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Physiotherapists' perspectives on physiotherapy during and/or after (chemo)radiotherapy for glioma: a qualitative study

Maria Louise Speksnijder
HABEO+ University of Applied Sciences
Yvette Kriellaars
Amphia Hospital
Michelle Verseveld
HABEO+ University of Applied Sciences
Jorine Vermaire
Instituut Verbeeten
Eva de Wee
Instituut Verbeeten
Karin Gehring
Elisabeth-TweeSteden Hospital
Caroline M. Speksnijder
c.m.speksnijder@umcutrecht.nl

UMC Utrecht

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Abstract

Purpose

Patients with glioma frequently require surgery and (chemo)radiotherapy. Physiotherapists are involved in the care of these patients but currently operate without guidelines. To date, no studies have addressed physiotherapy interventions that integrate both physical exercise and neurological symptoms. The aim of this qualitative study is to establish the perspectives and views of physiotherapists on the needs, facilitators and barriers related to physiotherapy for patients with grades 2 to 4 glioma, to inform development of tailored physiotherapy interventions during and/or after (C)RT.

Methods

A descriptive qualitative design was used with thematic analysis. Data were collected through semi-structured online face-to-face interviews with ten physiotherapists specialised in oncology and/or neurology, who had treated at least four patients with glioma.

Results

The patients' capacity is influenced by the symptoms caused by the glioma itself, the side effects of medical treatments, and psychosocial challenges. The patients' needs include maintaining daily functioning and participation, as well as support to enhance motivation for physiotherapy. Physiotherapists require disease-specific knowledge encompassing glioma pathology, prognosis, symptoms, communication strategies, as well as integrated oncology-neurology expertise.

Conclusion

The findings suggest that personalised physiotherapy integrating neurological and oncological expertise is needed during and after (C)RT.

Introduction

Glioma incidence varies worldwide with Oceania and Northern Europe reporting the highest rates at 5.23 and 5.06 per 100,000 person-years [1]. The World Health Organization (WHO) provides a standardized classification system for central nervous system tumours to guide prognosis and management. Gliomas are graded 1–4, with higher grades indicating more aggressive growth and poorer outcomes. Low-grade gliomas generally have prolonged survival (median 9–17 years), whereas high-grade gliomas are associated with a median survival of only 1–3 years [2]. Grade 1 gliomas are often treated with neurosurgery only, while grades 2–4 frequently require adjuvant (chemo)radiotherapy ((C)RT) [3]. Gliomas and their treatment may cause neurological, cognitive and physical impairments, including seizures, speech and cognitive dysfunction, paralysis, fatigue, impaired activities of daily living, imbalance and physical decline [4–8]. Collectively, these symptoms may result in a loss of independence

and a reduced quality of life (QoL) [6–8], creating unique challenges for physiotherapy because of neurological deficits, cognitive impairment, prognosis and disease progression [7, 9].

Most studies evaluating physiotherapy or exercise in patients with glioma are feasibility studies, showing that these interventions are safe and feasible [10–17]. Although evidence remains limited, structured exercise programs have shown promising effects on physical performance in patients with glioma [17]. However, interventions integrating physical exercise with management of neurological symptoms have not been studied, and evidence-based guidance on exercise prescription remains lacking [9, 10, 18–20]. Therefore, the aim of this qualitative study is to establish the perspectives and views of physiotherapists regarding the needs, facilitators and barriers related to physiotherapy for patients with a grade 2–4 glioma, to inform development of tailored physiotherapy interventions during and/or after (C)RT.

Methods

This qualitative study was reported according to the Standards for Reporting Qualitative Research (SRQR) [21]. A descriptive qualitative study design using thematic analysis was employed, using semi-structured interviews to obtain an in-depth understanding of physiotherapists' perceptions of the needs, facilitators and barriers to physiotherapy interventions for patients with grade 2–4 glioma [22, 23]. This study was reviewed by the Medical Ethics Committee (METC) Brabant, the Netherlands, and was deemed not to fall under the Medical Research Involving Human Subjects Act (nWMO) NW2024-38. All participants provided written informed consent.

Participants and Sampling

From December 2024 to February 2025, physiotherapists specialised in oncology and/or neurology and treating patients with grade 2–4 glioma were recruited by phone, email, through oncology and neurology professional networks, and via LinkedIn advertisement. Physiotherapists were included if they: 1) were specialised in oncology and/or neurology, 2) had treated at least four patients with grade 2–4 glioma, and 3) had full proficiency in Dutch.

