Am J Cancer Res 2025;15(2):652-660
www.ajcr.us /ISSN:2156-6976/ajcr0161901

Original Article

Association between psychological resilience and symptom burden in postoperative patients with brain gliomas and its influencing factors

Yanan Jing, Chan Liu, Lijun Wang, Xiaoxi Liu, Lei Wang

Department of Neurosurgery, Tangshan Gongren Hospital, Tangshan 063000, Hebei, China

Received November 11, 2024; Accepted January 27, 2025; Epub February 15, 2025; Published February 28, 2025

Abstract: Objectives: This study aimed to explore the relationship between psychological resilience (PR) and symptom burden in postoperative brain glioma (BG) patients and to identify factors influencing this relationship. Methods: A total of 296 postoperative BG patients were included in this study. Various scales were employed, including the General Information Questionnaire, the Psychological Resilience Scale for PR, the M.D. Anderson Symptom Inventory for Brain Tumors to assess symptom burden, the Social Support Rating Scale, and the General Self-Efficacy Scale. Pearson correlation and multifactor linear regression analyses were used to examine the relationship between PR and symptom burden, and to assess the impacts of social support and self-efficacy. Results: Higher PR was associated with younger age, higher educational level, and greater family income. A significant inverse correlation was found between PR and symptom burden ($r=-0.827$, $P<0.001$). Social support ($r=-0.832$, $P<0.001$) and self-efficacy ($r=-0.116$, $P=0.046$) were also negatively correlated with symptom burden. Multifactorial analysis revealed that both PR and social support independently influenced symptom burden. Conclusions: Enhancing PR and social support in postoperative BG patients may reduce symptom burden and improve quality of life. Future research should investigate interventions to improve PR and evaluate their long-term effects on symptom management and recovery.

Keywords: Brain glioma, psychological resilience, symptom burden

Introduction

Brain glioma (BG) is a neoplasm of glial cells originating in the white matter of the brain, representing one of the most common malignant central nervous system (CNS) tumors [1]. BG accounts for approximately 40% of all CNS tumors and approximately 80% of malignant CNS tumors in adults [1, 2]. The morbidity and mortality rates of BG remain high, posing a substantial burden on patient health and healthcare resources worldwide [3]. The primary treatment modalities for BG include surgery, radiotherapy, chemotherapy, and immunotherapy [4]. Despite advancements in surgical techniques, targeted therapies, and other treatment options in recent years, the mortality rate for BG patients remains concerning due to its aggressive nature [5]. Surgery, as the primary intervention for BG, significantly impacts patient health and well-being. Beyond the physical effects of the surgery, there is a considerable psychological burden associated with the high recurrence rate and potential treatment side effects [6]. These factors contribute to a decline in patients' quality of life.

In oncology, the psychological and mental state of patients has emerged as a critical factor influencing the efficacy of treatments [7]. Given the severity of the disease and the complexity of treatment, BG patients often experience significant psychological distress, including anxiety and depression [8]. These emotional challenges affect not only their mental health but also their disease prognosis and treatment adherence, ultimately influencing their recovery. Psychological resilience (PR) refers to the ability to adapt positively in the face of adversity, trauma, and stress [9]. An increasing body of research highlights the role of mental resilience in the quality of life for cancer patients [10]. Patients with higher PR are generally better equipped to manage the challenges of their condition, exhibiting stronger coping mechanisms and a more positive outlook. For postop-

https://doi.org/10.62347/QTZW9567

erative BG patients, PR can directly influence their attitudes toward the disease and treatment, impacting their recovery and prognosis. Symptom burden, including pain, fatigue, sleep disturbances, cognitive dysfunction, and other symptoms, is common in cancer patients [11]. These symptoms not only affect physiological function but can also exacerbate psychological issues, creating a vicious cycle. In BG patients post-surgery, the severity of symptom burden directly affects their psychological well-being and quality of life. Understanding the characteristics of symptom burden and its relationship with PR in BG patients is essential for developing targeted interventions.

