



Carer and Provider Perspectives about Pediatric Neuro-Oncology Rehabilitation in The Pakistan

Faiza Altaf¹, Hira Jabeen², Naila Kanwal³, Amna Ali⁴, Tehreem Mukhtar⁵

Original Article

ARTICLE INFORMATION

Corresponding Author:

- amnasundus123@gmail.com

Affiliations:

1. Pediatric Physiotherapist (Ability Plus Neuro rehabilitation center Lahore)
2. Assistance professor (Riphah international university Lahore, Pakistan)
3. Clinical Physiotherapist (Incharge Insync clinic, Lahore Pakistan)
4. Lecturer (Sutlej college of Allied Health Sciences Bahawalpur)
5. Clinical Physiotherapist (Tehreem's Wellness Clinic)

Keywords: Central Nervous System, Neuro-oncology, Pediatrics, Rehabilitation.

ABSTRACT

Objective: This study aims to find out the pediatric neuro-oncology rehabilitation services are available in Pakistan and needs of their patients and families are fulfilled.

Method: The Qualitative study was conducted using a convenience sampling technique. The sample size was 30 patients' carers and providers. The data was collected from the University of Child Health Sciences and Children Hospital, Lahore. The patient was included with age of 25 years those response the survey or above and excluded with severe hearing and visual loss or depression and developmental disorders. It was obtained through questionnaires given to the health care providers in Survey 1. Parents of pediatric neuro-oncology patients are involved in Survey 2. The quantitative data and the narrative content were reported by Descriptive statistics which summarized the open-ended responses. SPSS version 21 was used to analyze the data.

Findings: In this study different health care providers give response in which 11 Pediatric or neuro-oncologist and 7 physical therapist and minimum Occupational therapist were available for Rehabilitation Services during the Survey for Children and Young People. According age group of participant maximum (11) was in 2months to 3years and minimum (4) were in 12-15 year of age group. For the rehabilitation physiotherapist, occupational and ophthalmologist which was easily available for in and out door patients. 33% Insufficient of neuro-oncology services, as well as a lack of resources 16% are Outpatient faced specific barriers for treatment and 10% complain lack of medicine while, on response of survey 2, 12(40%) had Proper interaction between care giver and medical staff and Better organization with best rehabilitation services was 7(23%) while, specifically rehabilitations were 11(36%).

Conclusion: This study concluded that, services for pediatrics, adolescent, and young adult neuro-oncology were frequently inadequate. According to services of rehabilitations the most easily accessible were physical and occupational therapy for inpatients with the least availability being audiology, psychology for behavioral and emotional assistance, and neuropsychology for intellectual. Numerous obstacles to receiving rehabilitation services in neuro-oncology were found.

Introduction:

The brain and spinal cord comprises the central nervous system (CNS). The meningeal layers and skull protect the brain and spinal cord (O. Magnier et al., 2023). A lengthy bundle of nerve tissue makes up the spinal cord. In an adult, it is roughly 18 inches long and 1/2 inch thick. It runs down toward the back from brainstem to lower portion (Weiss et al., 2019). A growth known as a central nervous system tumor develops when normal brain or spinal cord cells alter and multiply uncontrolled. CNS tumors can be harmful, whether they are benign or malignant (Yousaf et al., 2023). Because a cancerous tumor is malignant, it has the potential to spread quickly to other bodily parts (Bethan Treadgold et al., 2019). When a tumor is benign, it usually grows more slowly and doesn't spread to other body areas (Boddy, 2016). The most prevalent