Data Collection

Interviews were scheduled at participants' convenience. Characteristics were collected during the interview, including age, oncology and/or neurology specialisation, graduation date, work location, number of patients with glioma treated, and years of experience. Data were collected through semi-structured interviews conducted via video conferencing, with recruitment continuing until data saturation was reached, defined as no new information emerged in the final two interviews [24, 25].

The interviews were conducted using a predefined topic guide developed by MLS, YK, and CMS through open discussion [26]. Following the first two interventions, the topic guide was iteratively refined to include topics and questions that had emerged as relevant. All participants were asked about their

perspectives, followed by questions arising from the following topics: 1) physical and cognitive impairments in patients with glioma; 2) physiotherapeutic intervention(s) applied in patients with glioma; 3) facilitators and barriers of the physiotherapeutic intervention(s); and 4) the effects of physiotherapeutic intervention(s) in patients with glioma. Needs, facilitators and barriers were identified by asking questions like: “What physiotherapeutic intervention(s) would you offer?”, “What physiotherapeutic intervention(s) would you recommend for these patients during and/or after (C)RT?” and “How did you adjust the goals during the intervention, and what prompted these adjustments?” All interviews were performed by MLS. MLS conducted a pilot interview via video conferencing with YK. Both MLS and YK were trained by CMS, a senior researcher with expertise in qualitative research methods.

Data analysis

Interviews were scheduled at participants’ convenience, audio-recorded, transcribed verbatim, pseudonymised, and imported into NVivo (QSR International Pty Ltd. Version 15, 2024). Data were independently analysed by MLS and YK. After every two interviews, findings were compared and discussed. A combined inductive-deductive thematic analysis was applied following the six-step plan: 1) transcribing and fragmenting, 2) coding, 3) thematising, 4) reviewing themes, 5) defining and naming themes, and 6) producing the report [22, 23]. Through iterative reading of the transcripts, relevant interview fragments were identified, coded, and summarised using keywords. Open codes were grouped into subthemes and overarching themes by MLS and YK, with discussions continuing until consensus was reached. Interview quotes were translated into English by MLS.

RESULTS

Participants characteristics

Ten physiotherapists participated (Table 1), with a median age of 49 years and a median of 227 patients with glioma treated per physiotherapist. Five participants worked in a hospital, three in private practice, and two in rehabilitation centres. Interviews were conducted between December 2024 and March 2025.

Overview of findings

Three main themes emerged: 1) patients’ capacity; 2) patients’ needs; and 3) physiotherapists’ skills. Table 2 presents illustrative quotes corresponding to the (sub)themes.

Patients’ capacity

Effect of glioma

Physiotherapists indicated that glioma symptoms vary widely depending on tumour location (e.g., frontal lobe: impulsiveness; cerebellum: balance and coordination), making standardised treatment difficult. High-grade gliomas progress rapidly and often affect multiple brain areas due to tumour size and infiltration into surrounding brain tissue, leading to more severe symptoms. Low-grade gliomas have milder, location-dependent symptoms (Quote nr. 1 (Q1), Table 2). Physiotherapists reported that neurological impairments including hemiparesis, paralysis, epileptic seizures and impaired balance, walking, and coordination, were common among patients. Other symptoms include visual disturbances, disorientation, dizziness, headache, ataxia and muscle weakness. Group therapy was considered usually inappropriate due to high cognitive and motor demands, with those experiencing neurological symptoms typically requiring individual support (Q2). A physiotherapist from a rehabilitation centre noted that group rehabilitation was not feasible for patients with a poor prognosis. Another physiotherapist indicated that the combination of poor prognosis and neurological complications makes this patient group particularly complex (Q3). Cognitive impairments were also mentioned, including memory and concentration problems, behavioural changes, apraxia, neglect, and overestimating abilities. These cognitive aspects require specific consideration, which is less prominent in patients with other cancers such as breast cancer (Q4). Cognitive impairments can hinder understanding and recall of physiotherapy instructions, and combined with motor and balance issues, increase the risk of falls (Q5). There is a risk of epileptic seizures during treatment. In the palliative and terminal phases, cognitive and physical decline often limit participation in physiotherapy.