Although the importance of PR and symptom burden in cancer patients is widely acknowledged, research on postoperative BG patients is limited. A retrospective cohort analysis by Yang et al. found a strong correlation between preoperative PR and the occurrence of postoperative complications, as well as patients' quality of life [12]. However, this study focused solely on postoperative complications and did not address symptom burden, which is more closely related to patient health. Research on the relationship between PR, symptom burden, and influencing factors is not yet thorough. This study aims to explore PR levels and their influencing factors in postoperative BG patients through surveys and statistical analysis, investigating the correlation between PR and symptom burden. The goal is to provide new insights for improving patients' quality of life and promoting rehabilitation. This study is innovative in systematically exploring the relationship between PR and symptom burden in postoperative BG patients and identifying the independent effects of PR, social support, and self-efficacy on symptom burden. Additionally, this research offers new insights into the mechanisms underlying the role of PR in symptom management, providing a scientific rationale for developing effective psychosocial interventions.

Materials and methods

Study subjects

This is an observational study involving 296 post-surgery BG patients, recruited from Tangshan Gongren Hospital between August 2021 and February 2024. The inclusion criteria were as follows: (a) post-operative patients with a pathologically or imaging-confirmed diagnosis of BG [13]; (b) patients with stable vital signs; (c) patients who have not undergone radiotherapy or chemotherapy following the current surgery. The exclusion criteria included: (a) patients with severe heart, lung, kidney, or other organ dysfunction; (b) patients with other malignant tumors; (c) patients with a history of mental illness; (d) patients who were unconscious and unable to complete the questionnaire. This study was approved by the Ethics Committee of Tangshan Gongren Hospital, and all patients voluntarily provided informed consent.

Data collection

Recruitment was conducted by the study team members in the hospital's neurosurgical wards. Participants were provided with detailed information about the study's objectives, procedures, and potential risks and benefits. After ensuring that patients fully understood the study and its contents, informed consent was obtained. Once patients' vital signs were stable, the investigator administered the questionnaires and instructions. The surveys included the General Information Questionnaire, the Psychological Resilience Scale (CD-RISC), the M.D. Anderson Symptom Inventory for Brain Tumors (MDASI-BT), the Social Support Rating Scale (SSRS), and the General Self-Efficacy Scale (GSEC). If patients were unable to complete the questionnaires on their own, the researcher verbally administered the questions and recorded their responses.

Research tools

The General Information Questionnaire gathered demographic data (age, gender, BMI, marital status, education, place of residence, employment status, household income) and disease-related information (duration of disease, tumor location, disease staging, histopathology, degree of resection, presence of chronic disease). The CD-RISC, developed by American psychologists Connor and Davidson, has demonstrated satisfactory reliability and validity in numerous global studies [14]. The scale contains 25 items, divided into three dimensions, and is rated on a five-point scale. A higher score indicates higher levels of PR. A score of 0-56 indicates low PR, 57-70 indicates medium PR, and 71-100 indicates high PR. The MDASI-BT, developed by the M.D. Anderson Cancer Center, has demonstrated reliability and validity ranging from 0.82 to 0.94 [15]. It consists of two parts: Part 1 contains 22 items that assess the

Table 1. Comparison of general characteristics between high PR group and low PR group

Variables	Total (n=296)	High PR group (n=147)	Low PR group (n=149)	Statistic	*P*
Age, Mean ± SD	62.87 ± 9.71	61.47 ± 8.86	64.25 ± 10.33	t=-2.49	0.014
BMI, Mean ± SD	22.86 ± 3.99	22.42 ± 3.81	23.28 ± 4.13	t=-1.86	0.064
Gender, n (%)				χ^2=4.62	0.032
Female	121 (40.88)	51 (34.69)	70 (46.98)		
Male	175 (59.12)	96 (65.31)	79 (53.02)		
Spouse, n (%)				χ^2=1.33	0.248
Yes	268 (90.54)	136 (92.52)	132 (88.59)		
No	28 (9.46)	11 (7.48)	17 (11.41)		
Education level, n (%)				χ^2=5.42	0.020
College and above	37 (12.50)	25 (17.01)	12 (8.05)		
High school and below	259 (87.50)	122 (82.99)	137 (91.95)		
Residence, n (%)				χ^2=0.86	0.353
Urban	147 (49.66)	77 (52.38)	70 (46.98)		
Rural	149 (50.34)	70 (47.62)	79 (53.02)		
Employment status, n (%)				χ^2=1.08	0.298
Employed	130 (43.92)	69 (46.94)	61 (40.94)		
Unemployed	166 (56.08)	78 (53.06)	88 (59.06)		
Household income, n (%)				χ^2=3.95	0.047
High	158 (53.38)	87 (59.18)	71 (47.65)		
Low	138 (46.62)	60 (40.82)	78 (52.35)		

