Life After Paediatric Low-Grade Glioma (PLGG): The Utility Of Survivor Narratives In Paediatric Low-Grade Glioma Outcome Research

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ABBREVIATIONS

Abbreviation	Full Term
CCLG	Children's Cancer and Leukaemia Group
FA	Framework Analysis
GOSH	Great Ormond Street Hospital
HRA	Health Research Authority
NF1	Neurofibromatosis Type 1
NPA	Non-Pilocytic Astrocytoma
OESSI	Open-ended Semi-structured Interview
OS	Overall Survival
PA	Pilocytic Astrocytoma
PESAT	Physical, Educational and Social Assessment Tool
PFS	Progression-Free Survival
PLGG	Paediatric Low-Grade Glioma
QOL	Quality of Life
WHO	World Health Organisation

ABSTRACT:

Background-

Paediatric Low-Grade Glioma (PLGG) is a generally survivable Paediatric CNS tumour, though enduring functional and quality of life (QOL) impairments often occur. To date PLGG outcome research has relied on quantitative scales, such as PedsQl and has not included survivor's reports of their lived experiences in years post treatment.

Methods-

We conducted open-ended semi-structured interviews (OESSIs) with adult long-term PLGG survivors greater than five years post treatment in the context of a larger study of prognostic modelling for PLGG. Interview transcripts were analysed using Framework Analysis (FA). Results from the larger study including medical records, clinically measured functional outcomes (at last follow-up), PedsQl (QOL) score, and responses to the Physical, Educational and Social Assessment Tool (PESAT; a functional questionnaire) and FA results were compared to assess concordance of the two approaches in assessing life in survival.

Results

Ten survivors at median age 21yrs (18-25 years); at median duration from diagnosis 12 years (9-18 years) completed interviews. OESSIs identified survivors' continuing struggle with PLGGs. Even survivors with high QOL scores worked to maintain a normal life. Interviews revealed functional deficits and problems not identified from clinical follow-up, PedsQl or PESAT questionnaires, including seizures, social relationships, employment and mental health.

Conclusions-

Survivors' narratives of their lived experiences provide unique insight into the complex, long-lasting impact of PLGG post treatment. The sometimes-stark differences regarding the nature of survivorship revealed by the different approaches warrants further exploration of the value of survivors' narrative accounts in outcome research and in informing clinical practice.

KEYWORDS: Narratives, Paediatric Low-Grade Glioma, Quality of Life, Functional Outcomes, Mixed-Methods

KEY POINTS:

PLGG survivor narratives revealed functional and QOL difficulties not identified from PedsQl or functional data which can be of use in outcome research, discussions with parents and patients and design of interventions which address patient reported needs.

IMPORTANCE OF THE STUDY:

This study makes a novel contribution to outcome assessment in PLGG. Through the use of survivor narratives the study reveals functional and QOL impairments not identified through the measures conventionally used to assess QOL and functional outcomes. The study evidences, through the survivors' own voices, the need for lifelong support services to mitigate the impact of functional deficits on QOL and optimise independent function.

INTRODUCTION:

Whilst Paediatric Low-Grade Glioma (PLGG) is a histologically benign and generally survivable brain tumour of childhood[1, 2], morbidities from heterogeneous patient, tumour and treatment factors may cause enduring functional and quality of life (QOL) impairments for survivors[3-8].

To date, studies have almost exclusively used quantitative measures, such as fixed choice instruments, to evaluate functional and QOL outcomes in PLGG survivors[9-15]. Absent are open-ended responses or interviews reflecting the lived experiences of long-term PLGG survivors.

As part of our recently completed mixed-methods study evaluating the development of a multifactorial prognostic model to optimise treatment decision making in a large PLGG cohort, we explored the value of including narrative accounts of long-term PLGG survivors in outcome research[16][17]. This article reports findings from PLGG survivor narrative accounts and compares these with each survivor's results on medical, functional and QOL measures. It also considers the implications of the narrative accounts for outcome research, clinical discussions with patients and parents, and potential future supportive interventions and policy.

Aims:

1) To examine narrative accounts of the lived experiences of adult long-term PLGG survivors including physical function, education, employment, social relationships and QOL
2) To compare the survivors' narrative accounts with clinically measured function, survivor-reported function (PESAT; physical, educational and social assessment tool) and QOL (PedsQl score)
3) To document the differences between what is revealed by PLGG survivor narratives compared with medical, survival and quantitative PLGG function and QOL scores.