Effect of medical treatments

Physiotherapists indicated that patients may also experience side effects from medical treatments and medications. Fatigue and reduced physical condition are common side effects. Anti-epileptic drugs may cause parkinsonism. Dexamethasone may lead to hyperactivity, overestimation of ability, and reduced strength, but can also result in rapid clinical improvement, thereby supporting recovery and physiotherapy outcomes (Q6). During (C)RT, patients may develop cerebral oedema, which can lead to cognitive decline or temporary increased muscle tone. One physiotherapist emphasised the importance of remaining physically active during (C)RT to maintain physical fitness, muscle strength and mobility, highlighting benefits such as coping better with the treatment process and feeling fitter after (C)RT (Q7).Continuous participation in physiotherapy during (C)RT is hindered by fatigue, frequent hospital visits, and travel demand (Q8). One primary care physiotherapist noted that when patients cannot attend during (C)RT, phone contact helps facilitate their return. A physiotherapist from a rehabilitation centre reported that rehabilitation is generally not feasible during (C)RT, as patients' capacity is often too limited and a schedule packed with appointments during rehabilitation is too intensive (Q9).

Psychosocial burden

A glioma diagnosis often results in major psychosocial changes, due to both the neurological impact of the tumour and the effects of treatment. Consequences such as being unable to work or care for

children can drastically affect a person's social life and contribute to a negative self-image, whereby individuals may feel they no longer meet the standards they have set for themselves (Q11). Physiotherapists emphasised the significant emotional burden experienced by patients, which can complicate treatment, especially when patients are immersed in their emotions, in denial, or overwhelmed by grief (Q10). Therapy-related fatigue may cause patients to unknowingly exceed their psychological limits, which is difficult for physiotherapists to detect and may increase psychosocial and emotional burden.

Patients' needs

Functioning in daily life and participation

Physiotherapists working in a hospital or rehabilitation centre indicated that patients often wish to return home, where informal carers play a key role in daily functioning. To achieve this, patients must manage ADL, including independent mobilisation like transfers, walking, getting out of bed, climbing stairs, and toileting (Q12). Consequently, patients need to improve their physical functioning, such as enhancing endurance, strength, and balance. This supports activities like cycling, work, and sports, enhancing daily participation.

Patients' motivation

Physiotherapists noted that most patients are grateful, positive, and motivated to engage in physical activity.When cognitively able, patients generally understand their rehabilitation goals, are motivated to work towards them, and can actively discuss their therapy and care needs. Coping strategies influence exercise needs; while some patients are eager to participate, others lack motivation or struggle to cope with their diagnosis and limitations, especially when the situation is perceived as inevitable or a 'lost cause', shaped by personal life experiences, coping strategies, and, in some cases, denial (Q13).

Patients' quality of life

Physiotherapists indicated that, in the palliative phase, the focus is on maintaining function and slowing physical decline. With a longer-term prognosis, needs may shift towards supporting ADL (Q14). In the terminal phase, respecting and responding to the patients' wishes becomes crucial. Patients must conserve energy for essential tasks and maintain QoL, including spending meaningful time with family and gradually coming to terms with end-of-life processes (Q15).

Physiotherapists' skills

Knowledge and experience

Interviews showed that physiotherapists need knowledge of the condition, medical treatments, basic neurology, recent professional literature, physiotherapeutic measurement instruments, and psychosocial aspects, including supporting patients with grief, loss, and self-development (Q16). One physiotherapist noted that gliomas are relatively rare in primary care, often requiring physiotherapists to independently seek additional information. According to a physiotherapist specialising in neurology, oncology physiotherapists often have limited knowledge of neurological conditions. Neurological damage involving behavioural and cognitive disorders is more commonly treated within the field of physiotherapists specialised in neurology (Q17). Oncology physiotherapists emphasised that combined oncology and neurology expertise is essential for appropriate care.

Physiotherapists indicated that experience with this patient group is important for developing treatment skills. Frequent exposure boosts their knowledge, confidence, and judgement about what is feasible, when to take risks, or when to scale back or refer to another discipline. Additionally, some physiotherapists have limited experience providing physiotherapy during (C)RT. Without a neuro-oncology guideline, physiotherapists with a neurology background often rely on stroke guidelines rather than oncology guidelines (Q18).

Communicative and clinical competencies

Physiotherapists emphasised advice and education as core competencies, enabling patients and carers to understand and manage the condition. This is particularly important as exercises are often performed in bed or in the patient's room, where family members are frequently involved, especially when patients have cognitive impairments and may struggle to remember instructions (Q19). In the terminal phase, home care is usually provided three to four times a day, with family members providing additional support. One physiotherapist also provides information on acquired brain injury to both patients and carers, explaining how the brain works and why behavioural or personality changes may occur, helping carers better understand their partner's responses and the need for repetition (Q20). In addition, listening, empathising, and thinking along with the patient are important competencies. Physiotherapists stated that communication should be tailored; with cognitive impairment, it's important to speak slowly and use short, clear sentences (Q21). Physiotherapists indicated that flexibility and adaptability are essential. Fluctuating symptoms or overestimated abilities often require treatment goals to be adjusted. Difficulties with sensory processing must be considered; as one primary care physiotherapist noted, exercising in busy or noisy settings is often unhelpful. Physiotherapists stated the importance of safety during epileptic seizures. In hospitals, treatment is usually stopped and help called via the emergency bell. One hospital physiotherapist emphasised the need for a safe exercise environment for patients prone to seizures, such as using a wheelchair, involving a nurse, or staying close to the patients' room (Q22). Timely risk identification should be a key competency of physiotherapists. Physiotherapists highlighted that measurement instruments are essential for effective treatment, but may be ineffective in patients with cognitive impairment, requiring alternatives such as demonstration or tactile guidance. For oncology-related symptoms, the physiotherapists mentioned the following measurement instruments: Visual Analog Scale-fatigue, Multidimensional Fatigue Index, 6-minute walk test, Steep Ramp Test (SRT),