forms of CNS tumors in children are as follows: Diffuse intrinsic pontine glioma (DIPG), also known as brain stem glioma, astrocyte, and ependymoma are tumors of germ cells. Medulloblastoma Grades are used to describe CNS tumors (Milano, Usuki, Walter, Clark, & Schell, 2011). The most frequent solid tumor in children and the leading cause of cancer-related death in children are tumors of the central nervous system (CNS). Among children and young adults aged 0 to 19, the incidence of CNS malignancies is 6.06 per 100,000.(Han, Teton, Gupta, Kawamoto, & Raslan, 2020) Children ages 0–4 are most likely to have embryonal tumors, while pituitary and craniopharyngeal duct tumors are the most prevalent tumor locations (Boddy, 2016). (Boddy, 2016). As part of a multidisciplinary team approach, advanced practice nurses with neuro-oncology knowledge is necessary for



managing children with CNS malignancies to provide better supportive care. Improved quality of life is possible when parents are aware of the special needs of children with brain tumors and the necessary measures (BENKADDOUR, Bendehiba, & Habita). Numerous factors account for CNS tumors in childhood and adolescence but major factors are environmental and genetic. Radiation's carcinogenic effects seem to be more pronounced in children (Iranmehr, Namvar, Rezaei, & Hanaei, 2023). The treatment for pediatric CNS malignancies is frequently invasive and usually involves two or more treatment modalities because of the nature of these tumors (Mukhtar, Afzal Pt, & Hussain, 2021). Chemotherapy and radiation therapy may hurt the targeted and surrounding tissues and organ systems, while surgery may result in anatomical and functional alterations to the growing brain. (Malbari, 2021) A neuromodulator technique called transcranial magnetic stimulation (TMS) allows for the selective activation and inhibition of certain cortical regions (Fischer, Petriccione, Donzelli, & Pottenger, 2016). With few side effects and no confirmed seizures, data have shown that rTMS is safe in the post-operative neuro-oncologic patient population.(Ostrom, Francis, & Barnholtz-Sloan, 2021) BT-related disabilities can be represented within the International Classification of Functioning, Disability, and Health (ICF) conceptual framework to characterize health and the multifaceted health-related problems of individuals. (Young, Cashion, Ekberg, Hassall, & Bradford, 2023) In the end, all of these symptoms and functional restrictions can lead to a decreased capacity to carry out (or maintain) typical family and social tasks, which can have a significant influence on quality of life.(B. Treadgold et al., 2019)

The significance was centered on establishing a multidisciplinary team for diagnostic, management, and optimal care guidelines and emphasis on improving the clinical necessity and considering neuro-oncology while designing the rehabilitation protocols and team suggests different treatment strategies with a standardized approach for pediatrics Neuro-Oncology in Pakistan. Undiagnosed CNS tumors had equal access to these hospitals. Two surveys were conducted one for parents and the other for health care providers to highlight the major ignorance for suggestions of both.

MATERIALS AND METHODS

The Qualitative study was conducted using a convenience sampling technique. The study was conducted at the University of Child Health Sciences and Children Hospital, Lahore. The study was approved by the Institutional Review Board and Ethics Committee of Research & Riphah International University (Institutional approval of research Study on 25-April 2022) for studies involving humans with Ref No. REC/RCR & AHS/22/0237. Written Informed consent was obtained from all subjects. Data was collected within 10 months after the approval of the synopsis. The sample size was 30 patients' carers and providers (Oliver et al., 2024b; Williams, Young, Burke, & Fountain, 2017). The patient was included with the age of 25 years or above. The participants with severe hearing and visual loss or those diagnosed with depression, bipolar disorder, schizophrenia and other psychoses, dementia, (Weiss et al., 2019) and developmental disorders including autism are excluded from the study. During the data collection process, neuro-oncologist members of the

cancer care and leukemia groups and physiotherapist specialists were chosen to collect the data that was used in analyzing the research study. It was obtained through questionnaires given to the respondents in Survey 1. Parents of pediatrics neuro-oncology patients are involved in Survey 2. A self-structured questionnaire is used to collect data. (Bethan Treadgold et al., 2019) In this study, two separate survey questionnaires were used. The first survey, entitled "Neuro-oncology Therapy Programs Study—Children and Adult Individuals," asked respondents about the neuro-oncology treatment programs their center presently offers. It consisted of 18 items with a combination of closed-ended and open-ended questions. Eight open-ended questions make up Survey 2, "Participants' and Household Perceptions Regarding Treatment for a Brain Tumor in Childhood," which attempts to collect data regarding current services and what improvement is needed to change in Pakistan. Both surveys were analyzed. The fictional nature of the open-ended answers was summarized, for the quantitative data Descriptive statistics were used. SPSS version 21 was used to analyze the data.

