scores indicating increased levels of depressive symptoms. According to Lovibond and Lovibond (1995), clinical cut-offs for the depression scale entail: normal < 9 , mild = 10–13, moderate = 14–20, severe = 21–28, and extreme > 28 . The psychometric properties of the DASS are well established in both clinical and nonclinical samples (Antony, Beiling, Cox, Enns, & Swinson, 1998; Brown, Chorpita, Korotitsch, & Barlow, 1997). Internal consistency for the present caregiver samples was sound ($\alpha = .82$ –.93).

Caregiver Strain Index (CSI)

The CSI (Robinson, 1983) is a 13-item scale on which participants respond 'yes' or 'no' to indicate the degree of strain experienced in their caregiving role, as these role demands currently apply to them. Questions refer to the inconvenience of the caregiving role, family adjustments that had to be made, physical, emotional and financial strain and the competing demands on the individual's time. A total score is calculated by summing the number of items to which the participant responded yes, with a score of seven or higher indicating a significant level of strain (Robinson). Acceptable internal consistency ($\alpha > .82$) of the CSI has been reported in general cancer research (Schumacher et al., 1993). Within the brain injury population, support has been found for the convergent validity of the CSI with the Caregiver Reaction Assessment scales ($r = .41$ –.80) and self-rated burden ($r = .66$) (van Exel et al., 2004). In the present study, Cronbach's alpha for the CSI was satisfactory ($\alpha > .70$) for each of the caregiver samples.

Patient Competency Rating Scale (PCRS)

The PCRS (Prigatano, Altman, & O'Brien, 1990) is a 30-item measure that was designed to assess functional difficulties experienced by individuals with a brain injury. Leatham, Murphy and Flett (1998) divided the PCRS items into four domains; ADLs, cognitive, emotional and interpersonal function, in order to reflect more specific areas of impairment. A score can be calculated for each domain, as well as a total score indicating the individual's overall level of functional ability.

Participants were asked to rate their relative's ability on a range of practical tasks using a 6-point Likert scale of (1 = *can't do* to 5 = *can do with ease*). Lower scores on the PCRS, and its domains, indicates a higher level of functional impairment. The psychometric properties of the PCRS have been well demonstrated in brain injury samples (Hart, 2000; Prigatano et al., 1990). However, to date, it has not been used in the cancer population. The PCRS was considered an appropriate measure in the present study because the four functional domains seem to also be relevant to individuals with cancer. For example, PCRS items relate to the individual's ability to drive a car, prepare meals, remember daily events, participate in group activities, handle arguments, and manage emotions (e.g., anger and depression; Hart, 2000). In the present study, internal consistency was found to be high for each of the PCRS domains and the total PCRS score in each sample ($\alpha = .81$ –.95).

Procedure

Following ethical clearance, the caregivers of individuals with brain tumour were recruited as a part of a larger study investigating the quality of life of individuals with brain tumour. The coordinators of a brain tumour support group and a major neurosurgical clinic in the Brisbane area initially approached participants by telephone to discuss the study. The contact details of interested potential participants were provided to the researchers. Recruitment of caregivers of individuals with other forms of cancer was initiated at The Cancer Council of Queensland (TCCQ) through meetings with support coordinators. Participants were then recruited from the following sources: (a) support meetings held at accommodation lodges; (b) a support meeting at a Leukaemia Foundation lodge; (c) the Prostate Cancer Foundation support group and a support group for the wives of men with prostate cancer; (d) an article in the statewide Prostate Cancer Foundation newsletter, and e) a support group for people with head and neck cancer.

Where caregivers were present at support meetings, they were invited to take a questionnaire package home and return completed forms to the researcher via a reply-paid envelope. Alternatively, individuals with cancer supplied their caregiver's postal address for a questionnaire package to be mailed out.