and 1(0)-repetition maximum (RM) (Q23). For neurological symptoms, instruments include Trunk Control Test, Motricity Index, Berg Balance Scale, Tinetti test, Mini-BESTest, Nottingham Sensibility Assessment, Martin Evidence Score, knee-heel and top-nose tests, Parkinson Activities Scale, and Functional Ambulation Categories are used (Q24). Additionally, the Medical Research Council scale, handgrip strength, Karnofsky Performance Status score, BORG scale, Patient-Specific Goal-setting method, and a patient capacity measurement instrument are employed.

Measurement instruments are used to assess baseline abilities and physiological responses during exercise. After six weeks, patients are retested to evaluate progress, and the treatment plan is adjusted, if necessary (Q23). Hospital physiotherapists stated that therapy frequency depends on physiotherapy treatment goals. Daily physiotherapy is aimed in patients at increased fall risk upon hospital discharge, but not when they are transferring to long-term care (Q25). Some patients are seen only two to three times before discharge, with sessions lasting 20 to 40 minutes depending on the patients' capacity. In primary care, treatment frequency and duration vary. One physiotherapist stated that 30-minute sessions are often sufficient, with therapy twice a week, and frequency reduced once patients are able to exercise independently (Q26). Another physiotherapist provides one-hour sessions for targeted recovery. In geriatric rehabilitation, sessions last 15 to 30 minutes, preferably five times a week, for one to two months. In a rehabilitation centre, sessions typically last one hour, twice a week, over a period of twelve weeks. During (C)RT, physiotherapy intensity is reduced, and sometimes frequency is adjusted due to lower tolerance and fatigue (Q27). A home exercise programme may include light cardio, strength exercises, walking, or using a small exercise bike or arm cycle.

Effects of physiotherapy intervention

Physiotherapists stated that physiotherapy supports ADL improvements through functional training, using clear instructions and dynamic exercises mirroring the home environment (Q28). In the hospital phase, the focus is on safe mobilisation and promoting independence through functional training. Physiotherapists stated that improving walking enables safe, independent mobility. For patients with hemiparesis, this begins with standing and progresses to walking. One physiotherapist advised frequent short walks at home to safely build walking ability. Balance training is also important, particularly in patients with neurological symptoms. In the acute phase, the focus is on trunk and static balance. Physiotherapists mentioned that improved strength and endurance are important outcomes of their interventions. For some patients with glioblastoma, walking 20 meters may be a significant achievement and constitutes both endurance and strength training (Q29). In the acute phase, functional training is used instead of heavy equipment, including exercises such as standing up from a seated position, squats, and weights exercise (Q30). Rehabilitation training takes place in a gym on an individual level, with a focus on endurance improvement through interval training. This involves 30-second intervals at 35% of resting and 60% of peak exertion, measured using the SRT. While not high-intensity interval training, this intensity is still challenging for patients (Q31). A physiotherapist mentioned that a tailored training programme has been developed in his private practice to improve exercise tolerance in patients with cancer. The focus is on enhancing recovery, with carefully dosed training to prevent exhaustion and

help patients sustain it for longer (Q32). Group training is beneficial for patients with oncology symptoms, due to interaction with fellow patients. It is crucial they recognise and communicate their physical limits (Q33). Improvement in upper-limb function, particularly in patients with hemiparesis, was also mentioned as a positive effect. All physiotherapists highlighted the restoration of confidence in movement and one's own body as a key benefit of physiotherapy (Q34). Physiotherapists emphasised the importance of maintaining functions during (C)RT, such as condition and strength. Building these is challenging in this phase, so the goal is stabilisation (Q35). Finally, they highlighted the reduction of complications, such as pressure ulcers and pneumonia in the terminal phase.