RESULTS

In this study different health care providers give response in which Pediatric or neuro-oncologist and physical therapist and minimum Occupational therapist were available for Rehabilitation Services during the Survey for Children and Young People. For the rehabilitation physiotherapist, occupational and ophthalmologist which was easily available for in and out door patients. For CNS tumors, rehabilitation services will be available with main-level accessibility programs for inpatients and outpatients in this hospital. Neuro-oncology services providers explain views on neuro-rehabilitation treatments about children and young peoples with brain tumors. And study focused on parents' perceptions about needs of neuro-rehabilitation in brain tumors patients.

Table 1 Occupation of health care respondents, which responded to the evaluation of the service

Occupation of respondents	Frequency (%)
Pediatric or neuro-oncologist	11(36)
Specialist nurses in neuro-oncology	5(16)
Physical therapists	7 (23)
Occupational therapist	2 (6)
Pediatric psychologist	5 (16)

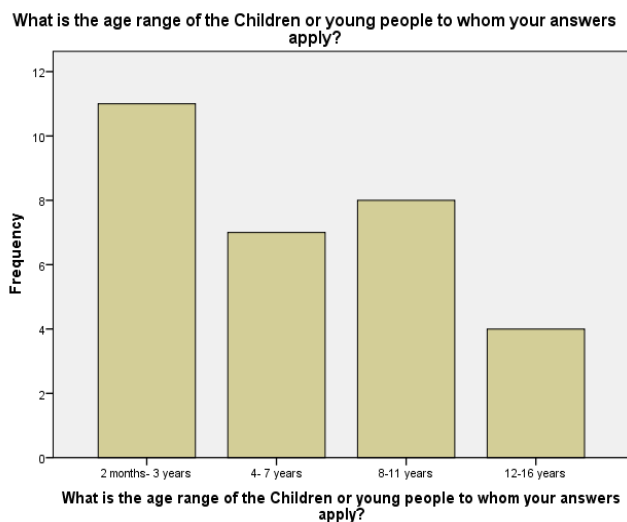
Occupation of healthcare care respondents, which responded to the services evaluation

Survey 1: Adolescents and Neuro-Oncology services for rehabilitation

Eleven Pediatrics neuro-oncologists five specialist nurses in neuro-oncology 7 physiotherapists 2 occupational therapists 5 pediatrics psychologists participated these multidisciplinary team completed the survey 1 (Table 1).



Figure 1 Most probable age group involved in CNS tumor



To record the most probable age group involved in CNS tumors among children, different groups are assigned based on their age. As the survey was conducted, the minimum age group recorded was 2 months to 3 years. While the maximum age recorded was 15 years. The maximum patients were in minimum age group 11(36%) (Figure 1).

Table 2 For children and adolescents with CNS tumors, rehabilitation services will be available at this hospital, with main-level accessibility to those programs for both inpatients and outpatients in 2021.