Abbreviations: PR, psychological resilience; BMI, body mass index.

severity of common symptoms in glioma patients over the past 24 hours, while Part 2 includes six items assessing the impact of these symptoms on daily life. The scale is rated from 0 to 10, with 0 indicating no symptoms or disturbance and 10 indicating the most severe degree of symptoms or disturbance. The SSRS consists of 10 items, measuring objective support, subjective support, and the utilization of support [16]. Social support levels are categorized as follows: ≤22 as low, 23-44 as medium, and 45-66 as high. A higher score indicates higher levels of social support. The GSEC includes 10 items rated on a four-point Likert scale. A higher total score reflects a higher level of self-efficacy [17].

Statistical analysis

Before data entry, a verification process was conducted to ensure data accuracy. Data were statistically analyzed using SPSS version 23.0. Continuous variables were expressed as mean ± standard deviation (SD) and compared across groups using the t-test and Mann-Whitney U test. Categorical variables were presented as frequencies and percentages, with group comparisons performed using the Chi-square test and Fisher's exact test. The average score of the CD-RISC was used as the cut-off value (approximately 57 points) to divide patients into high and low PR groups. The relationship between PR and symptom burden was analyzed using Pearson correlation. Additionally, both univariate and multivariate linear regression analyses were conducted to identify factors influencing patient symptom burden. Variables with a *P*-value less than 0.05 in the univariate analysis were included in the multivariate analysis using the stepwise regression method. All statistical tests were two-tailed, and a *P*-value of less than 0.05 was considered statistically significant.

Results

General characteristics

A total of 296 BG patients were included in this study. All continuous variables passed the normality test and followed a normal or approximately normal distribution. The mean age of the high PR group was 61.47 ± 8.86 years, while the low PR group had a mean age of 64.25 ± 10.33 years, with a significant difference (P=0.014) (**Table 1**). The proportion of males in the high PR group was significantly higher than in the low PR group (65.31% vs.

Table 2. Comparison of clinical characteristics between high PR group and low PR group

Variables	Total (n=296)	High PR group (n=147)	Low PR group (n=149)	Statistic	*P*
Duration of disease, Mean ± SD	16.32 ± 5.04	15.47 ± 4.82	17.16 ± 5.12	t=-2.92	0.004
Complication, n (%)				χ^2=0.21	0.649
No	165 (55.74)	80 (54.42)	85 (57.05)		
Yes	131 (44.26)	67 (45.58)	64 (42.95)		
Tumor location, n (%)				χ^2=0.29	0.867
Left	135 (45.61)	69 (46.94)	66 (44.30)		
Right	137 (46.28)	67 (45.58)	70 (46.98)		
Both	24 (8.11)	11 (7.48)	13 (8.72)		
Tumor staging, n (%)				χ^2=1.23	0.036
I and II	82 (27.70)	53 (36.05)	37 (24.83)		
III and IV	214 (72.30)	94 (63.95)	112 (75.17)		
Histopathology, n (%)				χ^2=1.35	0.509
Glioblastoma	54 (18.24)	27 (18.37)	27 (18.12)		
Low-grade glioma	124 (41.89)	66 (44.90)	58 (38.93)		
High-grade glioma	118 (39.86)	54 (36.73)	64 (42.95)		
Excision degree, n (%)				χ^2=0.81	0.368
Total resection	230 (77.70)	111 (75.51)	119 (79.87)		
Partial resection	66 (22.30)	36 (24.49)	30 (20.13)		

Abbreviations: PR, psychological resilience; SD, standard deviation.