Multidisciplinary collaboration

Physiotherapists emphasised the importance of multidisciplinary cooperation due to the complex symptoms. Occupational therapists support energy management and daily functioning, while speech therapists address speech and swallowing issues. One hospital physiotherapist mentioned regular collaboration with the occupational therapist and speech therapist during treatments (Q36). Dietitians are often consulted for nutritional advice and muscle mass assessment, while psychological support is provided by oncology nurses or case managers, with referral to social workers or psychologists if necessary. A physiotherapist from a rehabilitation centre mentioned working with a psychologist in cases of movement fear (Q37). Primary care physiotherapists collaborate with case managers or oncology nurses and maintain contact with home care to manage issues such as pressure sores and support patient activation. Hospital physiotherapists collaborate closely with nurses, advising on mobilisation and transfers. Physiotherapists in rehabilitation centres and hospitals take part in multidisciplinary meetings. Close contact with other professionals ensures efficient collaboration (Q38). A physiotherapist in primary care noted that communication with other professionals is less direct, but efforts are made to maintain good contact with them. Hospital physiotherapists provide a transfer report when referring patients to long-term care, geriatric rehabilitation, or private practice. Neurologically specialised physiotherapists prioritise neurological issues and usually refer to another physiotherapist specialised in neurology; they only refer to an oncology physiotherapist if no neurological deficits are present (Q39). Oncology physiotherapists usually refer within the oncology network, as finding an oncology physiotherapist is easier than finding a neurological physiotherapist in the neurological network.

DISCUSSION

This qualitative study explored the needs, facilitators, and barriers related to physiotherapy for patients with grade 2-4 glioma from the perspectives and views of physiotherapists.

Physiotherapists identified fall risk, cognitive and motor impairments, balance problems, epileptic seizures and treatment-related side effects as major barriers to physiotherapy. Although seizures were considered challenging, evidence suggests that physical activity rarely increases seizure frequency when appropriate precautions are taken [27, 28].Glioma progression and treatment toxicity further impair

cognition, physical functioning and quality of life, while frequent hospital visits during (C)RT hinder continuous physiotherapy [18, 20, 29].Early rehabilitation may improve participation and reduce muscle loss,but intensive programmes are often unsuitable during (C)RT or for patients with poor prognosis [9,17]. Individualised interventions are therefore preferred, particularly for patients with severe neurological deficits. Literature shows that only 38 to 41% of patients with glioma maintained recommended exercise levels during (C)RT, highlighting the difficulty of implementing standardised programmes in this group [30].Specialised oncology-neurology expertise and adaptation to evolving patient needs are essential for effective physiotherapy during (C)RT. Empathy, adaptability, and interdisciplinary collaboration are essential for high-quality care. Oncology providers need both medical expertise and strong communication skills to support patients [31].

Inhospitals, private practices, and rehabilitation centres, physiotherapy session frequency and duration vary. Timing, intensity, and duration are critical for effectiveness [32]. Research suggests that patients with cancer benefit most from programmes totalling at least 120 minutes weekly over two months, including 15 minutes of high-intensity training, though this has yet to be confirmed in patients with glioma [17,33]. Our findings further support the importance of early and continuous physiotherapy across the disease trajectory [9,34].

Physiotherapy offers several benefits that facilitate recovery or prevent deterioration, including improved mobility, physical function and confidence. Physiotherapy improved muscle strength, reduced step frequency over 10 metres and fatigue in patients with glioma, and enhanced coping strategies, independence, self-confidence, and hope [9]. A home programme improved cardiorespiratory fitness, supporting the role of physiotherapy [28].Importantly, high-intensity exercise does not appear to reduce survival in patients with high-grade glioma, while submaximal training may even be associated with prolonged survival, particularly in patients with glioblastoma [17]. In patients with a more favourable prognosis, improved strength and endurance support active participation, and group training may be beneficial [18].

Physiotherapists highlighted the need for multidisciplinary collaboration due to the complex symptoms in this patient group. Stronger links between healthcare decision-makers and oncology providers are key to optimising physical activity support [31,32].

To our knowledge, this is the first qualitative study exploring physiotherapists' expertise in glioma care. The diverse sample enhances transferability, and future research will integrate patients' perspectives to optimise intervention development. Physiotherapists require specialised oncology-neurology expertise, including knowledge of glioma, treatment-related symptoms and disease progression. Future guidelines and training should integrate neurological and oncological assessment, personalised interventions and disease-specific recommendations across the entire care continuum.

In conclusion, this study emphasises the importance of tailored physiotherapy interventions that integrate oncological and neurological expertise for patients with glioma during and after (C)RT.