METHODS:

Participants were long-term PLGG survivors greater than 5 years from PLGG diagnosis/relapse or treatment recruited from participants in a large mixed-methods PLGG cohort study (814 Patients)[17]. Participants in the larger study were asked to indicate interest in being interviewed about their views of their lives around a prior PLGG. The first ten survivors who accepted the

invitation and consented for participation were interviewed for this study. Due to limitations in translation resources, only English-speaking participants were eligible for participation.

Open-ended semi-structured interviews (OESSIs) were conducted on zoom for participant ease. KG (an experienced paediatric oncology fellow undertaking this study as part of an MD(Res) programme[17]) conducted the interviews using a project-specific interview guide including prompts and topic aids. The guide covered the patient's past, present, and future, including topics such as friendships, relationships, daily activities, school experiences, employment, PLGG experiences, and hopes for the future (***Supplementary Figure 1).***

OESSIs were audio recorded and transcribed verbatim, with non-verbal communication also recorded within the transcriptions. Transcripts were analysed using Framework Analysis [FA] [18-21], supported by NVivo analysis software. FA is well suited for the analysis of OESSI data[19] and allowed the identification of themes across the data set whilst also allowing comparison both across, and within, cases. Pseudonyms were used to humanise participants without disclosing confidential patient identifiers.

Analysis proceeded through the five key phases of FA [20, 22]: 1) Data familiarisation, 2) Coding, 3) Indexing, 4) Charting, 5) Mapping and Interpretation (***Supplementary Figure 2)***. FA was performed by KG and supervised by MBL (a highly experienced ethnographer). After FA, individuals' perspectives on their lived experiences (with seminal quotes illustrating themes emerging through FA) were compared with data for each survivor from the wider study (***Supplementary Figures 3 and 4***), including A) retrospectively collected medical and functional data from patient medical records, B) current survival outcomes (overall and progression-free survival), and C) current PedsQl Core (QOL) scores and responses to the PESAT (functional) questionnaire (***Figure 1***). The PESAT is a patient reported functional outcome questionnaire created specifically for this study with both face and content validity. PESAT evaluates eight functional domains: physical, visual, auditory, endocrine, educational and neurocognitive, social, mobility and travel and employment, with space for free-text responses throughout and at end of questionnaire.

RESULTS:

1. Characteristics of Survivors Who Completed the OESSSI- Narratives of their Experience

Ten adult long-term PLGG survivors across a range of diagnostic ages, PLGG histological subtypes, tumour locations and treatments received ***(Table 1)*** were interviewed 6-12 weeks after completing the Peds QL and PESAT.

2. Findings from Framework Analysis of Open-Ended Semi Structured Interviews: Narratives of Survivors' Lived Experiences

As summarised in ***Figure 2***, FA of the OESSI transcripts identified four major themes (Identity and Self, Social World, Experiences of a PLGG, and Realities of Survivorship) and 18 sub-themes. The four major themes with seminal quotations from the participants are detailed further below.

2.1 Identity and Self

Some survivors began their narrative accounts in relation to having had a PLGG and reported feeling that their identity had been invaded by their diagnosis of PLGG.

> *Hi, I'm Laura. I had a brain tumour...if I never had the brain tumour then I'd be a completely different person*.
>
> ***Laura***

Others, however, talked about refusing to let this be the case. They focused on their identity apart from their PLGG, and on their resilience:

> *I do not let my diagnosis define me, nor do I define my diagnosis. It's a part of me; I'm not a part of it. It never stopped me and it never will stop me doing what I want to do in life.*
>
> ***Isabel***

Several participants who reported functional deficits, such as Isabel who reported visual loss, endocrinopathies and infertility from her tumour and treatment, also reported actively trying to minimise the impact of those deficits on their life, with some also discussing the need to continually and consciously make active efforts to maintain a life free from disease and morbidity post PLGG:

I'm still able to do everything. I can still drive. And I've got married, I've got my house, I've got a full-time job, regardless of the effects of the muscles and the writing and everything, I still carried on with life.

Isabel

Related to the theme of the PLGG impacting survivor identity and self-perceptions, some reported feeling that the PLGG had compromised their perception of normality, with suggestion of an altered normality due to the PLGG which was distinct and separate to a perceived normality where the PLGG did not exist:

My dream would be for me to be normal again.

Laura

Others, however, reported responding to the tumour by incorporating it, or its effects, into their normality as a continuous and fluctuating perception of a singular normality. This sense of normality, like the identity of being disease free, was seen by survivors as an achievement, but something they would always have to work at, even unconsciously, to attain.

Dealing with the seizures was just a normal part of my day.

