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Objective: This exploratory study applied a biopsychosocial perspective to investigate cognitive and psychosocial factors related to emotional adjustment and QoL after brain tumour. *Methods:* Participants included 30 adults with a brain tumour (60% benign and 40% malignant) who were aged 28 to 71 years ($M = 51.5$, $SD = 12.3$) and on average 5.4 years post-diagnosis ($SD = 5.6$ years). Participants completed a brief battery of cognitive tests and self-report measures of emotional status (Depression, Anxiety Stress Scale), subjective impairment (Patient Competency Rating Scale), coping (COPE), social support (Brief Social Support Questionnaire), and QoL (Functional Assessment of Cancer Therapy – Brain Tumour [FACT-Br]). *Results:* QoL was significantly associated with global cognitive ability ($r = .49$, $p < .01$), subjective impairment ($r = .66$, $p < .01$), and satisfaction with support ($r = .50$, $p < .05$). Level of depressive symptoms was significantly correlated with premorbid IQ ($r = -.49$, $p < .01$), use of planning to cope ($r = -.48$, $p < .01$), and satisfaction with support ($r = -.47$, $p < .01$). *Conclusions:* Overall, these exploratory findings indicate that emotional adjustment and QoL after brain tumour is related to a slightly different pattern of neuropsychological, psychological (self-perceptions and coping) and social factors. The clinical implications for interventions with individuals with brain tumour are discussed.

Keywords: brain tumour, quality of life, emotional adjustment

Brain tumour is a relatively rare form of brain injury (7.3/100 000 for males and 5.7/100 000 for females), but has a high mortality rate (Cancer Institute New South Wales, 2006). With the combined effects of cancer and brain injury, individuals with malignant brain tumour face considerable uncertainty regarding treatment outcomes and their lifespan, and typically have persisting functional limitations. Although malignant tumours pose the greatest threat to survival, benign tumours may recur and their growth and treatment can seriously affect functioning. Quality of life (QoL) and emotional adjustment issues have received considerable attention in the literature (Armstrong, Goldstein, Cohen, & Tallent, 2002; Janda et al., 2007; Weitzner, Meyers, & Byrne, 1996); however, most empirical studies to date have focused primarily on the impact of tumour characteristics (e.g., grade, size and location) and neuropsychological impairment on these out-

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comes (Ownsworth, Hawkes, Steginga, Walker, & Shum, 2009). The role of self-perceptions, coping and social support has been largely overlooked, and warrants investigation in addition to neuro-cognitive factors given that these psychosocial issues are potential targets for intervention.

An in-depth review of the empirical literature indicated that the influence of tumour characteristics on QoL and emotional adjustment outcomes is largely unclear, due to inconsistent findings (Ownsworth et al., 2009; Weitzner et al., 1996). For example, while higher tumour grade was found to be associated with poorer QoL outcomes in some studies (Giovagnoli, Silvani, Colombo, & Boiardi, 2005; Lilja & Salford, 1997; Salo, Niemela, Joukamaa, & Koivukagas, 2002), other authors reported no significant effects of tumour grade on emotional status (Anderson, Taylor, & Whittle, 1999; Hahn et al., 2003; Keir, Guill, Carter, & Friedman, 2006) or QoL (Brown et al., 2006; Giovagnoli, 1999; Kalkanis, Quinones-Hinojosa, Buzney, Ribaudo, & Black, 2000; Osaba, Brada, Prados, & Yung, 2000). Similarly, the findings concerning the impact of tumour size are mixed (Hahn et al., 2003; Mainio, Hakko, Niemela, Koivukangas, & Rasanen, 2006; Salo et al., 2002), although in a large multi-site study (n = 598) it was reported that depression was more common for individuals with larger and multifocal tumour sites (Litofsky et al., 2004). There are conflicting findings concerning tumour location, with some studies identifying poorer emotional adjustment or QoL following left hemisphere tumours (Giovagnoli, Tamburini, & Boiardi, 1996; Hahn et al., 2003), whereas others reported poorer QoL following right hemisphere tumours (Salo et al., 2002). A further study found no differences in emotional adjustment outcomes between left and right hemisphere tumour groups (Pringle, Taylor, & Whittle, 1999).