Results

Data Analysis

All raw data were screened according to the procedures outlined by Tabachnick and Fidell (2007). In the few instances of missing data (< 5%), prorated data was substituted for item values. The associations among strain, functional ability, and depressive symptoms were examined using Pearson product-moment correlation (r) for the two caregiver samples separately. A hierarchical multiple regression was conducted with the total caregiver sample to investigate the impact of functional ability and strain on depressive symptoms, after controlling for potential confounds. To investigate the potential mediating effect of strain on functional ability and depressive symptoms, the bivariate correlation matrix was initially inspected to determine the suitability of mediation analysis (Baron & Kenny, 1986). Following this, three regression analyses were conducted, controlling for relevant confounds. In the first analysis, strain was regressed onto functional ability. In the second, level of depressive symptoms was

regressed onto functional ability. In the third analysis, level of depressive symptoms was regressed onto both functional ability and strain to determine whether the strength of the relationship between functional ability and depressive symptoms was significantly reduced with strain entered in the model (Baron & Kenny).

Descriptive Analysis

As shown in Table 2, approximately 25% of the total caregiver sample was in the clinical range for depressive symptoms. Independent t tests revealed that the general cancer caregiver group reported a significantly higher level of depressive symptoms (mean score in the 'mild' range; 36% in the clinical range overall) than the brain tumour caregiver sample (mean score in the 'normal' range; 11% in the clinical range overall). However, the two caregiver samples did not significantly differ on level of strain ($p > .05$), with a similar proportion of caregivers in each sample in the range indicating significant strain (22–26%).

The general cancer caregiver group reported greater difficulties with ADLs for their relative than the brain tumour caregiver sample ($p < .05$). No other significant differences were observed regarding functional impairments. Using scale item averages as a general guide to interpretation, scores on the PCRS for individuals with brain tumour were within the upper level of *Can do with some difficulty* to mid range of *Fairly easy to do* and *Can do with ease* (i.e., range: Emotional = 3.6–ADLs = 4.47). With the exception of ADLs (item average = 3.8), item averages for individuals with general cancer were similar, although most typically in the upper level of *Can do with some difficulty* (range: Emotional = 3.7 – Interpersonal = 3.9).

In the total caregiver sample, an independent t test identified that females ($M = 9.0$, $SD = 7.8$) reported higher levels of depressive symptoms than males ($M = 3.3$, $SD = 4.0$, $t = 2.96$, $p < .01$). However, age, education and time since diagnosis were not significantly related to depressive symptoms ($p > .05$).

Factors Associated with Depressive symptoms for Caregivers with Cancer

As shown in Table 3, increased strain was significantly related to a higher level of depressive symptoms in both samples and for the total sample. Greater functional impairment was significantly correlated with strain in each sample, but was not significantly associated with depressive symptoms in either sample. However, functional

TABLE 2

Summary of Descriptive Statistics and Between Groups Differences for the Brain Tumour and General Cancer Caregiver Samples

Variables (measure, possible range)	Mean (SD) / n (%) (Range)		<i>t</i>	<i>p</i>	Total sample
	Brain tumour	General cancer			
Depressive symptoms (DASS, 0–42)	4.93 (4.40) (0–15)	9.19 (8.58) (0–37)	–2.36	.021	7.37 (7.36) (0–37)
Normal range (0–9)	24 (88.9)	23 (63.9)			47 (74.6)
Mild (10–13)	1 (3.7)	3 (8.3)			4 (6.3)
Moderate (14–20)	2 (7.4)	7 (19.4)			9 (14.3)
Severe (21–28)	0 (0)	1 (2.8)			1 (1.6)
Extreme (29–42)	0 (0)	2 (5.6)			2 (3.2)
Strain (CSI, 0–13)	4.82 (2.88) (0–10)	4.83 (3.25) (0–12)	–0.02	.981	4.83 (3.07) (0–12)
Normal range (0–6)	20 (74.1)	28 (77.8)			48 (76.2)
Clinical range (7–13)	7 (25.9)	8 (22.2%)			15 (23.8)
Functional Ability (PCRS total, 30–150)	120.24 (18.90) (82–146)	112.36 (23.14) (66–144)	1.45	.154	115.74 (21.63) (66–146)
ADLs (PCRS, 8–40)	35.76 (4.58) (24–40)	30.08 (8.11) (14–40)	3.26	.002	32.52 (7.35) (14–40)
Cognitive (PCRS, 8–40)	31.82 (6.32) (16–40)	30.42 (6.81) (17–40)	0.83	.409	31.02 (6.59) (16–40)
Emotional (PCRS, 7–35)	25.28 (5.26) (16–34)	26.00 (5.60) –12.35	–0.52	.605	25.69 (5.42) (12–35)
Interpersonal (PCRS, 7–35)	27.50 (5.29) (18–35)	27.52 (5.40) (12–35)	–0.02	.987	27.51 (5.31) (15–35)