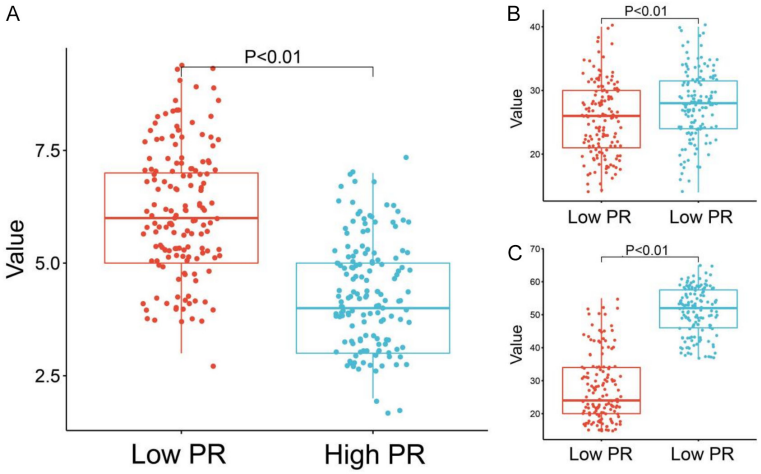

Figure 1. Comparison of symptom burden, social support, and self-efficacy between high PR and low PR groups. A. Symptom burden; B. Social support; C. Self-efficacy. Abbreviation: PR, psychological resilience.

53.02%, P=0.032). In the high PR group, 25 (17.01%) patients had received college education or higher, significantly more than the 12 (8.05%) patients in the low PR group (P=0.020). Additionally, the high PR group had a higher proportion of patients with higher household income compared to the low PR group (59.18% vs. 47.65%, P=0.047). No significant differences were found in BMI, marital status, residence, or employment status between the two groups (all P>0.05, **Table 1**).

Comparison of clinical characteristics

The mean disease duration in the high PR group was 15.47 ± 4.82 years, significantly lower than the 17.16 ± 5.12 years in the low PR group (P=0.004) (**Table 2**). In the high PR group, 53 (36.05%) patients had stage I or II tumors, while 37 (24.83%) patients in the low PR group had stage I or II tumors, with a significant difference (P=0.036). No significant differences were observed regarding underlying conditions, tumor locations, histopathological features, or the extent of resection between the two groups (all P>0.05, **Table 2**).

Comparison of MDASI-BT, SSRS and MCMQ

The mean MDASI-BT score in the high PR group was 4.35 ± 1.19, significantly lower than the 6.16 ± 1.43 in the low PR group (P<0.01) (**Figure 1A**). Regarding social support, the SSRS score in the high PR group was 51.07 ± 7.10, significantly higher than the 27.76 ± 10.09 in

Table 3. Comparison of adverse reactions between high PR group and low PR group

Adverse reactions	Total	High PR group (n=147)	Low PR group (n=149)	Statistic	*P*
Epilepsy	38	12	26	5.70	0.017
Acute kidney injury	37	16	21	0.70	0.404
Intracranial infection	27	10	17	1.89	0.169
Cerebrovascular accident	20	6	14	3.32	0.069
Raised intracranial pressure	16	7	9	0.24	0.627

Abbreviation: PR, psychological resilience.

Table 4. Correlation analysis of symptom burden with psychological resilience, social support, and self-efficacy

Variable	Correlation (95% CI)	*P* value
Psychological resilience	-0.827 (-0.860 - -0.787)	<0.001
Social support	-0.832 (-0.864 - -0.793)	<0.001
Self-efficacy	-0.116 (-0.227 - -0.002)	0.046

Abbreviation: CI, Confidence interval.

the low PR group (P<0.01) (**Figure 1B**). In terms of self-efficacy, the MCMQ score of the high PR group was 27.73 ± 5.30, significantly higher than the 25.47 ± 5.67 in the low PR group (P<0.01) (**Figure 1C**).