The neuropsychological impairments arising from brain tumour have been widely documented, including deficits in attention, memory, and executive function in both verbal and nonverbal domains (Giovagnoli & Boiardi, 1994; Hahn et al., 2003; Klein et al., 2001). However, the evidence for a significant relationship between level of neuropsychological impairment and QoL or emotional adjustment varies between studies. For example, Giovagnoli et al. (2005) reported that higher global performance on neuropsychological tests predicted better QoL in multivariate analysis. However, global cognitive function did not significantly predict level of depression in a multivariate model by Armstrong et al. (2002). Further, Brown et al. (2006) found that although global cognitive function was correlated with QoL it was not a significant predictor in multivariate analysis. Overall, the inconsistent empirical findings suggest that neuro-cognitive factors cannot sufficiently account for emotional adjustment and QoL outcomes following brain tumour.

Ownsworth and colleagues (2009) developed a biopsychological framework to guide the organisation and critical review of empirical studies investigating factors related to adjustment and QoL in the context of brain tumour. This framework encompassed pre-illness functioning and characteristics (e.g., demographic variables, premorbid IQ, pre-illness psychological wellbeing and pre-existing social support), neuropathology and objective indicators of functional impairment (e.g., tumour characteristics and treatment effects, and physical and cognitive impairment), personal appraisals and coping reactions (subjective impairment, awareness of diagnosis and prognosis, sense-making and coping style), social support and resources (e.g., information, psychological and tangible support, access to services, and rehabilitation).

Overall, the review by Ownsworth et al. (2009) identified consistent findings concerning the association between emotional status and QoL, with measures of depression or anxiety predicting QoL at the time of diagnosis (Mainio et al., 2006), post-treatment (Giovagnoli et al., 2005; Giovagnoli, 1999; Mainio et al., 2006), and long-term follow-up (Janda et al., 2007). Although the association between emotional status and QoL is well established, relatively few studies have examined the impact of self-perceptions of illness, coping, and social support on QoL outcomes following brain tumour.

Anderson et al. (1999) found that self-perceptions of illness status (diagnosis and prognosis) were not significantly associated with emotional status, although there was a trend for individuals who were more aware of their illness status to display lower emotional distress. Various studies have reported that individuals with brain tumour perceive high levels of functional impairment, including problems with fatigue, concentration, memory, communication, and activity restrictions (Armstrong et al., 2002, Giovagnoli & Boiardi, 1994; Osaba et al., 2000). Krupp and colleagues (2009) found that younger adults in particular perceived major differences in their functional status compared to their pre-illness function, and experienced associated low self-esteem and reduced life satisfaction. Level of self-reported symptoms has been found to predict depression and QoL independent of more objective indices of physical and cognitive function (Armstrong et al., 2002; Brown

et al., 2005; Wellisch, Kaleita, Freeman, Cloughesy, & Goldman, 2002). Self-reported impairment provides insight into how individuals perceive the everyday functional consequences of their illness and thus is likely to be more closely related to QoL and emotional adjustment than more objective indices of function (e.g., cognitive test performance or relative ratings of impairment).

In a qualitative study of coping, Strang and Strang (2001) identified that many individuals with brain tumour make sense of their situation by seeking detailed information about their illness, and draw upon internal resources and coping strategies to manage their situation. Edvardsson and Ahlström (2005) reported that individuals manage the functional impairments arising from the tumour with a broad range of coping strategies, including problem-focused approaches (e.g., changing their approach, and planning/anticipating) and emotion-focused approaches (e.g., accepting, maintaining hope, and expressing feelings). Herrmann et al. (2000) found that while individuals reported using a range of coping strategies, including depressive coping, minimisation and wishful thinking, active/problem-oriented coping strategies (e.g., seeking information) were most commonly employed. Previous studies therefore support that individuals employ diverse strategies to cope with their illness; however, research is yet to examine whether use of coping strategies is related to emotional adjustment and QoL.