Aoife

Many reported a sense of purpose and control as a result of having successfully overcome their PLGG and/or the functional difficulties it caused. They spoke of how the experience empowered them with renewed determination, strength and positivity in navigating life post PLGG. They expressed gratitude and a sense of fortune that they had survived, aware that others had not.

Having seen that Shannon had passed, and Tom had passed, for me, it was a case of, 'I now need to go live my life to the full', because I think Shannon was 20, and Tom was 21, they were very young when they lost their lives... I'm here now, living the moment, life's short.

Aoife.

2.2 Social World

The survivors' narratives of their social worlds included not only how the views and behaviours of others affected them during and after a PLGG diagnosis

> *I think the tumour affects me now as I'm very good at being alone. I'm a very isolated being now, because of everything that's happened, and I haven't told a soul in Glasgow about 'the ill me'*
>
> ***Aoife***

but also consideration of how their PLGG was perceived to have affected others around them

> *I only feel sad if I think about it [the tumour] or how it affected my family*".
>
> ***Lizzie***

PLGG survivors discussed relationships with others in a number of contexts including:

Family,

> *I remember that I had the most support I could ever have from my friends and family and also from the hospital, as well. I was lucky*
>
> ***Lizzie***

> *I'd be up in my room, and I'd hear mum and dad arguing about who was taking me to the hospital. That was such a crap feeling....I felt like a bit of a burden*.
>
> ***Isabel***

Education,

> *Really, the things that bring back bad memories from my school days were not only children bullying me, it was also with members of staff not being bothered to understand my condition*.
>
> ***Mike***

Employment,

> *It delayed me getting jobs and work. Obviously, they'd be like, 'oh no, we don't really want that one to work here because it's faulty'*
>
> ***Laura***

Perceived self-identity,

> *I felt I was more mature quicker than a lot of my friends, but I never really had a typical social group of friends while I was at school….I always felt like I didn't belong*
>
> ***Isabel***

Survivors attributed the difficulties and hurt they felt from others to their PLGG or their functional limitations from it:

> *You got pushed into a corner with all the other people that had varying disabilities, physical, non-physical, which also outcasted you in high school...it's like I was one of 'those' people; like you had special needs, and no one really wanted to be around you, because you were different and you are strange... People can't cope and I think that's generally how the rest of the world perceived it.*
>
> ***Aoife***

> *Because of all my complex needs that they [teachers] have to deal with and they don't want to be liable. I'm too much hard work for them.*
>
> ***Zara***

How others perceived them was singularly important to all survivors. Some reported attempting to influence and control the way that they were seen by others, by consciously compensating for self-realised memory or cognitive difficulties

> *I think I have a very good way of covering it up, and I think I am also very good at hiding it…I think I'm very good at just saying something to end a particular conversation*
>
> ***Emma***

or by giving false explanations for post-surgical scars or concealing their PLGG diagnosis and history entirely

> *People here don't know about my illness or my past, and I don't tell anyone. I just say that I've got a scar on my head because I was in a rugby accident*
>
> ***Aoife***

Survivors explained that these strategies were motivated by a fear of rejection, alienation or being perceived as a burden which others would be unable to manage.

> *I don't go around telling people because it's embarrassing, and because I don't want to be judged or alienated*.
>
> ***Emma***

A boy who was in a class with another boy with a brain tumour was the only survivor who did not discuss feeling alienated by their tumour. He explained that having had another boy in the class with a brain tumour provided a kind of safety in numbers and a perverse "normality" for them and their peers:

> *I think it did help a little bit because obviously, then, people didn't think it was as strange and as weird as what they first saw, because I wasn't the only one in school with one, and then obviously, there was two of us in a class that had it.*
>
> ***Ollie***

Survivors could also see their social worlds as offering opportunities for others around them to either help or hinder them in education, employment, relationships and integrating into society.

> *I got a lot of support from teachers, and a lot of understanding. From classmates as well, I did have a lot of understanding*
>
> ***Lizzie***

Mention of control and the strategies above revealed the active work that PLGG survivors do in conducting everyday life.

2.3 Experiences of a PLGG

While there were notable differences among the survivors about their experiences in the period of diagnosis and treatment, the majority reported mainly negative memories and feelings of their PLGG experiences.

> *I've got an unnatural fear of hospitals. I won't go in one, because I've got bad memories and fears related to that time of my life.*
>
> ***Aoife***

It's been a hell.

Zara

There were a few reported memories laced with some positive feelings or memories of that period:

It has affected my relationships with family in a good way.

Ayesha

I've met nice people while at hospital. I met celebrities. It's been all right, it's not all been negative.

Isabel

Two survivors reported having no memories of diagnosis or subsequent treatment:

It's scary because I don't remember what it's like to have a tumour that's growing inside my head. I don't remember what it felt like.