Comparison of postoperative adverse reactions

Out of all patients, 38 developed postoperative epilepsy, including 12 (8.16%) in the high PR group and 26 (17.45%) in the low PR group, with a significant difference (P=0.017) (**Table 3**). Six (4.08%) patients in the high PR group experienced cerebrovascular accidents, compared to 14 (9.40%) in the low PR group, with a statistical trend (P=0.069) (**Table 3**). No significant differences were found between the two groups regarding the incidence of acute kidney injury, intracranial infections, or elevated intracranial pressure (all P>0.05).

Correlation analysis

Pearson correlation analysis revealed a significant negative correlation between PR level and symptom burden (r=-0.827, P<0.001) (**Table 4**). Additionally, social support (r=-0.832, P<0.001) and self-efficacy (r=-0.116, P=0.046) were also negatively correlated with patients' symptom burden.

Univariate linear regression analysis

Univariate linear regression analysis revealed a significant negative association between patient PR and symptom burden (β=-0.13, P<0.001) (**Table 5**). Additionally, social support (β=-0.09, P<0.001) and self-efficacy (β=-0.03, P=0.046) were also negatively associated with symptom burden (**Table 5**).

Multifactorial linear regression analysis

Multifactorial linear regression analysis demonstrated that both PR (β=-0.06, P<0.001) and social support (β=-0.05, P<0.001) independently and significantly negatively influenced the symptom burden in BG patients (**Table 6**).

Interaction analysis

Multiplicative interaction analysis was used to explore potential interaction effects between variables. The results indicated no significant interaction between psychological resilience (P=0.078), social support (P=0.624), and self-efficacy (P=0.645) in relation to symptom burden (**Table 7**).

Discussion

This study aimed to investigate the relationship between PR and symptom burden in postoperative BG patients, as well as to identify factors that influence symptom burden in the context of PR. The analysis of 296 postoperative BG patients revealed a significant negative correlation between PR and symptom burden. Furthermore, factors such as social support and self-efficacy were found to affect symptom burden. Below, the results are discussed in detail, along with potential mechanisms.

The study found that patients with higher PR reported lower symptom burden. This finding

Table 5. Univariate linear regression analysis of symptom burden in BG patients

Variables	β	S.E	t	*P*	β (95% CI)
Psychological resilience	-0.13	0.01	-25.23	<0.001	-0.13 (-0.14 - -0.12)
Social support	-0.09	0.00	-25.73	<0.001	-0.09 (-0.10 - -0.08)
Self-efficacy	-0.03	0.02	-2.00	0.046	-0.03 (-0.07 - -0.01)

Abbreviations: BG, Brain glioma; SE, standard error; CI, Confidence interval.

Table 6. Multifactorial linear regression analysis of symptom burden in BG patients

Variables	β	S.E	t	*P*	β (95% CI)
Psychological resilience	-0.06	0.01	-4.31	<0.001	-0.06 (-0.09 - -0.03)
Social support	-0.05	0.01	-5.22	<0.001	-0.05 (-0.07 - -0.03)

Abbreviations: BG, Brain glioma; SE, standard error; CI, Confidence interval.

Table 7. Interaction analysis

Interaction term	β	95% CI	*P* value
Psychological resilience*Social support	-0.001	-0.001-0.000	0.078
Psychological resilience*Self-efficacy	0.000	-0.002-0.001	0.624
Social support*Self-efficacy	0.000	-0.002-0.001	0.645

Abbreviation: CI, Confidence interval.

aligns with previous research suggesting that PR is a key psychological resource for managing stress associated with chronic diseases [18]. Taylor et al. reported that patients with higher PR are more likely to use positive cognitive reappraisal strategies to reinterpret negative disease-related information, viewing it as a challenge or opportunity for growth. This process helps reduce negative emotions, such as anxiety and depression, which in turn diminishes symptom perception [19]. Additionally, studies by Chang, Song, and McAllister have suggested that individuals with high PR typically exhibit better emotional regulation, allowing them to manage negative emotions post-surgery, such as fear, anger, or sadness. This emotional regulation helps prevent the exacerbation of these emotions on physical symptoms [20-22].