Rehabilitation	Inpatient services		Outpatient services	
	Ease of access if available	if	Ease of access if available	if
Physiotherapy	Easy		Moderate	
Occupational therapy	Available		Moderate	
Speech and language therapy	Easy		Not Accessible	
Neuropsychology for cognitive testing	Average		Difficult	
Psychology for emotional and behavioral support	Mild		Not assessable	
Endocrinology	Accessible		Average	
Ophthalmology	Easy		Moderate	
Audiology	Moderate		Difficult	
Educational support	Difficult		Moderate	
Other	None		None	

For children and adolescents with CNS tumors, rehabilitation services for both inpatients and outpatients

Each healthcare professional assessed that inpatient rehabilitation services were more accessible and available than outpatient rehabilitation services for all types of treatments. Physical therapy and occupational therapy services were easily available. Neuropsychology for cognitive and testing, Psychology for emotional and behavioral support, and Audiology were the rehabilitation services for inpatients with the least availability. The least accessible rehabilitation services for outpatients, according to surveys, are speech and language therapy and audiology. (Table 2)

Table 3 Views on neuro-rehabilitation treatments for children with brain tumors from providers of neuro-oncology services

Type of barriers	Frequency	Quotation
Insufficient provision of neuro-oncology rehabilitation services, as well as a lack of area and resources	10(33)	Insufficient beds specifically for neuro-rehabilitation availability of beds, specific equipment, and expertise Lack of beds specifically designated for neuro-rehabilitation because neuro-oncology rehab and non-oncology rehab are currently separate, there is "no specific neuro-rehab team in pediatrics neuro-oncology." Staffing and scheduling; acute patient treatment and discharge are given priority over rehabilitation. There is no specific neuro-oncology rehabilitation team. Specialized equipment, hospital rooms and time, few workers, and comparatively few alternatives in the community are examples of resources and funding. The lag between inpatient and outpatient care affects children's rehabilitation.
Insufficient engagement with other organizations and agencies	6(20)	Unclear referral paths and commissioning Patients with complicated needs are not being supported by local services, Time restrictions caused by clinical worsening Follow-up both during and following treatment Communication across departments. The community's services are poorly coordinated.
Absence of distinct elements within the multifunctional team	6(20)	Insufficient staffing in the audiology department Lack of speech and language support, neuropsychology for cognitive testing and psychology assessment No dedicated educational support
Lack of medication for fits	3(10)	Shortage of antiepileptics in the market as well as in hospitals in need of time
Outpatient specific barriers	5(16)	Need to be in-patient for formal neuro-rehab - haven't got a developed out-patient neuro-rehab service. Availability of outpatient rehabilitation is limited. 'Patients access community-based services during follow up however there are variable issues with waiting time and intensity of treatment that patients need' When patients are discharged some difficulties with accessing local services.

Views from providers of neuro-oncology services on neuro-rehabilitation treatments

The views given as free text and divided into five categories: Insufficient facilities and assets specifically designated for neuro-oncology rehabilitation programs, insufficient contact with other services and departments, so, Absence of distinct



elements within the multidisciplinary team, Absence of drugs for seizures, Challenges unique to outpatients (Table 3)

Survey 2: Possible Need for neurological oncology Recovery Services for Patients

For survey 2 Thirty Parents and carers were respondents of those children who had been treated for a CNS tumor and responded about the care of patients in the Hospital. Children who had been treated by their expenses didn't respond to the survey. The carers and professionals discussed neurological malignancies, with 12 (40%) and 30 participants give response to study. The survey participants indicated that they needed more specific information regarding the management of sick people and their households at residence, various treatments for CNS tumors, their side effects, and more specific about the communication gap, from where families could get guidance after being released from the hospital. Psychological counseling, vocational therapy, speech-language therapy, and physiotherapy as the four main rehabilitation resources required for the treatment of CNS malignancies including their behavioral and emotional support were cited by eleven (36%) survey participants. Additionally, seven out of twenty-three survey participants suggested alterations to the management of rehabilitation programs and operations.