Emma

Frequently discussed topics around diagnosis and treatment included:

communication,

I think I'd always know it was bad news if I got asked to leave the room with the nurse. I didn't hear anything directly, about what the scans showed, because when he [the doctor] told my parents about it growing back or something, they'd take me to the playroom. Then I'd get told briefly afterwards. If it's good news then I'd stay in the room and he would say, "It's cleared." I'd learnt that if I got asked to go to the playroom then it was bad news.

Lizzie

decision-making processes,

I would have liked more support and more, "Do you understand what's being said to you? Do you understand this? Do you understand that?" Whereas I think because I was so young back then, it was a case of, yes, I was just agreeing with what I was being told.

Isabel

and growth and fertility

> *I know everyone has different side effects, but just to know that there would be some point in the future where I might stop growing properly, I might not be able to have children the normal way and stuff like that*.
>
> ***Emma***

For those who had seizures (half of the interviewed cohort)– all reported that the seizures were a memorable part of their PLGG experience. Each talked about how difficult seizures were, invariably due to the social consequences, academic implications, limitations on travel and functional limitations. Difficulties were not limited to the seizure episodes themselves. They continued into the present even if they had not had a seizure for many years:

> *It very much bothered and outcasted me and my mum, because, in a sense that people wouldn't want to be near you, they didn't want to really want their kids to be near you. It was like I was diseased and contagious.*
>
> ***Aoife***

Most survivors mentioned how their perspective had changed from when they were a child.

> *There's something a bit almost PTSD about it. When you become an adult, it suddenly hits home and that's when you get the PTSD. When you're young, you don't really appreciate what you've got…Then you become an adult and suddenly you are like, 'Wait a second!*
>
> ***Emma***

Many reported feeling more concerned about their PLGG now as an adult than they recalled feeling at the time as a child.

> *It feels more worrying having had a brain tumour now as an adult then it ever did at the time.*
>
> ***Ayesha***

> *I wasn't scared of the operation. I don't know why. Looking back I should have been [laughs]*
>
> ***Laura***

They attributed their increased concern to a more mature understanding of the gravity of what a brain tumour is, or perhaps, more concerningly for them, what the potential outcomes could have been.

> *I think I didn't get this when I was younger, but as I've grown up, you sort of appreciate life a bit more. You think, 'Wow, that could have gone so wrong. That could have been it for me'.*
> ***Ayesha***

> *I feel like I'd feel a lot worse now, because since I'm older, I'll have more of an understanding of what's actually happening.*
> ***Lizzie***

Several survivors reported experiencing mental health difficulties as adults. They attributed these difficulties to issues that had not been realised or managed at the time of PLGG treatment:

> *I've been dealing with mental health and physical health issues since I was eight, so I just get on with it. For me, that used to be self-harming, drinking alcohol, a lot of it, smoking [subsequent to diagnosis and treatment].*
> ***Laura***

> *I had bad anxiety and stress and was quite alone with that [at the time of treatment].*
> ***Aoife***

In addition, they felt that current lack of access to clinicians and services where they could discuss their concerns exacerbated their problems:

> *I don't have an oncologist or a neurologist about my tumor anymore. I feel like I lost that when I was a teenager…. I was still a child then, so I probably wasn't thinking about it, but then suddenly you become an adult, and you're like, "Hang on, who do I actually talk to about this?*
> ***Emma***

2.4 Realities of Survivorship

Woven through their discussions of the future was the issue of functional support; including assessment of support required, as well as whether they felt they had received necessary support.

> *I think the hardest bit was not getting the full support I needed for me*.
>
> ***Isabel***

A common thread was the lack of awareness or identification of the needs that survivors themselves perceived; particularly additional support to deal with ongoing and more subtle dysfunctions such as memory or cognitive impairments, or visual field defects.

> *I'm only blind in one eye…I think back to when I was younger, I couldn't really verbally explain that I could see perfectly fine because of my one good eye. People treated me like both of my eyes were affected.*
>
> ***Isabel***

Some survivors reported a total absence of supportive interventions

> *They just made me get on with it. They didn't do anything. They did nothing to help me*.
>
> ***Jack***

Others reported supportive interventions that, whilst well-intended, had not actually been of benefit due to a lack of understanding of disability and the consequent dysfunction and specific support needs:

> *At the time, that wasn't what I needed. What I really needed was someone to solve the problems I was having, but it was really hard for me to articulate what they were....Once a week, I would have a session with someone at school. I'm not even sure what his job title was, but he would do things like help me learn how to touch type. It was weird. It felt so odd.*
>
> ***Emma***

Many survivors reported feeling that necessary support was not easily available and described, in language analogous with 'fighting', how support had only become available with determined and proactive efforts from them or their parents:

> *I've got to keep fighting for the next thing*
>
> ***Aoife***

My mum had to reach out a couple of times

Isabel

Most of those interviewed reported feeling that they would benefit from increased functional support in their current adult life. This included survivors such as Aoife and Isabel who had optimal total PedsQl scores.