Similar to the broader cancer research (see Hegelson & Cohen, 1996), the findings of a number of qualitative studies have underscored the importance of perceived informational, instrumental and emotional support following diagnosis of brain tumour. In particular, various authors found that although individuals with brain tumour were generally satisfied with procedural aspects of care and how their physical needs were met, they perceived that the emotional impact of their illness and need for existential support was often

TABLE 1
Summary of Tumour Characteristics and Treatment for the Sample (n = 30)

	Tumour characteristics	*n* (%)
Benign/low grade tumours	Meningioma	5 (17)
	Pituitary gland	4 (13)
	Astrocytoma	3 (10)
	Oliogodendroglioma	2 (7)
	Craniopharyngioma	1 (3)
	Colloid cyst	1 (3)
	Acoustic neuroma	1 (3)
	Benign tumour (unknown type)	1 (3)
Malignant tumours	Glioblastoma multiforme	4 (13)
	Oliogodendroglioma	4 (13)
	Melanoma metastases	1 (3)
	Multiple malignant tumours	1 (3)
	Malignant tumour (unknown type)	2 (7)
Tumour location	Right frontal or frontotemporal	9 (30)
	Left frontal, parietal or temporal	8 (27)
	Pituitary gland	5 (17)
	Bilateral frontal	2 (7)
	Brain stem	2 (7)
	Hypothalamus	2 (7)
	Auditory nerve	1 (3)
	Third ventricle	1 (3)
Treatment	Surgery	10 (33)
	Surgery + radiation	9 (30)
	Surgery + radiation + chemotherapy	9 (30)
	Radiation	1 (3)
	Cyber knife	1 (3)

overlooked by professionals (Fox & Lantz, 1998; O'Donnell, 2005; Strang & Strang, 2001, Wyness, Durity & Durity, 2002). Family members were viewed as the most valued source of instrumental and emotional support throughout the course of the illness (Fox & Lantz, 1998). Support groups were found to provide a 'safe haven' for people to express their greatest fears whilst also maintaining their morale (Leavitt, Lamb, & Voss, 1996). Other studies have highlighted the need for early access to information and support from the time of diagnosis to help manage uncertainty about the future and to prepare for various possible outcomes, ranging from resuming normal life roles to hospice care (Edvardsson & Ahlström, 2005; Janda, Eakin, Bailey, Walker, & Troy, 2006). Although the importance of social support has been emphasised in the literature, the impact of individuals' satisfaction with support on their QoL and emotional adjustment is yet to be examined.

The present study adopted a biopsychosocial perspective to investigate the influence of pre-illness characteristics (i.e., premorbid IQ), neuropsychological function (i.e., global cognitive function), personal appraisals and coping (i.e., subjective impairment and coping), and social resources (i.e., social support). It was hypothesised that better QoL and emotional adjustment would be significantly associated with greater pre-illness and post-illness cognitive ability, lower subjective impairment, increased use of coping strategies, and higher satisfaction with social support.

Methods

Participants

Ethics approval was granted by Griffith University and Wesley Hospital Human Research Ethics Committees prior to commencement of the study. Following referral from a brain tumour support group and private neurosurgery clinic, 39 individuals with a brain tumour were initially screened for eligibility to participate. For inclusion in the study it was required that participants: (a) had been diagnosed with a brain tumour at least three months prior to the study; (b) had undergone primary treatment and were sufficiently well to participate; and (c) displayed adequate cognitive and communication skills to complete questionnaires and tests. Of the 39 individuals initially referred, three became too unwell to participate, three withdrew from the study, two passed away prior to data collection, and one was excluded due to very severe cognitive impairment. The final sample comprised 30 individuals aged 28–71 years (M = 51.5, SD = 12.3) with an approximately equal number of males (47%) and females (53%). The average time since tumour diagnosis was 5.39 years (SD = 5.4). As shown in Table 1, the sample included 18 participants with benign/low grade tumours and 12 with malignant tumours. Details regarding the diagnosis (with histology confirmed), tumour type, location, and treatment were obtained from medical reports. Most individuals had received surgery, typically combined with radiation or both radiation and chemotherapy.