The research identified a notable inverse relationship between social support and the symptom burden experienced by patients, highlighting that social support plays a crucial role in alleviating symptom burden. Social support is an essential resource for cancer patients to cope with the challenges of the disease, offering emotional comfort and practical assistance to reduce psychological stress and physical symptoms [23, 24]. Additionally, emotional support from family and friends can alleviate feelings of loneliness and helplessness, boosting patients' confidence and determination to face the challenges of their illness.

The findings also indicated a slight negative correlation between self-efficacy and patients' symptom burden. While this correlation was relatively weak, it suggests that self-efficacy may still play a role in symptom management [25]. Individuals with high self-efficacy are more likely to adopt positive coping strategies, such as seeking social support and utilizing relaxation techniques, to reduce symptom impact. They are also more inclined to adhere to medical advice, such as taking medications on time and engaging in rehabilitation exercises, which can lead to more effective symptom management [26].

Patients with higher levels of PR had significantly lower rates of postoperative complications compared to those with lower levels of PR. This suggests that PR may be a crucial factor influencing the postoperative recovery of BG patients [27]. Resilient patients may exhibit greater physiological adaptability and immunity, enabling them to better cope with surgical trauma and the recovery process. Additionally, mental toughness could indirectly reduce the risk of postoperative complications by influencing the patient's psychological state and behavior. For instance, patients with high resilience may be more attentive to postoperative care and rehabilitation, reducing the incidence of complications such as infection and bleeding [28, 29].

The results of multifactorial linear regression analysis further confirmed that both PR and social support significantly and independently reduce symptom burden in postoperative BG patients. This finding reinforces the importance of PR and social support in alleviating symptom burden. In summary, mental toughness plays a key role in managing symptom burden in postoperative BG patients. The mechanisms may include the following: (a) psychologically resilient patients have greater self-recovery and adaptability, enabling more effective symptom management; (b) they are better at establishing and maintaining social relationships, leading to more social support; (c) they are more confident in their abilities and are more likely to adopt positive coping strategies; (d) they may have stronger physiological resilience and immunity, which help them cope with the challenges of surgery and recovery.

Future research could explore the specific components and mechanisms of PR and how interventions might enhance patients' PR levels. Additionally, it would be beneficial to examine other factors, such as genetic and environmental influences, which may affect postoperative BG patients' symptom burden, to gain a more comprehensive understanding of its causes and management strategies.

Despite these valuable insights, there are limitations to this study. First, the study employed an investigative research design, which may have been subject to recall bias due to reliance on patient recollection and the completeness of medical records. Furthermore, an observational design does not establish causality, only correlations. Second, the sample was drawn from a limited number of regions, which may not be representative of all postoperative glioma patients. The geographical and cultural specificity of the sample may limit the generalizability of the findings. Finally, since this study did not implement interventions to improve PR or social support, the direct impact of such interventions on symptom burden could not be assessed. Future research could expand the sample size, incorporate objective indicators, and adopt interventional studies to enhance the scientific validity and accuracy of the findings.

In conclusion, this study found significant associations between psychosocial factors and postoperative symptom burden, based on a comprehensive assessment of PR, symptom burden, social support, and self-efficacy in 296 postoperative BG patients. The results highlighted that PR is a pivotal factor influencing postoperative symptom burden, with a strong negative correlation to symptom severity. Social support and self-efficacy were also negatively associated with symptom burden, suggesting their potential role in symptom management. These findings emphasize the importance of incorporating psychosocial interventions in the comprehensive treatment of postoperative glioma patients. Improving patients' PR, social support, and self-efficacy could reduce symptom burden and enhance quality of life. This study provides valuable insights for understanding symptom burden in postoperative BG patients and offers a scientific foundation for the development of effective psychosocial interventions. Enhancing patients' PR and social support could significantly improve their postoperative quality of life, which is essential for their long-term recovery and health management.