Declarations

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process
The authors used Deep Learning (DeepL) version 2026 for translation and language editing and Chat Generative Pre-trained Transformer version 4 (ChatGPT-4; OpenAI) as a writing support tool to improve clarity and academic language. All content was critically reviewed, revised, and approved by the authors, who take full responsibility for the manuscript.

Declaration of interest statement

The authors declare no conflicts of interest.

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Ethical approval and consent to participate

Ethical approval was obtained from the Medical Ethics Committee (METC) Brabant, the Netherlands, and was deemed not to fall under the Medical Research Involving Human Subjects Act (nWMO) NW2024-38 . All participants provided written informed consent prior to participation in the study.

Data availability statement

The datasets generated and/or analysed during the current study are not publicly available due to confidentiality agreements but are available from the corresponding author on reasonable request.

Author contributions (CRediT)
Conceptualization: Maria Louise Speksnijder, Yvette Kriellaars, Jorine Vermaire, Karin Gehring, Caroline Speksnijder.
Methodology: Caroline Speksnijder, Karin Gehring, Maria Louise Speksnijder.
Formal analysis: Maria Louise Speksnijder, Yvette Kriellaars, Caroline Speksnijder.
Investigation: Maria Louise Speksnijder.
Resources: Caroline Speksnijder.
Data curation: Maria Louise Speksnijder.
Writing – original draft: Maria Louise Speksnijder.
Writing – review & editing: Yvette Kriellaars, Michelle Verseveld, Jorine Vermaire, Eva de Wee, Karin Gehring, Caroline Speksnijder.
Supervision: Michelle Verseveld, Caroline Speksnijder.
Project administration: Maria Louise Speksnijder, Yvette Kriellaars.

All authors read and approved the final manuscript.

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Tables

Table 1. Characteristics of participating physiotherapists

	Interviewed physiotherapists **(n=10)**
Sex	
Male	2
Female	8
Age in years [median (range)]	49 (29-69)
Work setting	
Hospital	5
Rehabilitation Centre	2
Private practise	3
Work experience in oncology and/or neurology in years [median (range)]	22.5 (4-41)
Treated people with glioma [median (range)]	227 (4-450)
Training	
MSc	6
Oncology physiotherapy	1
Neurorehabilitation and innovation	1
Human movement sciences	1
Course	1
Oncology in physiotherapy and neurorehabilitation	
Neurorehabilitation	
Interview duration in minutes [median (range)]	44 (30-57)

Table 2. Quotes illustrating physiotherapists' perspectives and views regarding physiotherapy in patients with glioma

Themes	Subthemes	Physiotherapist	Quote	Quotes
Patients' capacity	Effect glioma	2	1	Yes, the symptoms are usually worse with a high-grade glioma. With low-grade gliomas, it really depends on their location. You see, high-grade gliomas often spread across multiple parts of the brain. Due to both the size of the tumour and its growth, you can see that multiple parts of the brain are affected. With low-grade gliomas, it is of course possible that only one part of the brain is affected. But then it depends on which part is affected.
		9	2	Some people also had more neurological symptoms, so they were not placed in the oncology group, but were treated as neurological cases because they had more physical symptoms, such as severe balance problems, which made it better to see them individually.
		7	3	I realised even more how complex the issues are for this group of patients, unlike other patients who may be nearing the end of their lives due to their cancer, but who often don't have to deal with the physical consequences of brain damage on top of that.
		5	4	Well, I definitely think the cognitive aspect is something you need to take into account. Yes, someone with breast cancer can express very clearly what's going on with her. Someone with cognitive difficulties, on the other hand, has a harder time doing that.
		5	5	For example, when we give instructions on how to walk with a rollator, you always hope that your instructions will stick with someone, but that can be really hard to teach sometimes. So it doesn't stick; they forget it or think it's not necessary, and they end up

			walking without the rollator, which increases the risk of falling.
Effect of medical treatments	2	6	There are also side effects from the medication. The medication is often used to treat epilepsy, but also to reduce swelling of the tumours, so it includes dexamethasone or bevacizumab or other drugs. With dexamethasone, we sometimes see that people are hyperactive and sometimes overestimate themselves, but they also improve very quickly. That is of course very nice, because it makes it easier to help them get back on their feet.
	5	7	It has been proven that staying active during radiotherapy helps people maintain their physical fitness, muscle strength and mobility. So, I do see the effects of staying active during radiotherapy: people simply cope better with the treatment process and come out of it feeling fitter.
	2	8	So, we sometimes advise patients to see a primary care physiotherapist ... but that is often very difficult to combine with radiotherapy. But I often hear from people who've been admitted here. They say, "Yeah, I ended up not doing that after all; I had to go to the hospital four times a week, so I found it pretty tough to go to the physical therapist on top of that."
	9	9	During chemoradiation, I think people's capacity really is reduced to the point where rehabilitation shouldn't be considered. Yes, if you have a full schedule of appointments, it's just not going to work, because it's really tough for people.
Psychosocial burden	8	10	You're admitted to our hospital with a new recurrence, go through the whole diagnostic