Measures

Cognitive function. Participants were administered a brief battery of standardised neuropsychological tests including measures of premorbid IQ (Wechsler Test of Adult Reading), attention (Digit Span from the Wechsler Adult Intelligence Scale — Third edition and Trail Making A), memory (Hopkins Verbal Learning Test and Rey Complex Figure recall), and executive function (Rey Complex Figure copy, Trail Making B, and Controlled Oral Word Association Test). Age-adjusted standardised scores were calculated using normative data spanning the relevant age bands for each test (Lezak, Howieson, & Loring, 2004; Strauss, Sherman, & Spreen, 2006). Consistent with a previous approach by Armstrong et al. (2002), a composite score of global cognitive function was derived by summing the age-standardised scores on tests of attention, memory and executive function.

Subjective impairment. The Patient Competency Rating Scale (PCRS; see Hart, 2000) is a 30-item self-report measure that assesses perceived level of function following brain injury in the areas of activities of daily living, cognitive skills, emotional management and interpersonal skills. Items are rated on a 5-point Likert scale from 1 (*Can't do*) to 5 (*Can do with ease*). Scores range from 30 to 150 with lower scores reflecting greater levels of subjective impairment. The PCRS has high internal consistency (α = .91–.95) and test-retest reliability (r = .92) and demonstrated evidence of concurrent validity (Hart, 2000). The relative's version of the PCRS was also administered to a family member (predominantly a spouse or partner) to provide a significant other's perspective of the individual's everyday function.

COPE. The COPE (Carver, Scheier, & Weintraub, 1989) is a standardised 60-item measure of 13 conceptually distinct coping styles. Whilst all COPE items were administered in the present study, only five scales were used in data analysis, based on

their satisfactory internal consistency in both a normative sample (Carver et al., 1989) and the current sample (i.e., $\alpha > .60$), as well as previous empirical findings regarding the relevance of these coping styles to adjustment in brain tumour (Edvardsson & Ahlström, 2005). These included three problem-focused coping strategies (active coping, planning, and seeking instrumental social support) and two emotion-focused strategies (acceptance and positive reinterpretation). In the present study the COPE was used to examine dispositional coping characteristics, or how participants generally react to difficult or stressful life experiences.

Brief Social Support Questionnaire (BSSQ). This brief measure based on the Social Support Questionnaire (SSQ; Sarason, Levine, Basham, & Sarason, 1983) was developed to examine individuals' satisfaction with their social support since diagnosis, and has been used previously with caregivers of people with brain tumour (Ownsworth, Henderson & Chambers, in press). The BSSQ has separate scales to assess number of supports and satisfaction with support. Participants were asked to list up to nine people, organisations, or services that have provided support since the onset of their illness until the present time. For each source of support they rated how satisfied they were on a 6-point Likert scale from 1 (*Very dissatisfied*) to 6 (*Very satisfied*). These ratings were summed and averaged to derive an average satisfaction with social support score, whereby higher scores reflect greater satisfaction. Individuals additionally provided an overall rating of their satisfaction with all social support received on the 6-point Likert scale (Ownsworth et al., in press).