Acknowledgements

This work was supported by Hebei Provincial Health Commission Research Fund Project (20221779).

Disclosure of conflict of interest

None.

Address correspondence to: Yanan Jing, Department of Neurosurgery, Tangshan Gongren Hospital, No. 27, Wenhua Road, Lubei District, Tangshan 063000, Hebei, China. Tel: +86-031-52305113; E-mail: jynnyj@163.com

References

[1] Miller KD, Ostrom QT, Kruchko C, Patil N, Tihan T, Cioffi G, Fuchs HE, Waite KA, Jemal A, Siegel RL and Barnholtz-Sloan JS. Brain and other central nervous system tumor statistics, 2021. CA Cancer J Clin 2021; 71: 381-406.

[2] Horbinski C, Berger T, Packer RJ and Wen PY. Clinical implications of the 2021 edition of the WHO classification of central nervous system tumours. Nat Rev Neurol 2022; 18: 515-529.

[3] Pöhlmann J, Weller M, Marcellusi A, Grabe-Heyne K, Krott-Coi L, Rabar S and Pollock RF. High costs, low quality of life, reduced survival,

and room for improving treatment: an analysis of burden and unmet needs in glioma. Front Oncol 2024; 14: 1368606.
[4] Yasinjan F, Xing Y, Geng H, Guo R, Yang L, Liu Z and Wang H. Immunotherapy: a promising approach for glioma treatment. Front Immunol 2023; 14: 1255611.
[5] Zhang Y, Xiao Y, Li GC, Gong FY, Zhang XN and Hou K. Long non-coding RNAs as epigenetic mediator and predictor of glioma progression, invasiveness, and prognosis. Semin Cancer Biol 2022; 83: 536-542.
[6] Liu X and Zhan G. Prevalence, risk factors and prognostic value of anxiety and depression in recurrent glioma patients. Psychol Health Med 2023; 28: 2474-2485.
[7] Aslakson RA, Rickerson E, Fahy B, Waterman B, Siden R, Colborn K, Smith S, Verano M, Lira I, Hollahan C, Siddiqi A, Johnson K, Chandrashekaran S, Harris E, Nudotor R, Baker J, Heidari SN, Poultsides G, Conca-Cheng AM, Cook Chapman A, Lessios AS, Holdsworth LM, Gustin J, Ejaz A, Pawlik T, Miller J, Morris AM, Tulsky JA, Lorenz K, Temel JS, Smith TJ and Johnston F. Effect of perioperative palliative care on health-related quality of life among patients undergoing surgery for cancer: a randomized clinical trial. JAMA Netw Open 2023; 6: e2314660.
[8] Young JS, Al-Adli N, Sibih YE, Scotford KL, Casey M, James S and Berger MS. Recognizing the psychological impact of a glioma diagnosis on mental and behavioral health: a systematic review of what neurosurgeons need to know. J Neurosurg 2022; 139: 11-19.
[9] Troy AS, Willroth EC, Shallcross AJ, Giuliani NR, Gross JJ and Mauss IB. Psychological resilience: an affect-regulation framework. Annu Rev Psychol 2023; 74: 547-576.
[10] Öcalan S and Üzar-Özçetin YS. The relationship between rumination, fatigue and psychological resilience among cancer survivors. J Clin Nurs 2022; 31: 3595-3604.
[11] Hallet J, Zuckerman J, Guttman MP, Chesney TR, Haas B, Mahar A, Eskander A, Chan WC, Hsu A, Barabash V and Coburn N; and for the REcovery after Surgical Therapy for Older Adults Research-Cancer (RESTORE-C) Group. Patient-reported symptom burden after cancer surgery in older adults: a population-level analysis. Ann Surg Oncol 2023; 30: 694-708.
[12] Yang G, Shen S, Zhang J and Gu Y. Psychological resilience is related to postoperative adverse events and quality of life in patients with glioma: a retrospective cohort study. Transl Cancer Res 2022; 11: 1219-1229.
[13] Xu S, Tang L, Li X, Fan F and Liu Z. Immunotherapy for glioma: current management and future application. Cancer Lett 2020; 28; 476: 1-12.