Table 4 Parents' perceptions of the neuro-rehabilitation needs of children and adolescents with brain tumors (responses to survey 2)

Types of barriers	Frequency (%)	Quotation
Proper interaction between households and medical staff	12(40)	Communication should be at the level of the Parent or family carer level so that all information is clearly understood by them. Additional assistance in comprehending what to do once all treatment is complete Communicate properly what is happening and why it is happening
specific rehabilitation services	11(36)	Support for children and Parents Besides treatment for the tumor itself, Psychological help has been the most important for us Timely recommendations for well-being. Assistance for the child and the household Better support for parents and carers in dealing with changes and more psychological help It is important to bring peace to both parents and children.
Better organization and management of rehabilitation services	7 (23)	Rehabilitation services need to be better More Specialist rehab. acquired brain injury from surgery Neuropsychology for cognitive testing has been a struggle for us Increased funding for rehabilitation could significantly change a child's long-term illness. More healing at this point translates into higher living standards and less long-term care for the remainder of one's life.

Survey 2: Perceptions of parents on the neuro-rehabilitation requirements for neuro-oncology children and adolescents (Table 4).

DISCUSSION

The findings of this study offer the first understanding of the pediatric neuro-oncology rehabilitation services that are offered in Pakistan. It highlighted the primary requirements of patients and their families for these services, as well as several impediments to access. The absence of a recognized framework for the treatment of children and young adults in Pakistan suffering from CNS tumor treatment was frequently stated as a barrier by doctors (Survey 1), and it was noteworthy in customer remarks as well (Survey 2). In general, inpatients have access to more services than outpatients, which leads to unequal access to rehabilitation services, particularly speech therapy. A thorough pediatric neuro-rehabilitation center must be accessible, and there weren't enough outpatient therapy programs to help the growing child as they mature, and neuro-oncology restoration services receive disproportional funding compared to anti-tumor treatments these issues are raised in these two surveys. These problems appear in both surveys, which imply that the gaps and barriers found do not adequately address the rehabilitation requirements of these kids and teens and their families. Notably, parents also requested that services be offered more locally as outpatients. Even though both teams' comments clarified how important clinical psychological assistance is, there was an intriguing disparity between the surveys: care providers in several centers identified, the matter of restricted or nonexistent access to neurological psychology but parents of brain tumor survivors did not. This can just be a result of service users not understanding the difference between these two categories of psychological treatments (Einstein et al., 2022). Contrasting the Functional Independence Measure for Children (WeeFIM) and the Pediatric Evaluation of Disability Inventory (PEDI) as outcome measures in the treatment of kids with acquired brain injury (ABI). The review was submitted to the PROSPERO International Prospective Register of Systematic Reviews in accordance with PRISMA guidelines.(Orlane Magnier et al., 2023). There were 26 retrospective studies in total. Thirteen studies used the WeeFIM, twelve used the PEDI, and one researched both. Both the WeeFIM and PEDI showed statistically significant responsiveness, despite the presence of strong ceiling effects. There was only one location using the PEDI with evidence of clinically substantial responsiveness. (Bethan Treadgold et al., 2019) Mushtaq et al. conducted a total of 124 meetings and addressed 545 cases reported by healthcare professionals to enhance their knowledge and awareness about pediatric oncology care. The project achieved further protocols and significant milestones. Pakistan's first pediatric oncology fellowship program was launched (Mushtaq et al., 2024) Zahid et al. undertook the study to improve neuro-oncology care, as the multidisciplinary nature of neuro-oncology requires teams of highly specialized experts. This is the most complex sort of medical care to provide, requiring the assistance of specialists, staff nurses, and physical resources. Increasing collaboration and developing technologies may improve the neuro-oncology care for children (Zahid et al., 2024). Nasir et al. Given their high response rate Information was provided by 17 out of 20 PTCs, and the perspectives of carers and service users were



included. The results are in perfect agreement with earlier research. The results are therefore probably trustworthy and relevant to pediatric neuro-oncology services provided throughout the United Kingdom. (Nasir et al., 2021)