Depression Anxiety and Stress Scales (DASS). The DASS (Lovibond & Lovibond, 1995) includes three 14-item self-report scales measuring symptoms of depression, anxiety and stress. Participants rate the extent to which they have experienced various symptoms over the past week, with 0 indicating the symptom *Did not apply* and 3 indicating the symptom *Applied very much or most of the time*. Scores are obtained by summing the scores for each item of the scale and range from 0 to 42. Clinically significant levels of distress are indicated by cut-off scores: > 9 for depression, > 6 for anxiety, and > 13 for stress (Lovibond & Lovibond, 1995). The DASS has sound psychometric properties in both clinical and nonclinical samples (Lovibond & Lovibond, 1995). Adequate internal consistency (α = .86–.95), test–retest reliability (r = .60–.77) and concurrent validity with the Hospital Anxiety and Depression Scale (r = .53–.73) has been reported in a brain tumour sample (Ownsworth, Little, Turner, Hawkes, & Shum, 2008). The psychometric properties of the depression scale were particularly strong (e.g., α = .95) and, given the high correlations with the other scales of the DASS (e.g., stress and depression r = .76) (Ownsworth et al., 2008), depression was selected as the main measure of emotional adjustment.

Functional Assessment of Cancer Therapy (FACT) Scale. The FACT (Cella, 1997) is a well-established and validated measure of QoL in cancer research. To measure QoL of people with brain tumour in the present study the FACT-General (FACT-G) subscales (physical, social, emotional, and functional wellbeing) were combined with the FACT-Brain (FACT-Br) subscale to comprise the Total FACT-Br score (Cella, 1997). Responses on each subscale are made on a 5-point Likert scale (*Not at all* to *Very much*), with higher overall scores reflecting better QoL. The FACT has sound psychometric properties, as reported in previous cancer and brain tumour studies (Janda et al., 2007). Brucker and colleagues (2005) reported general population norms on the FACT-G (M = 80.1, SD = 18.1) with a guideline that 0.5 SD signifies a meaningful difference between the norms and clinical participants, thus reflecting poor quality of life.

Procedure

Following ethics approval for the study, participants were referred to the study by the clinical nurse of a neurosurgical practice and the coordinator of a brain tumour support group. Researchers visited participants in their own homes to explain the study and obtain informed consent. Individuals with a brain tumour and their relatives initially participated in an interview regarding their experiences of social support received since the time of diagnosis (note: this qualitative component forms the basis of another study). The brief neuropsychological battery was administered after the interview with tests given in a fixed order. Participants then completed the questionnaires or were given these to complete and return by post using reply paid envelopes.

Data Analysis

Data screening was conducted in accordance with guidelines by Tabachnick and Fidell (2007). Missing data were found for two individuals (both with malignant tumours) on the self-report measures, thus the sample size for the full data

set was reduced to 28. There were no concerns regarding multicollinearity and tolerance issues. However, the data were skewed on a number of variables and thus correlational analyses were run using both transformed and untransformed data (note: there were no substantive differences between these analyses). Descriptive analyses were initially conducted with cut-off scores used to calculate the proportion of individuals in the clinical range on relevant measures. Associations among variables were examined using Pearson product moment correlation coefficients. Due to the large number of variables in the correlation analysis, an adjusted alpha level of .01 was adopted.

Results

Descriptive Results

The descriptive data on each measure are presented in Table 2. A series of independent *t* tests revealed that there were no significant differences on the measures of psychosocial function-

TABLE 2

Summary of Descriptive Data on Measures of Cognitive and Psychosocial Function and Quality of Life