				process, and end up with a grade 4 GBM. Yeah, the patient obviously has no idea what that means. And then we can say, “Well, that’s great if you’ll be able to walk to the bathroom at home later,” but of course there are 100,000 other things you’ll run into at home and often have to experience firsthand. Then there are the people who are still going through the full range of emotions, in denial and grief, who aren’t open to anything.
		7	11	This applies to their partner or children. They are no longer able to meet their expectations. They find it increasingly difficult to fulfil this role and start to force themselves, developing a negative self-image in which they feel they no longer meet the standards they have set for themselves. These are often people who tend towards a certain perfectionism.
Patients’ needs	Functioning in daily life and participation	5	12	Well, here at the hospital, you actually see that people just want to go home as soon as possible. So whatever it takes to make that happen—they often want to get out of bed, and if there are stairs, they need to be able to climb them, of course. So, what we’re seeing here as a request for help is actually very practical.
	Patients’ motivation	7	13	The inability that inevitably arises in these kinds of processes, where sooner or later it becomes clear that this is a lost cause. … All kinds of personal life experiences and coping strategies that people have come into play, as well as denial.
	Patients’ quality of life	6	14	If someone is more palliative, then it's either about maintaining their QoL if they are still reasonably okay. Maintaining what you have, so

				not allowing further decline in physical fitness and fatigue. Well, teaching ADL techniques, how to do the things you still need to do in the most energy-efficient way possible.
		7	15	But you hope to create an atmosphere as early as possible in which they can grow with as much QoL as possible until they eventually say goodbye to life, right? As strange as that may sound.
Physiotherapists' skills	Knowledge and experience	10	16	Yes, in any case, knowledge of the condition, the treatment and the psychosocial aspects. You also need to be able to deal with grief and loss, … so you need to be fairly stable yourself and, of course, you need to be familiar with the tests we use. And you need to know what the current status is regarding operations, because that can change, right? You need to stay informed and keep up with the professional literature, because what you learn in training today may be different a year from now, so it's good to know what the current status is and what medications they are receiving and their side effects.
	Communicative and clinical competencies			

2	17	I also gave a lecture once. Oncology physiotherapists initially said, “Well, we can do that very well. What's the difference? They all have the same kind of treatments.” When I asked, “But how can you do that when you get someone out of bed, when you start walking with someone who is partially paralysed?”, they fell silent. And I thought, yes, you know a lot about treatments and building up fitness and maintaining functions during all the interventions aimed at fighting cancer, but real neurological damage with behavioural and cognitive disorders is something that belongs more in the field of neurology.
8	18	In fact, all guidelines or protocols that are often drawn up for oncology patients are complicated for our group due to neurological deficits. That is why we use the stroke guidelines.
5	19	Yes, certainly as an exercise that the patient can do mainly in bed, … or in their room. We always want family members to be involved in this, and they’re always willing to help, especially if a patient has some cognitive impairment and cannot remember things very well. In that case, we always involve the family.
7	20	Including information for informal carers, so that they understand how the central nervous system works and what its specific characteristics are, and why it’s important for me to understand why the other person is the way they are or is becoming the way they are. The better-informed people are, the better they understand that they need to adjust their pace, … or that they shouldn't

		find it strange to repeat things and need to be patient. One of the important aspects that also plays a role here is the character change that people undergo when they become frustrated about not being able to do what they want to do anymore. … Which depend a little on where in the brain the process takes place and which functions are affected. You sometimes see them change emotionally, so it's important to explain that.
2	21	Yes, you need to speak a little slower, so use shorter sentences sometimes, and check that what you want to say is clear. Don't tell them a whole story, because then they'll lose you. Just use short, clear sentences and don't jump from one thing to another; just be clear.
2	22	So that means bringing a wheelchair or creating a safe environment or bringing someone along, such as a nurse. We often try to prevent real problems if people have frequent episodes, in which case you stay close to the room.
6	23	I always do a Steep Ramp as a starting point, if possible, and 1RM exercises to see where you are now and what someone can still do. … What's the heart rate doing, what's the oxygen level doing, just the baseline measurement, so you can measure that once every six weeks to monitor someone: 'Hey, is someone making progress? Are we doing the right thing?' Is someone regressing? How is that possible when we are training? So it's certainly useful for my own monitoring, especially with this target group.
3	24	For example, we use the Truck Control Test, Berg Balance Skill, the Tinetti, and the