Note: ADLs = Activities of Daily Living; DASS = Depressive symptoms Anxiety Stress Scales; PCRS = Patient Competency Rating Scale.

impairment was significantly correlated with depressive symptoms for the total caregiver sample. A different pattern emerged between the two caregiver samples with regards to correlations between the functional domains and depressive symptoms. Specifically, level of depressive symptoms in the general caregiver sample was significantly correlated with level of cognitive, emotional and interpersonal difficulties, but not with ADLs. However, functional ability was not significantly correlated with depressive symptoms on any of the domains for the brain tumour caregiver sample. Greater functional impairment on each domain was associated with a higher level of strain for both samples, with the exception of cognitive ability for the brain tumour caregiver sample ($p > .05$).

Regression Analysis of Factors Related to Depressive symptoms

Preliminary analyses identified that the gender ratio differed considerably ($p < .001$) between the two

samples and that females reported a higher level of depressive symptoms. Further, given that the general cancer caregiver sample reported a higher level of depressive symptoms than the brain tumour caregiver sample, gender and cancer type (brain tumour vs. general cancer) were selected as variables to control for in all multivariate analyses. The potential impact of relationship type (i.e., spousal [$n = 56$] vs. non-spousal [$n = 7$] caregivers) was also examined by conducting the correlation analyses with and without the non-spousal caregivers. The inclusion of non-spousal caregivers was not found to make a substantive difference to the findings and, therefore, these cases were retained for the multivariate analyses.

In the first step of a hierarchical multiple regression (see Table 4), gender and cancer type were entered and accounted for 14% of the variance in depressive symptoms ($p < .05$). Functional ability and strain were entered in step two, and accounted for a significant proportion of additional variance (18%, $p > .005$) in depressive symptoms. Inspection of beta-weights, revealed

TABLE 3

Pearson's Product Moment Correlations between Strain, Functional Ability, and Depressive Symptoms for the Caregivers of Individuals With Cancer

Variable/sample	Depressive symptoms	Strain
Strain		
Brain tumour	.57**	—
General cancer	.50**	—
Total caregiver sample	.48**	—
Functional ability (total)		
Brain tumour	-0.16	-.58**
General cancer	-0.31	-.46**
Total caregiver sample	-.31*	-.49**
ADLs		
Brain tumour	-0.25	-.49**
General cancer	-0.12	-.36*
Total caregiver sample	-.25*	-.36**
Cognitive ability		
Brain tumour	-0.04	-0.36
General cancer	-.40*	-.38*
Total caregiver sample	-.30*	-.37**
Managing emotions		
Brain tumour	-0.19	-.54**
General cancer	-.36*	-.44**
Total caregiver sample	-.27*	-.48**
Interpersonal skills		
Brain tumour	-0.2	-.64**
General cancer	-.46**	-.58**
Total caregiver sample	-.36**	-.60**

Note: * $p < .05$ ** $p < .01$

that strain was the only significant predictor of depressive symptoms ($\beta = .44, p < .005$) in the final model.