The goal of the study was to provide proper surgical treatment for brain tumors, as a result of inadequate training for specialized surgeons, delays in diagnosis and operation, and a lack of a multidisciplinary team. To increase the accessibility, cost, and caliber of their services, interventions were necessary. It differs greatly from multidisciplinary teams and international collaborations, which are essential for enhancing patient outcomes and service delivery (Shakir, Shariq, et al., 2024a). The study concluded that, after several studies, the specific areas are not covered by researchers including policies that should be taken into consideration, as well as training programs in neuro-oncology, neuro-anesthesia, and interdisciplinary teams—all of which are essential for addressing workforce difficulties and enhancing patient outcomes for improving the resources and funding for pediatric neuro-oncology development. (Shakir, Khawaja, et al., 2024) The study was carried out to determine and solve these unmet patient rights needs and influencing gaps in healthcare and effective treatment, as well as support for patients, their families, and caretakers. The goal of the research project was to draw attention to the range of issues that cancer patients and their caregivers deal with. To better their countries' unmet and met demands, 18 countries conducted surveys, solved informal difficulties, and contributed to the provision of the greatest possible health and quality of life for neuro-oncology patients. (Oliver et al., 2024a) Shakir et al. conducted a study on Low-income countries struggle to provide adequate neurosurgical care. This study was conducted to Effective governance in addressing challenges, policies and resource availability that impact living quality. This study emphasizes the difficulties and tactics that have been documented, and consequently, the policy that supports neurosurgical treatment. (Shakir, Shariq, et al., 2024b) Bashir et al. Pediatric malignant central nervous system tumor needs effective treatment from a multi-disciplinary team to reduce the early death rate. A significant proportion of this is characterized by a high mutational burden in these patients, leading to secondary tumors. (Bashir et al., 2023)

Limitations: The study was limited to a Cross-sectional survey. However, there was no incentive to complete either because the survey was anonymous. A prospective examination of service delivery, including comments from both parents and patients, would corroborate our findings. This study focused on a population with free access to health care in the tertiary care system. Due to scheduling restrictions, our sample size was quite small. The study's strengths were a high response rate and the availability of additional information because the viewpoints and thoughts were included from care and service providers.

CONCLUSIONS

According to the study's findings, services for pediatrics, adolescent, and young adult neuro-oncology were frequently inadequate. No appropriate and equal access available for children and young people. The maximum cases of neuro-oncology were un-diagnosed. The most easily accessible services are physical and occupational therapy for inpatients

with the least availability being audiology, psychology for behavioral and emotional assistance, and neuropsychology for intellectual. Numerous obstacles to receiving rehabilitation services in neuro-oncology were found. Multidisciplinary teams are absent, neuro-oncology rehabilitation initiatives lack a designated area, and there is an interpersonal gap.

Recommendations: Further research is recommended on a larger scale, and the sample size should be enlarged. In society, with CNS malignancies children should have access to their rehabilitation services for a year afterwards. All neuro-malignant children and their families receive psychosocial assistance, including referrals to alternative treatment settings and long-term follow-up.