I would have liked more support.

Isabel

All of the interviewed survivors were able to consider a future life beyond the PLGG diagnosis and treatment, and to discuss either concrete hopes or theoretical wishes as a proxy for their hopes and dreams.

I'd like to have two children by then, have a full-time job, be a typical mum rushing around in the morning, trying to get everything ready for school.

Isabel

Many survivors spoke about a future independently from the PLGG, even in the face of ongoing functional limitations but one which they currently were unable to enjoy.

If I do ever get to go on holiday, I want to do all of those stuff [things]. Swim with the dolphins, go skydiving.

Zara

A minority described a future life inseparable from the PLGG or its functional implications:

I've got this thing in my head, it's never going to go away. It's already given me these side effects. What else is it going to do to me?

Emma

3. <u>Functional and QOL Outcomes From Peds QL and PESAT:</u>

One-hundred and twenty-two long-term PLGG survivors completed PedsQl and PESAT questionnaires within the larger PLGG study. The median total PedsQl score was 82/100 (physical 91, psychosocial 77). The mean PedsQl scores were significantly reduced compared to an adult reference population (N=649)[23], but were statistically comparable to only 137 adults with chronic

diseases within that reference population. Median number of functional domains reported as affected was 3/8. Functional deficit was perceived in 87% of 122 long-term survivors.

The median Total PedsQl score for the 10 survivors who completed the OESSIs was 76/100 (physical 86/100, psychosocial 73/100). Median number of functional domains affected was 3/8. Only 10% (N=1) reported an absence of perceived functional deficit as an adult. While the mean PedsQl scores of these 10 survivors were statistically comparable to the overall 122 PLGG survivor cohort, the scores were statistically significantly lower than an adult reference population (N=649)[23]. ***Figure 3*** evidences the PedsQl and PEASAT scores for each survivor. ***Table 2*** summarises the PedsQl and PESAT scores for the 10, along with survivor's additional quotes in the free text space on the PESAT and illustrative quotes from the OESSIs.

4. Findings from the Comparison of Qualitative and Quantitative Data of Interviewed PLGG Survivors

For each of the 10 survivors interviewed we compared 1)physical, demographic and tumour details **(Table 1**), 2)clinically measured functional outcomes, 3)survivor reported QOL (PedsQl) and 4) functional (PESAT) outcomes (**Figure 3),** and 5)quotations illustrating the themes and subthemes identified from FA of OESSI transcripts **(Table 2)**. Overall, we found that five survivors reported PedsQl scores discordant with the interviews. Three reported higher PedsQl scores than expected and two the reverse. And despite being at least five years from PLGG treatment and without tumour relapse/progression every one of the ten long term PLGG survivors interviewed – all adults- considered themselves to still be affected by their PLGG, all be it to varying extents or in varying ways.

Mike and Aoife were the survivors with the greatest contrast between the PLGG narrative accounts and the quantitative data. Mike, for example, received a PedsQl physical score of 100% (the maximal physical QOL), yet his OESSI transcript was replete with detailed descriptions of multiple physical functional difficulties including visual loss, hemiplegia and hearing difficulties as well as description of his life as "dull" and unfulfilling owing to multiple physical and neurocognitive impairments. Similarly, Aoife who achieved favourable PedsQl scores (psychosocial score 87/100, total score 89/100), described hearing difficulties and neurocognitive difficulties on PESAT. Further, in her

OESSI, she described ongoing anxiety, social isolation, and secondary consequences of prior seizures as so detrimental to her current QOL that she had decided to move 300 miles from home and to hide the evidence of her prior PLGG diagnosis and treatment from peers in a quest for a “new life”.

DISCUSSION

Despite the shared diagnosis of PLGG, the survivor narratives demonstrate the variation and complexity of survivor identities, experiences, memories, and views about the world to an extent not previously documented. They provide a novel introduction to the daily lives, functional challenges and QOL deficits of long-term PLGG survivors revealing undocumented and unmet needs of PLGG survivors. This vital information has not been achieved by other means currently used to understand outcomes in survivorship.

Going forward, results from survivor narratives could not only contribute to PLGG outcome research, but also in explaining to patients and parents what might lie ahead as they make treatment decisions, and in designing interventions and planning services to address the self-expressed needs of survivors.