Mediation of Strain on Functional Ability and Depressive Symptoms

The suitability of mediation analysis was supported by the pattern of bivariate correlations for the

broader caregiver sample as previously shown in Table 3. After controlling for gender and cancer type, functional ability significantly predicted strain in the first equation ($\beta = -.49, t = -4.42, p < .001$). However, functional ability did not significantly predict depressive symptoms in the second equation ($\beta = -.22, t = -1.81, p = .07$).

Mediation analyses were also conducted for each functional domain, based on the pattern of significant correlations among the functional domains, strain and depressive symptoms (see Table 3). Similar to the findings for overall functional ability, ADLs and cognitive function did not significantly predict depressive symptoms when controlling for gender and cancer type. However, there were significant mediation effects for the domains of emotional and interpersonal function. As shown in Table 5, the standardised beta-weight for interpersonal function decreased from .31 ($p < .05$) to .09 ($p > .05$) in the third equation, indicating that strain mediated the relationship between the individual with cancer's interpersonal skills and caregiver depressive symptoms. Similarly, the standardised beta-weight for emotional function decreased from .26 ($p < .05$) to .08 ($p > .05$), indicating that strain mediated the relationship between the individual with cancer's ability to manage their emotions and caregiver depressive symptoms.

Discussion

The present study aimed to identify associations among functional impairment, strain and depressive symptoms in two different caregiver groups, namely, the caregivers of individuals with brain tumour and caregivers of individuals with diverse cancer types. Consistent with the first hypothesis, overall functional impairment was significantly related to strain, and strain was significantly associated with caregiver depressive symptoms in both samples. In the general cancer caregiver sample, level of depressive symptoms was significantly related to cognitive, emotional and interpersonal

TABLE 4

Hierarchical Multiple Regression of Variables Associated with Caregiver Depressive Symptoms

Variables	R ²	R ² adj	ΔR ²	ΔF/β	t	t
Step 1. cancer type, gender	.14	.11	.14	4.91		.011
Step 2. all variables entered	.32	.28	.18	7.88		.001
Cancer type				.23	1.77	.083
Gender				-.11	-0.82	.417
Strain				.44	3.45	.001
Functional ability				-.02	-.14	.887

TABLE 5

Mediating Effects of Strain on the Relationship between the Functional Abilities of Individuals With Cancer and Caregiver Depressive Symptoms

Mediation Equation ^a	R ²	β	t	p
Interpersonal difficulties				
1. Effect of interpersonal skills on strain	.38	-.56	-.511	< .001
2. Effect of interpersonal skills on depressive symptoms	.19	-.31	-2.56	.013
3. Effect of interpersonal skills and strain on depressive symptoms	.33			
Interpersonal skills		-.09	-0.63	.534
Strain		.41	2.97	.004
Managing emotions				
1. Effect of managing emotions on strain	.28	-.43	-3.82	< .001
2. Effect of managing emotions on depressive symptoms	.20	-.26	-2.15	.036
3. Effect of managing emotions and strain on depressive symptoms	.33			
Managing emotions		-.08	-0.61	.545
Strain		.42	3.29	.002

Note: ^a Gender and cancer type were controlled for in each equation.

difficulties, but not difficulties with ADLs. Furthermore, level of depressive symptoms was not significantly related to overall functional impairment or specific functional domains for the brain tumour caregiver sample. Strain was significantly related to depressive symptoms after controlling for gender and cancer type in the total caregiver sample. Tests of mediation suggested that the individuals' level of interpersonal and emotional difficulties contributed to caregiver depressive symptoms through increasing level of strain. Such findings largely support theoretical perspectives on caregiver emotional wellbeing and have implications for the development of caregiver support programs.