REFERENCES

1. Bashir, F., Qureshi, B. M., Minhas, K., Tabori, U., Bouffet, E., Hawkins, C., . . . Mushtaq, N. (2023). Pakistan national guidelines for pediatric high-grade gliomas. *Pakistan journal of medical sciences*, 39(5), 1548.
2. BENKADDOUR, M. K., Bendehiba, K., & Habita, A. *Efficient Image Classification for Early Prediction of Alzheimer's Disease*. Kasdi Marbah University Ouargla.
3. Boddy, C. R. (2016). Sample size for qualitative research. *Qualitative market research: An international journal*, 19(4), 426-432.
4. Einstein, E. H., Dadario, N. B., Khilji, H., Silverstein, J. W., Sughrue, M. E., & D'Amico, R. S. (2022). Transcranial magnetic stimulation for post-operative neurorehabilitation in neuro-oncology: a review of the literature and future directions. *Journal of Neuro-Oncology*, 157(3), 435-443.
5. Fischer, C., Petriccione, M., Donzelli, M., & Pottenger, E. (2016). Improving care in pediatric neuro-oncology patients: an overview of the unique needs of children with brain tumors. *Journal of child neurology*, 31(4), 488-505.
6. Han, S. J., Teton, Z., Gupta, K., Kawamoto, A., & Raslan, A. M. (2020). Novel Use of Stimulating Fence-Post Technique for Functional Mapping of Subcortical White Matter During Tumor Resection: A Technical Case Series. *Oper Neurosurg (Hagerstown)*, 19(3), 264-270. doi: 10.1093/ons/opaa027
7. Iranmehr, A., Namvar, M., Rezaei, N., & Hanaei, S. (2023). Brain and Spinal Cord Tumors Among the Life-Threatening Health Problems: An Introduction *Human Brain and Spinal Cord Tumors: From Bench to Bedside. Volume 1: Neuroimmunology and Neurogenetics* (pp. 1-18): Springer.
8. Magnier, O., Gofti-Laroche, L., Gaspar, N., Schiff, I., Chevassut, D., Desagneaux, A., . . . Bobillier-Chaumont, S. (2023). Adolescents and Young Adults with Primary Brain Tumor: Description of the Care Pathway of Patients Diagnosed in Grenoble Between 2013 and 2019. *J Adolesc Young Adult Oncol*, 12(4), 546-554. doi: 10.1089/jayao.2022.0061
9. Magnier, O., Gofti-Laroche, L., Gaspar, N., Schiff, I., Chevassut, D., Desagneaux, A., . . . Bobillier-Chaumont, S. (2023). Adolescents and Young Adults with Primary Brain Tumor: Description of the Care Pathway of Patients Diagnosed in Grenoble Between 2013 and 2019. *J Adolesc Young Adult Oncol*, 12(4), 546-554.