Key Findings in the Context of the Literature

All ten interviewed survivors described a long-lasting impact of PLGG. Their reports of continuing to feel affected by their childhood PLGG many years from diagnosis and treatment supports prior studies which conclude that PLGG is a chronic disease[3-5, 24], and offers additional examples of just how PLGG continues to impact the lives of long-term survivors.

The results reported here offer a caveat to the reports of favourable QOL from several small PLGG series studies [9,27]. We demonstrate that making a comparison between PLGG survivors and normal controls on the basis of quantitative scores can be deceptive, as the survivor efforts to minimise impact of PLGG-related dysfunction, and the control which survivors exercise in their daily lives, are overlooked. Similar scores between survivors and ‘normal’ controls thus obscure important differences not detectable by quantitative measures.

From the narrative accounts, we learn that for all survivors, having had seizures at any point from PLGG diagnosis to follow-up, had secondary impacts on function and QOL that were enduring. Seizures impacted multiple functional domains including education, employment, social relationships, travel, and mental health. Indeed, a previous study evaluating neurocognitive function did demonstrate higher emotional reactivity and negative psychological well-being in PLGG survivors with epileptic burden[25]. However, the survivor narratives here suggest that there may not be an association between frequency and duration of seizures and impact on QOL, so much as having had a seizure. If so this suggests that there exists a potential cohort of PLGG survivors who are living with undiagnosed psychological distress from prior seizures .

Indeed, many of the interviewed survivors disclosed mental health difficulties, ongoing trauma from their prior diagnosis and treatment, and depression or anxiety even in the absence of seizures. Whilst the notion of psychological change is documented post PLGG surgical resection[25], this study calls attention to the extent of mental health impact from a PLGG and its treatment.

Most concerning, however, was learning that many survivors felt that their functional needs had been, and/or still were, unidentified or unsupported. Such information, critical to the development of support services and opportunities to improve PLGG survivor QOL, was not revealed through more conventional QOL and functional questionnaires (such as PedsQl) completed by the same survivors.

The survivors' views of themselves appear intimately related to the survivors' perceptions of normality, and how the PLGG diagnosis and treatment had altered those perceptions. This finding supports recent work proposing 'normalcy' as a key element in paediatric brain tumour survivor QOL[26]. Survivor-perceived QOL appeared closely linked to the survivor's perception of their ability to have autonomy and control over their life, as well as their perceived sense of purpose. This finding is important in the development of support services, as facilitating autonomy and independence for survivors in itself is likely to improve survivor function and QOL.

Our findings support work indicating that children diagnosed with tumours and receiving cancer treatments develop their survivor identities both around the tumour diagnosis and independently of it [27, 28]. However, as we found, some survivors' positive constructs of themselves did not

always align with their documented medical and functional issues. Whilst this incongruence may in part be due to the Disability Paradox[29, 30], it may also suggest that additional variables such as personality traits, the social environment or socio-economic factors mitigate or influence the impact of dysfunction on perceived identity and wider QOL[25]. Thus further underscoring the role that PLGG survivor narratives can play in better understanding the variables influencing functional and QOL outcomes.

The Value and Utility of Integrating Survivor Narrative Accounts In PLGG Outcome Research

The PLGG survivor narrative accounts are the result of a different methodology, with different concepts focusing on individual survivor lived experiences. The narrative accounts provided new information and insights as to the PLGG survivor experiences; demonstrating not just what dysfunction may exist, but how that dysfunction impacts daily life, thus providing a depth and context helpful to the interpretation of the quantitative QOL and functional questionnaire data.

The content and format of PedsQl presupposes the functional domains that survivors may consider problematic and appears to lack the sensitivity to include the impact of, for example, Mike's unilateral hemiplegia on the navigation of his daily life. In contrast, the open and survivor-led approach of OESSIs with direction of conversation (and therefore data) driven by the survivor's concerns and priorities offers a more empirical, patient-centred understanding of a survivor's QOL and the difficulties that they face as they perceive them. This produces results which are relevant and representative of the heterogeneous range of survivor outcomes not currently realised through other means.

The Value Of Narrative Accounts For Developing Future Support Services

PLGG survivor narratives provide patient reports of what they want in response to their own perceived needs. Through survivor narratives, we are better able to understand not just the dysfunction that challenges survivor QOL, but also survivor suggestions for mitigating those effects– providing valuable insights for developing support services and policies with maximal patient benefit.