It is important to initially highlight that the majority of caregivers in the present sample were in the normal range for level of depressive symptoms and strain, thus reflecting relatively positive adjustment to their role. Nevertheless, approximately one quarter of the present sample reported clinically significant levels of emotional distress and strain. The finding that a higher level of strain was associated with increased level of caregiver depressive symptoms is consistent with previous studies in the cancer and brain injury literature (Cameron et al., 2002; Machamer et al., 2002; Nijboer et al., 1999; Sander et al., 1997). Contrary to past research (Given et al., 2004), in the present study level of difficulty with ADLs was not associated with depressive symptoms in the brain

tumour or general cancer caregiver group. The finding that cognitive, emotional and interpersonal difficulties were related to depressive symptoms in the general caregiver group, but not in the brain tumour caregiver group is particularly interesting. While this may partly be explained by the smaller sample size of the latter group, which potentially reduced statistical power for the correlational analysis, it was noted that the correlations for the brain tumour caregiver sample were not approaching significance ($p > .10$) and the effect sizes were not substantial. An alternative explanation for the unexpected findings regarding the associations between functional domains and depressive symptoms for the caregiver groups relates to caregiver mastery and preparedness (Scherbring, 2002; Schumacher et al., 2007; Sherwood et al., 2007).

In the context of caregiving, mastery refers to the caregiver's perceptions of their ability to cope and effectively provide care to the individual with cancer (Gitlin et al., 2003). Scherbring (2002) found that caregivers who felt better prepared to handle particular care demands experienced lower subjective burden. Further, Sherwood et al. (2007) found that behavioural disturbances (e.g., delusions and aggression) following brain tumour contributed to lower caregiver mastery, which in turn was related to increased caregiver depressive symptoms. Therefore, in the present study, it is possible that participants in the general cancer

caregiver group may have felt better prepared for, or more capable of managing their relative's difficulties with ADLs as compared to cognitive, emotional and interpersonal difficulties. Further, caregivers of individuals with brain tumour may have been more prepared to manage a broader range of functional impairments in their relative; thus, degree of functional impairments was not significantly related to their level of depressive symptoms. However, this proposed explanation is only speculative as caregiver mastery and preparedness were not investigated in the present study. Nonetheless, it highlights a key area for exploration in future research.

Overall, the present findings indicated that it was not the individuals' degree of functional impairments per se, but the level of demands or strain associated with the caregiver role that had the most significant impact on caregiver emotional wellbeing. The results of mediation analyses revealed that the interpersonal and emotional difficulties of individuals with cancer contributed indirectly to caregiver depressive symptoms through their associated impact on strain. In previous cancer research (Schumacher et al., 1993), emotional adjustments (e.g., handling arguments) were found to be the most common type of role strain (77%) reported by caregivers, followed by family adjustments (51%). Interestingly, Wimberly, Carver, Laurenceau, Harris and Antoni (2005) found that a greater level of emotional involvement (i.e., expression of affection and absence of relationship tension) in interactions between women with breast cancer and their partners predicted lower emotional distress in the individual with cancer. Cancer places considerable strain on close relationships; hence, there may be reciprocal effects on the emotional wellbeing and interpersonal function of individuals and their caregivers (Wimberly et al., 2005).

Considering the present findings and previous literature together, it is suggested that caregivers who more effectively manage the strain associated with the emotional and interpersonal consequences of cancer are likely to experience better emotional adjustment themselves (i.e., fewer depressive symptoms). According to past empirical research, the likely mechanisms through which caregivers manage strain include their own internal coping resources and external support. Specifically, coping mechanisms have been found to mediate the effects of strain on depressive symptoms (Schumacher et al., 1993; Sherwood et al., 2007). Interestingly, social support was found to have a mediating effect on functional status and depressive symptoms, rather than a moderating or stress-buffering role

(Schumacher et al., 1993). It is important to note that such studies focused on specific functional impairments (viz., behavioural dysfunction in brain tumour and physical disability in cancer) rather than a broader range of functional consequences. Therefore, it is recommended that future research examine the role of coping mechanisms and potential buffering effects of social support in the relationship between different functional consequences of cancer, strain and caregiver emotional adjustment.