10. Malbari, F. (2021). Pediatric neuro-oncology. *Neurologic Clinics*, 39(3), 829-845.
11. Milano, M., Usuki, K., Walter, K., Clark, D., & Schell, M. (2011). Stereotactic radiosurgery and hypofractionated stereotactic radiotherapy: Normal tissue dose constraints of the central nervous system. *Cancer treatment reviews*, 37, 567-578. doi: 10.1016/j.ctrv.2011.04.004
12. Mukhtar, T., Afzal Pt, A., & Hussain, S. (2021). Effects of Gaze Stability Exercises with Proprioception Training to Improve Gait and Functional Independence in Cerebellar Ataxic Patients. *Pak. J. Med. Health Sci*, 15, 3467-3469.
13. Mushtaq, N., Qureshi, B. M., Javed, G., Sheikh, N. A., Bakhshi, S. K., Laghari, A. A., . . . Kabir, A. (2024). Capacity building for pediatric neuro-oncology in Pakistan-a project by my child matters program of Foundation S. *Frontiers in Oncology*, 14, 1325167.
14. Nasir, R., Tabassum, R., Anwar, S., Chaudhary, M., Mukhtar, T., & Perveen, W. (2021). Comparative Effects of Static Stretching versus Stretching with Traction on Hamstrings Flexibility in Patients with Backache; A Randomized Controlled Trial. 1, 2-8. doi: 10.55735/thjprs.v1i1.18
15. Oliver, K., Granero, A., Berankova, A., Miller, C., Hindson, C., La Haye, C., . . . Arons, D. (2024a). Brain tumor patients' rights and the power of patient advocacy: the current international landscape. *Neuro-Oncology Practice*, npae079.
16. Oliver, K., Granero, A., Berankova, A., Miller, C., Hindson, C., La Haye, C., . . . Arons, D. (2024b). *Neuro-Oncology Practice*.
17. Ostrom, Q. T., Francis, S. S., & Barnholtz-Sloan, J. S. (2021). Epidemiology of brain and other CNS tumors. *Current neurology and neuroscience reports*, 21, 1-12.
18. Shakir, M., Khowaja, A. H., Shariq, S. F., Irshad, H. A., Tahir, I., Rae, A. I., . . . Enam, S. A. (2024). Neurosurgical Care of Brain Tumors in Low-and Middle-Income Countries: A Scoping Review of the Workforce Challenges. *World Neurosurgery*.
19. Shakir, M., Shariq, S. F., Irshad, H. A., Khowaja, A. H., Tahir, I., Rae, A. I., . . . Enam, S. A. (2024a). Barriers to Neurosurgical Care of Brain Tumors in Low-and Middle-Income Countries: A Systematic Review of the Service Delivery Challenges. *World Neurosurgery*.
20. Shakir, M., Shariq, S. F., Irshad, H. A., Khowaja, A. H., Tahir, I., Rae, A. I., . . . Enam, S. A. (2024b). Governance Challenges to the Neurosurgical Care of Brain Tumors in LMICs: A Systematic Review. *World Neurosurgery*.
21. Treadgold, B., Kennedy, C., Spoudeas, H., Sugden, E., Walker, D., & Bull, K. (2019). Paediatric neuro-oncology rehabilitation in the UK: carer and provider perspectives. *BMJ Paediatr Open*, 3(1).
22. Treadgold, B., Kennedy, C., Spoudeas, H., Sugden, E., Walker, D., & Bull, K. (2019). Paediatric neuro-oncology rehabilitation in the UK: carer and provider perspectives. *BMJ Paediatr Open*, 3(1), e000567. doi: 10.1136/bmjpo-2019-000567
23. Weiss, A., Sommer, G., Schindera, C., Wengenroth, L., Karow, A., Diezi, M., . . . F., S. P. O. G. R. A. K. S. M. A. M. B. P. P. B. J. G. M. G. H. H. T. K. J. R. (2019). Hearing loss and quality of life in survivors of paediatric CNS tumours and other cancers. *Quality of life research*, 28, 515-521.
24. Williams, K. S., Young, D. K., Burke, G. A., & Fountain, D. M. (2017). Comparing the WeeFIM and PEDI in neurorehabilitation for children with acquired brain injury: a systematic review. *Developmental neurorehabilitation*, 20(7), 443-451.
25. Young, K., Cashion, C., Ekberg, S., Hassall, T., & Bradford, N. (2023). Quality of life and family functioning soon after paediatric brain tumour diagnosis: A cross-sectional observational study. *European Journal of Oncology Nursing*, 67, 102463.
26. Yousaf, Q., Kiran Pt, Q., Khizar, R., Mukhtar, M., Mahmood, T., & Amjad, A. (2023). Effectiveness of Manual Therapy Versus Electrotherapy in Patients with Neck Pain Due to Poor Posture –A non-randomized trial: Manual Therapy Versus Electrotherapy in Patients with Neck Pain. *The Superior Journal of Physical Therapy and Rehabilitation*, 3. doi: 10.56536/sjptr.v3i.42
27. Zahid, N., Enam, S. A., Mårtensson, T., Azam, I., Mushtaq, N., Moochhala, M., . . . Javed, F. (2024). Factors associated with changes in the quality of life and family functioning scores of primary caregivers of children and young people with primary brain tumors in Karachi, Pakistan: a prospective cohort study. *BMC pediatrics*, 24(1), 389.



CONFLICT OF INTEREST

Authors declared no conflict of interest, whether financial or otherwise, that could influence the integrity, objectivity, or validity of their research work.

GRANT SUPPORT AND FINANCIAL DISCLOSURE

Authors declared no specific grant for this research from any funding agency in the public, commercial or non-profit sectors

DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request



This is an Open Access article distributed under the terms of the Creative Commons License Online Research Publications by authors is licensed under a Creative Commons Attribution-Non-commercial, No Derivatives 4.0 International License.

SJPTR web address: www.sjptr.pk
Email address: sjptr@superior.edu.pk