The Value of Narrative Accounts For Outcome Discussions with Patients/Parents

In current clinical practice, neuro-oncologists are well-equipped to answer parents' questions about survival outcomes for PLGG. However, they are less equipped to provide an evidence-based answer to the question which inevitably follows– what will that survival look like? We hope that this study paves the way for further large studies to incorporate survivor narrative accounts in PLGG outcome research to better-assist clinicians in answering these challenging yet important outcome questions.

Strengths and Weaknesses

The strengths of this work lie in the novel provision of PLGG survivor narratives obtained through survivor led OESSIs which allowed participants to feel safe enough to discuss difficult, and at times emotional, topics related to their PLGG experiences, to reflect on their lives, consider their futures, and to provide recommendations for care and service development rooted from their experiences.

This is a single centre study. The sample is small as time and funding restraints restricted OESSI completion to only ten PLGG survivors. Making speaking English an eligibility requirement may have contributed to sample bias. Nevertheless, mean PedsQl and PESAT scores were statistically comparable between the interviewed and wider cohorts.

CONCLUSION:

Narrative accounts of PLGG survivors allow new insights into the lived experiences of long-term PLGG survivors, and contribute novel findings not obtained from quantitative QOL instruments. Survivor narratives can serve as an integral component of paediatric brain tumour survivorship research.

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Data Availability:

Anonymised study data presented within the manuscript will be made available upon reasonable request.

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FIGURES

Figure 1:

Figure 1- Diagram summarising the review and comparison of multi-source data alongside framework analysis of the OESSI transcripts and selection of seminal quotations. Data includes A) Retrospective medical data and clinically measured functional outcomes, B) Current survival outcomes, and C) Current Functional (PESAT questionnaire) and QOL (PedsQl Core questionnaire) outcomes.

Figure 2:

Figure 2- The four major themes and 18 subthemes identified from Framework Analysis (FA) of the OESSI interview transcripts of 10 adult long-term PLGG survivors.

Figure 3:

Figure 3- The PedsQl scores *(Physical score: green, Psychosocial score: blue, Total score: yellow*) and the number of functional domains reported as affected on the PESAT questionnaire (thin blue line).

TABLES

Table 1

Table 1– Demographics and Tumour Details of The 10 Long-Term PLGG Survivors Completing OESSIs In This Study.

Table 2

SUPPLEMENTARY FIGURES

Supplementary Figure 1- The OESSI Interview Guide Template.

Supplementary Figure 2- The Codebook Created and Implemented for FA of OESSI transcripts.

Supplementary Figure 3- The PESAT Functional Outcome Assessment Questionnaire Completed By Participants

Supplementary Figure 4- The PedsQl Core Quality Of Life Outcome Assessment Questionnaire Completed By Participants

Supplementary Figure 5. The Mean PedsQl Core and PESAT questionnaire scores, with statistical comparisons of each, from: 1) The 10 interviewed adult long-term PLGG survivors, 2) The 122 long-term PLGG survivors completing PedsQl and PESAT questionnaires as part of a wider study, 3) A comparative reference cohort of 649 adults[23].

Lay Summary

Paediatric Low-Grade Glioma (PLGG) is the commonest brain tumour of childhood. Most children and young adults under eighteen years old given the diagnosis will survive long-term, but many will face functional or quality of life consequences from the tumour and its required treatment. To date, most research into the outcomes of PLGG has focused on measuring function and quality of life with questionnaires using rating scales, without direct reports of the experiences or views of the survivors themselves. We hypothesised that adding these PLGG survivor narratives to survivor outcome research would help to provide novel information, as well as context and meaning in which to evaluate quantitative rating-scale data.

We conducted open-ended interview discussions with 10 long-term PLGG survivors who were at least five years from having received any treatment for PLGG. We asked questions around the survivor's past and present life, and their hopes for their future. Once completed, the interviews were transcribed to scripts, and these scripts analysed using a method called Framework Analysis which looks for patterns within and between the interview scripts.

Ten survivors at a median age of 21 years (range 18-25 years) and at a median duration from diagnosis of 12 years (range 9-18 years) completed interviews. Interviews identified survivors' continuing struggle with PLGGs, even decades from diagnosis. Even survivors with high QOL scores worked hard to maintain a normal life. Interviews revealed functional deficits and problems not identified from clinical follow-up, or from the quantitative functional or quality of life questionnaires, including seizures, social relationships, employment and mental health difficulties.

Survivors' narratives of their lived experiences provide unique insights into the complex, long-lasting impact of a PLGG after treatment. Our data suggests that further exploration of the value of survivors' narrative accounts in childhood brain tumour outcome research and in informing clinical practice is warranted.