Measures	Mean (*SD*)			Clinical cut-offs[a]
	Benign/low grade (*n* = 18)	Malignant (*n* = 10)	Total sample (*n* = 28)	Total sample (*n* = 28)
PCRS self-ratings	115.56 (14.2)	107.00 (17.2)	112.50 (15.6)	N/A
PCRS relative-ratings	119.53 (17.3)	115.70 (14.6)	118.0 (16.0)	
COPE				
Active coping	11.89 (2.8)	10.9 (2.1)	11.54 (2.6)	N/A
Planning	12.2 (3.5)	11.6 (3.4)	12.00 (3.4)	
Seeking support	9.0 (3.7)	9.50 (4.1)	9.17 (3.8)	
Positive reinterpretation	12.72 (2.7)	11.90 (3.0)	12.42 (2.8)	
Acceptance	12.61 (2.4)	12.60 (2.0)	12.61 (2.2)	
BSSQ				
Number of supports	7.22 (1.8)	6.75 (1.3)	7.03 (1.6)	N/A
Average satisfaction	4.78 (0.7)	5.11 (0.6)	4.9 (0.69)	
Overall satisfaction	4.42 (1.2)	5.00 (0.7)	4.65 (1.1)	
Depression	8.03 (9.9)	6.83 (6.0)	7.55 (8.5)	32%
Anxiety	6.94 (6.7)	8.58 (7.7)	7.60 (7.1)	39%
Stress	12.06 (8.4)	13.8 (4.9)	12.77 (7.2)	43%
FACT-G	76.06 (21.7)	79.50 (10.2)	77.29 (18.3)	29%
FACT-Br	53.94 (11.7)	46.00 (11.9)	51.11 (12.2)	N/A
FACT-Total	130.89 (32.9)	123.50 (23.4)	128.25 (29.6)	N/A
Premorbid IQ (WTAR)	102.17 (9.2)	103.33 (7.5)	102.70 (6.5)	N/A
Attention				
Auditory attention (Digit Span)	10.94 (2.8)	10.00 (3.5)	10.57 (3.1)	30%
Visual attention (Trails A, secs)	33.89 (15.5)	40.33 (16.0)	36.47 (15.7)	20%
Memory				
Verbal learning (HVLT, Total recall)	24.06 (4.8)	22.33 (3.8)	23.37 (4.4)	53%
Delayed verbal recall (HVLT)	8.28 (2.3)	6.92 (2.3)	7.73 (2.4)	47%
Delayed visual recall (RCF)	16.72 (5.9)	13.67 (7.0)	15.50 (6.4)	30%
Executive function				
Planning and organization (RCF)	31.42 (4.4)	29.75 (5.5)	30.75 (4.8)	50%
Verbal fluency (COWAT)	32.78 (12.7)	33.58 (10.0)	33.10 (11.5)	37%
Mental flexibility (Trails B, secs)	74.06 (19.7)	88.67 (42.7)	79.90 (31.2)	13%

Note: COWAT = Controlled Oral Word Association Test; FACT = Functional Assessment of Cancer Therapy (G = General, Br = Brain); HVLT: Hopkins Verbal Learning Test; PCRS = Patient Competency Rating Scale; RCF = Rey Complex Figure; WTAR = Wechsler Test of Adult Reading.

[a]Clinical cut-offs are based on normative data provided by Lezak, Howieson and Loring (2004) and Strauss, Sherman, and Spreen (2006).

TABLE 3
Correlations between Cognitive and Psychosocial Variables and Quality of Life (QoL) and Emotional Adjustment (n = 28)

	QoL	Depression	Anxiety	Stress
Cognitive function				
Premorbid IQ	—	-.49*	—	—
Global cognitive function	.49*	—	—	—
PCRS self-ratings	.66*	—	—	—
PCRS relative's ratings	—	—	—	—
Coping	—	—	—	—
Acceptance	—	—	—	—
Active coping	—	—	—	—
Positive reinterpretation	—	—	—	—
Planning	—	-.48*	—	—
Seeking social support				
Social support				
No. of supports	—	—	—	—
Average satisfaction with support	—	—	—	—
Overall satisfaction with support	.50*	-.47*	—	—

Note: *p < .01, PCRS = Patient Competency Rating Scale. Dashes indicate nonsignificant correlation coefficients.

ing and cognitive ability between the benign/low grade tumour group and the malignant tumour group (p > .05). Comparison of self- and relative ratings on the PCRS indicated that individuals typically perceived a higher level of functional impairment than their relatives. Based on clinical cut-off scores, approximately one third (29–43%) of participants demonstrated clinically significant levels of emotional distress and poor QoL. Cognitive deficits were most evident in the areas of verbal learning and delayed verbal recall and planning and organisation, which were impaired for approximately half of the sample (47–53%) relative to the test norms.