[14] Connor KM and Davidson JRT. Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). Depress Anxiety 2003; 18: 76-82.
[15] Armstrong TS, Vera-Bolanos E, Gning I, Acquaye A, Gilbert MR, Cleeland C and Mendoza T. The impact of symptom interference using the MD anderson symptom inventory-brain tumor module (MDASI-BT) on prediction of recurrence in primary brain tumor patients. Cancer 2011; 117: 3222-3228.
[16] Wang X, Zhang F, Ge Y, Ding Y and Liu T. The associations between social support, self-regulatory fatigue, and health-promoting behaviors among people with type 2 diabetes mellitus: a cross-sectional survey. Front Public Health 2023; 11: 1281065.
[17] Dahlberg K, Stenberg E, Liang Y, Nilsson U and Jaensson M. The general self-efficacy scale in a population planned for bariatric surgery in Sweden: a psychometric evaluation study. BMJ Open 2022; 12: e061509.
[18] Lan M, Yang L, Zhang H, Su A, Yin Q and Li J. A structural equation model of the relationship between symptom burden, psychological resilience, coping styles, social support, and psychological distress in elderly patients with acute exacerbation chronic obstructive pulmonary disease in China. Asian Nurs Res (Korean Soc Nurs Sci) 2024; 18: 231-237.
[19] Taylor MG and Carr D. Psychological resilience and health among older adults: a comparison of personal resources. J Gerontol B Psychol Sci Soc Sci 2021; 76: 1241-1250.
[20] Song C, Du XT, Hong YX, Mao JH and Zhang W. Association between social supports and negative emotions among pediatric residents in China: the chain-mediating role of psychological resilience and burnout. Front Public Health 2023; 10: 962259.
[21] McAllister SJ, Vincent A, Hassett AL, Whipple MO, Oh TH, Benzo RP and Toussaint LL. Psychological resilience, affective mechanisms and symptom burden in a tertiary-care sample of patients with fibromyalgia. Stress Health 2015; 31: 299-305.
[22] Chang L, Zhang S, Yan Z, Li C, Zhang Q and Li Y. Symptom burden, family resilience, and functional exercise adherence among postoperative breast cancer patients. Asia Pac J Oncol Nurs 2022; 9: 100129.
[23] Liao Z, Zhou H and He Z. The mediating role of psychological resilience between social participation and life satisfaction among older adults in China. BMC Geriatr 2022; 22: 948.
[24] Bottaro R, Craparo G and Faraci P. What is the direction of the association between social support and coping in cancer patients? A systematic review. J Health Psychol 2023; 28: 524-540.

[25] Farley H. Promoting self-efficacy in patients with chronic disease beyond traditional education: a literature review. Nurs Open 2019; 7: 30-41.
[26] Selzler AM, Habash R, Robson L, Lenton E, Goldstein R and Brooks D. Self-efficacy and health-related quality of life in chronic obstructive pulmonary disease: a meta-analysis. Patient Educ Couns 2020; 103: 682-692.
[27] REGAIN (Regional versus General Anesthesia for Promoting Independence after Hip Fracture) Investigators. Preoperative psychological resilience and recovery after hip fracture: secondary analysis of the REGAIN randomized trial. J Am Geriatr Soc 2023; 71: 3792-3801.
[28] Ejder ZB and Sanlier N. The relationship between loneliness, psychological resilience, quality of life and taste change in cancer patients receiving chemotherapy. Support Care Cancer 2023; 31: 683.
[29] Wang Y, Huang C, Zhang H, Cai Y, Shen Z, Hu X, Zhou B, Yang L and Chen Q. Correlation among psychological resilience, social support, and coping style in patients with complicated hepatolithiasis. Front Behav Neurosci 2022; 16: 939512.