		Motricity Index. We frequently use the FAC to assess and record walking ability.
2	25	We try to adjust the frequency depending on the ultimate goal. So, if someone is able to go home but. For example, is at risk of falling, we really try to work on that every day with balanced and walking training, so that they are able to get home safely. If you know that someone is going to be staying for a long time, basically for the rest of their life, then you already know that the therapy will be fairly minimal. So we don't necessarily focus on daily therapy.
10	26	It depends a bit on what kind of help they need when they start strength training. It used to be twice a week, but that also depends on what stage they are at in the treatment programme, because it has to be manageable. … I often start with twice a week and at a certain point you see that they are picking up other things again, such as walking the dog or sometimes they want to join a sports club or do yoga or something. Yes, I encourage that, because that is exactly what they will need to keep up later on. And then we can also look at things like, 'Oh, what's not going well with the yoga, or what's not going well at that sports club?' Or 'What can't you do yet? … Yes, you do want them to get back into the wider world.
6	27	I usually reduce the intensity a little, but in principle I try to keep doing the same thing as much as possible, depending on how they respond to the radiation. If I see that people are really getting tired, I think it's important to conserve their energy so they can get through it. So if I notice that they are sleeping a lot during the day or that they say they are very

				tired, then I don't go to 70%, I just go to 40 or 50% so that they keep moving, because I think that's important, but you just go back to a lower level for a while.
	Effects of physiotherapy intervention	6	28	Dynamic exercises, so mainly imitating the home situation. Just do some squats to imitate how you would unload the dishwasher. Reach high, you know, from low to high. With dynamic exercises, I've noticed that most people find them most beneficial for everyday activities at home.
		3	29	A few weeks ago, there was someone with a high-grade glioblastoma who was eventually able to walk 20 metres with a rollator, but that was already fitness training and, in fact, strength training for him.
		3	30	We do have some weights and Thera-bands here, and we do that, but also sitting, standing, sitting exercises, squats, for example. So that's more in the room.
		9	31	Yes, well, I do 35%, let's say their rest, and 60% of the Steep Ramp for 30 seconds at the top of the interval. So I don't think that's real HIIT, but people often experience it that way; they find it really tough.
		7	32	Well, it is important to develop that insight and ensure that they know how to pace themselves in terms of training so that they build up their recovery function and don't exhaust themselves during exercise. Yes, initially we try to make that clear by working with heart rates. But the most important thing is actually that people start to feel it. We also let them go over the limit once so that they realise, okay, that's my reaction.

	9	33	Others had more oncology-related complaints, such as fatigue, … or they really appreciated contact with fellow patients because they found it very difficult to come to terms with cancer, which is such a big thing, so they were placed in the oncology group. So, to see if they can learn to recognise their limits and indicate this during the training itself.
	1	34	But what you do see is that confidence in movement is returning much more. I think that's one of the biggest or most important things for the success of your rehabilitation.
	10	35	No, you aim more for stabilisation, because that is very difficult to achieve with chemoradiation anyway, so even if you know that everything will remain the same, that is already a gain, because otherwise you will simply decline very quickly, and if you decline quickly in strength, you will also do less at home, so you also ensure that they keep coming even if they are not making progress.
Multidisciplinary collaboration	2	36	If the speech therapist really wants a patient to sit upright for swallowing or talking and I want to practise sitting, then that is a very good combination. I sit with the patient on the edge of a chair, and their sitting balance is poor, so it's quite an achievement if they can sit there for eight minutes while the speech therapist does exercises with them. With the occupational therapist, we sometimes observe washing and dressing, where the occupational therapist looks more at practical skills. A physiotherapist, on the other hand, looks more at balance and the use of both arms and legs.

	9	37	But if they’re really anxious about moving, that’s fine too. So we can arrange for the psychologist to join us in the room, and then we can do that really scary leg press or balance exercise – or whatever it is – and the psychologist can guide them through it.
	5	38	So we just try to keep the lines of communication short via the nurse if they notice that they're running into something, or we go through the doctor or other paramedics to try to solve problems together.
	2	39	It is often better to look for a neurological physiotherapist than an oncology physiotherapist, unless someone has no functional impairment and you want them to recover well after surgery, chemotherapy. … But if there is significant functional impairment, I think a neurological physiotherapist is better suited to provide primary care than an oncology physiotherapist.