Associations Between Cognitive and Psychosocial Variables and Emotional Adjustment and QoL

As shown in Table 3, global cognitive function was positively correlated with QoL (p < .01) but not with emotional adjustment on the DASS. Premorbid IQ was negatively correlated with depressive symptoms (p < .01), but not with QoL or symptoms of anxiety and stress. Subjective impairment on the PCRS was significantly correlated with QoL, but not with emotional adjustment. Interestingly, level of subjective impairment on the PCRS was not significantly correlated with relatives' ratings (r = .39, p = .06). Further, relative-rated impairment on the PCRS was not significantly correlated with individuals' QoL or emotional adjustment. Use of planning as a coping strategy was negatively correlated with level of depressive symptoms (p < .01), but not with QoL or symptoms of anxiety and stress. No other coping strategy was significantly related to QoL or emotional adjustment. In relation to social support, higher overall ratings of satisfaction with support were significantly associated with better QoL and lower depressive symptoms. The social support variables were not significantly correlated with levels of anxiety or stress.

QoL and emotional adjustment were not significantly related to age, education or time since diagnosis (p > .05). There were no significant differences in outcome between individuals with benign and malignant tumours (p > .05) or between males and females (p > .05). QoL was significantly correlated with level of depressive symptoms (r = -.67, p < .001), anxiety (r = -.53, p < .01) and stress (r = -.53, p < .01).

In summary, with the exception of overall satisfaction with support, the pattern of variables significantly associated with depression (premorbid IQ, use of planning to cope and overall satisfaction with support) differed to the variables significantly associated with QoL (global cognitive function, subjective impairment, overall satisfaction with support).

Discussion

Unlike previous studies that have predominantly focused on tumour characteristics and neuropsychological functioning, the present study adopted

a biopsychosocial perspective to investigate factors related to QoL and emotional adjustment following brain tumour. As hypothesised, greater global cognitive ability, lower self-perceptions of impairment and higher satisfaction with support were related to better QoL. Further, higher premorbid IQ, increased use of planning as a coping strategy and higher satisfaction with support were related to a lower level of depressive symptoms. Surprisingly, these cognitive and psychosocial factors were not significantly related to levels of anxiety and stress. As the first study to investigate the impact of self-perceptions, coping and social support on QoL and emotional adjustment after brain tumour, the findings have useful implications for clinical practice and future research.

A key finding of this study is that individuals with brain tumour reported a higher level of functional impairment than their relatives. This is contrary to the pattern observed in other brain injury populations, particularly traumatic brain injury, where individuals more typically underreport their functional difficulties due to lack of self-awareness (Hart, 2000; Sherer, Hart, & Nick, 2003). Previous research has found that individuals with brain tumour perceive high levels of functional impairment relative to other cancer groups (Klein et al., 2001; Lidstone et al., 2003; Osaba et al., 2000), although these studies did not compare self-reports with collateral ratings. These findings suggest that individuals may overestimate or overgeneralise the effects of their tumour on everyday tasks which, in turn, contributes to a poorer global sense of wellbeing.

Individuals' overall satisfaction with their support network was found to be more closely related to QoL and level of depressive symptoms than the number of supports or typical satisfaction with support received. The positive impact of social support on psychological adjustment in the context of cancer is well established (Helgeson & Cohen, 1996); although until the present study had been largely overlooked in brain tumour research. It needs to be acknowledged that the BSSQ is not a validated tool and further research is needed to determine its psychometric properties. Additionally, previous cancer research suggests that particular types of support (i.e., emotionally supportive interactions) may be more closely related to emotional adjustment than others (Helgeson & Cohen, 1996). Therefore, the impact of different types of social support (e.g., emotional, informational and instrumental) throughout the course of brain tumour needs to be investigated.

The finding that a greater use of planning as a coping strategy was related to a lower level of depressive symptoms suggests that this approach may be particularly adaptive in adjusting to a brain tumour. As measured by the COPE, planning entails making a plan of action, considering which steps to take and generally thinking about the best approach to handle the stressor (Carver et al., 1989). The nature of this relationship is nonetheless unclear. Specifically, use of planning as an active coping approach may help to protect individuals from developing depression; or, alternatively, those who are less depressed may be better able to engage in planning as a way of coping with their illness (Herrmann et al., 2000). Further research is needed to better clarify the direction of the relationship between coping styles and depression in the context of brain tumour.