It is important to acknowledge a number of methodological limitations of the present study. First, given the cross-sectional research design the direction of associations between variables cannot be assumed. Consistent with theoretical models, level of depressive symptoms was conceptualised as an outcome variable impacted by the primary stressor of functional impairments and secondary role strain (see Schumacher et al., 1993). However, bidirectional relationships may exist between these variables. For example, the caregivers' emotional status may have influenced their perceptions of the relative's functional ability and role strain. Second, there was considerable heterogeneity within each caregiver group and within the total sample with respect to type of cancer, time since diagnosis and stage of illness. In the total caregiver sample, caregivers of individuals with brain tumour were overrepresented, particularly when considering that brain tumour only accounts for 1.4% of all cancers (AIHW, 2007). Further, medical information regarding the stage and prognosis of the cancer was not available for most individuals, and thus could not be examined in the analyses. In particular, individuals with general types of cancer were not screened for cerebral metastases which may have impacted levels of functional impairment reported by caregivers.

A further limitation related to participant recruitment, which involved convenience sampling rather than a more rigorous recruitment strategy, such as consecutive admissions to an oncology ward. Although caregivers are predominantly female (Jenkins, Rowland, Angus, & Hales, 2003), females were overrepresented in the general cancer group (92%) as efforts to recruit more male caregivers (e.g., through support avenues for caregivers of women with breast cancer) were not successful. Finally, the current investigation is the first known study to use the PCRS as a functional impairment measure in cancer. Whilst internal consistency was sound in the present study for both samples, other psychometric properties need to be examined to determine the suitability of its use with this population. Related to this issue, the assessment in the present

study relied solely on self-report data, with the DASS referring to symptoms experienced in the last 7 days and the CSI reflecting current levels of strain only. It is likely that levels of caregiver emotional distress vary according to a range of circumstances, including the prognosis and status of the individual's cancer and treatment characteristics, as well as issues not directly related to the caring experience; however, these were not investigated in the present study. These methodological issues may limit the extent to which the findings can be generalised to the broader population of caregivers of individuals with brain tumour and other cancers.

Given the overall low level of depressive symptoms reported in the present study, it is important to emphasise that it may only be a subgroup of caregivers (e.g., 25% in the present sample) that exhibits clinically significant levels of distress. Longitudinal studies are needed to observe the patterns of emotional distress and contributing mechanisms for caregivers across the diagnosis, treatment and long-term adjustment phases. Empirical support for the model of caregiver emotional wellbeing by Schumacher et al. (1993) may therefore vary according to the level of emotional distress exhibited by a given caregiver sample, and thus patterns of findings may differ across caregiver groups and at different time points in the adjustment process.

Overall, the present findings highlight the need to monitor caregiver's emotional wellbeing and associated role strain to identify the need for support interventions. Various approaches have been described in the literature, including tele-based cancer help-lines, psychoeducation, problem-solving interventions, stress management, and group therapy or peer support (see Hutchinson, Steginga, & Dunn, 2006). The approaches that incorporate support for both the individual and their caregiver (e.g., couple-based interventions) appear to be more efficacious, particularly those with an early intervention focus (see McCorkle & Pasacreta, 2001). However, a systematic review of caregiver support interventions is yet to be conducted and would make a useful contribution to the literature. Further, there are no known controlled intervention studies for caregivers of individuals with brain tumour, thus representing an important avenue for clinical research.

In conclusion, the present study identified that level of strain was associated with depressive symptoms for caregivers of both individuals with brain tumour and other cancers. Overall, functional impairments were more consistently related to strain than depressive symptoms. Particular

functional impairments (i.e., emotional and interpersonal difficulties) were found to have an indirect effect on depressive symptoms through their impact on strain. These findings highlight the need to monitor caregiver wellbeing and implement intervention strategies for alleviating strain, ideally through programs that support both individuals with cancer and their caregivers.

Acknowledgments

The authors gratefully acknowledge the funding and support from The Cancer Council of Queensland and Griffith University. We would also like to acknowledge the coordinators and staff at the Apex Lodges, Prostate Cancer Foundation, Leukaemia Foundation Lodges, Head and Neck Cancer Support Group, Brain Tumour Support Service and Brizbrain and Spine Centre. We also extend our gratitude to the participants of the study.

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