The finding that self-perceptions, coping and social support were not significantly related to levels of anxiety and stress was unexpected. It is likely that these aspects of emotional adjustment are related to other psychosocial variables that were not examined in the study. For example, previous research identified that existential dilemmas contribute to anxiety and distress following diagnosis of brain tumour (Strang & Strang, 2001). Further, individuals' personal appraisals (e.g., sense of threat, challenge, controllability) concerning their illness and the extent to which they feel that their situation is manageable has been found to predict emotional distress in other forms of cancer (e.g., Jenkins & Paragment, 1998). A broader range of psychosocial factors therefore needs be considered in future research to better understand factors contributing to anxiety and stress in brain tumour.

Methodological Considerations

A number of methodological limitations need to be acknowledged in the present study, including the small and heterogeneous sample. The small sample size potentially reduced statistical power for the correlational analysis and also precluded the use of multivariate analysis to determine the relative importance of the biopsychosocial variables to QoL and emotional adjustment outcomes. The sample comprised individuals with diverse tumour types, including one individual with secondary brain tumours, and time since diagnosis varied considerably. Overall, the small and heterogeneous sample may limit the extent to which findings can be generalised to other brain tumour samples. Bearing in mind that brain tumour is a rare form of cancer and/or brain injury and that sample size is a common dilemma, future research

should ideally employ separate analyses for different tumour subtypes. Further, due to the cross-sectional study design, the direction of the relationship between the psychosocial factors and QoL and emotional adjustment outcomes cannot be determined. While the present study should be viewed as exploratory given these issues, the findings provide some useful insights for clinical practice and future research.

In terms of clinical implications, the findings suggest that individuals with brain tumour may overestimate the impact of the tumour on their functional abilities. Such perceptions may contribute to self-limiting beliefs that impact on goal-setting and activity participation, thus resulting in a poorer general sense of wellbeing. There may be potential for psychotherapy and rehabilitation interventions to target these maladaptive self-appraisals and support the development of effective coping strategies (e.g., use of planning). While there is some evidence to support the efficacy of therapy approaches for improving self-management of symptoms and reducing distress in brain injury (e.g., Bombardier et al., 2009) and cancer (Greer et al., 1992), there is an absence of controlled interventions in brain tumour.

The finding that both level of depressive symptoms and QoL were related to overall satisfaction with social support highlights the need to evaluate strategies for strengthening and enhancing social support networks. Currently, descriptive studies support the benefits of nurse-led telephone-based support and nurse-facilitated support groups from a client satisfaction perspective (Leavitt et al., 1996; Sardell, Sharpe, Ashley, Guerrero, & Brada, 2000). Further, evaluation of in-patient and post-acute rehabilitation suggests that individuals with brain tumour experience comparable functional gains to those of patients with other forms of brain injury (Greenberg, Treger, & Ring, 2006). From a cost-economic perspective, given that brain tumour is a relatively rare form of cancer and brain injury, examination of the extent to which other cancer and brain injury support services effectively meet the support needs of those with brain tumour would assist to determine the need for brain tumour-specific support interventions.

Conclusion

The results of this study suggest that a range of biopsychosocial factors contribute to adjustment and sense of wellbeing after brain tumour. Better Qol was associated with greater global cognitive ability, lower subjective impairment and higher overall satisfaction with support. Lower level of depressive symptoms was related to a combination of higher premorbid IQ, increased use of planning to cope and higher overall satisfaction with social support. Although the study was limited by a small, heterogeneous sample as well as the cross-sectional design, these findings are useful to inform future research and clinical practice. In particular, it is recommended that the efficacy of psychotherapy and rehabilitation interventions for individuals with brain tumour be trialled. It is further recommended that the suitability of existing cancer and brain injury support services be examined in order to determine the need for brain tumour-specific services.

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