Table 1

Participant Pseudonym	Jack	Laura	Ayesha	Lizzie	Aoife	Zara	Isabel	Ollie	Emma	Mike
Gender *(F/M)*	M	F	F	F	F	F	F	M	F	M
Age At Interview Completion *(Yrs.)*	18	22	18	18	19	21	24	25	24	24
Age At PLGG Diagnosis *(Yrs)*	12	14	11	7	11	1	6	4	4	0
BRAF Status	Unknown	Unknown	KIAA1549 Fusion	V600E Mutant	Wildtype	Unknown	Unknown	Unknown	Unknown	Unknown
NF1 Status	NF1	Non-NF1	Non-NF1	Non-NF1	Non-NF1	Non-NF1	Non-NF1	NF1	Non-NF1	Non-NF1
Seizures At Presentation	No	Yes	No	Yes	Yes	Yes	No	Yes	No	No
Seizures In Follow-up	No	Yes	No	No	No	Yes	No	No	Yes	No
Tumour Location	Optic Pathway	Cerebral Hemisphere	Cerebellum	Cerebral Hemisphere	Cerebral Hemisphere	Brain stem	Optic Pathway	Optic Pathway	Optic Pathway	Deep Midline (Thalamus, Basal Ganglia)
Tumour WHO Grade	1	1	1	2	1	1	1	1	1	Unknown
Tumour Histology *PA = Pilocytic Astrocytoma* *NPA=Non-Pilocytic Astrocytoma*	PA	NPA	PA	NPA	NPA	NPA	PA	PA	PA	Unknown
Adjuvant Therapy (Chemo/ Radiotherapy) received?	Chemo Therapy	None	None	None	None	None	Chemo & Radio Therapy	Chemo therapy	Chemo & Radio Therapy	Chemo & Radio Therapy
Surgical Resection	No Surgical Resection	Surgical Resection	Surgical Resection	Surgical Resection	Surgical Resection	Surgical Resection	Surgical Resection	No Surgical Resection	Surgical Resection	No Surgical Resection
Received Endocrine Replacement Therapy?	Yes- Growth Hormone	No	No	No	No	No	No	Yes- Hydrocortisone	Yes- Growth Hormone	Yes- Growth Hormone
Tumour Progression Or Recurrence?	No	No	No	Yes	No	No	Yes	No	Yes	Yes
Interview Duration *(Minutes)*	38	57	39	32	87	73	39	28	52	39

Table 2

Survivor Pseudonym	PedsQl Physical Health Score (Maximal QOL 100%)	PedsQl Psychosocial Health Score (Maximal QOL 100%)	Total PedsQl Score (Maximal QOL 100%)	Number of Functional Domains Affected on PESAT (Total 8 Domains)	Relevant Medical / Functional Information (Data From Medical Records)	PESAT Questionnaire Additional Comments Provided	Seminal OESSI Quotes
Jack	72	65	67	3	NF1, Unilateral Blindness, single endocrinopathy.	"I have Neurofibromatosis type 1 and joint hypermobility. I am blind in my left eye".	"I'm generally fairly resilient and good at getting on with things and doing extra studying".
Laura	69	40	50	3	Seizures, Depression, Anxiety, Autism Spectrum Disorder, Memory Impairment.	"I cannot use a kettle, hoover or oven. I have difficulty with seizures, anxiety and autism. I have had memory impairment since surgery. I sat exams with extra time in a separate room. I struggle with all friendships and relationships. My mental health is worse since surgery".	"I'm so affected by all the different health problems I have, mental and physical. They're always going to be there. If I never had the brain tumour, then I'd be a completely different person. I'd probably be in university right now. I don't feel strong. I feel very weak, very pathetic, very damaged from everything."
Ayesha	81	82	82	1	No ongoing objective physical or functional disabilities	None provided	"I feel like I know more about it now, I know what could potentially happen. Whenever I think about that, it brings back memories of what happened in the past, which I can feel sad about."
Lizzie	100	100	100	0	No ongoing objective physical or functional disabilities. Seizures at diagnosis.	"I am going to university for my undergraduate degree".	"I'm happy with everything I'm doing now. I'm going to university. Since I'm busy, I never really think about it [PLGG] too much and I'm still able to do everything that I want to do like my drawing, and netball, and cycling. It hasn't stopped me from doing what I love doing".
Aoife	94	87	89	3	Seizures at diagnosis and for years until final surgery. Hearing impairment. Memory and neurocognitive difficulties.	"I find it hard to hear what people say. I went to a brain injury centre in Cambridge for help. I have a reader and a scribe for exams. I get on with older people easier than with people my. I missed important social development opportunities".	"It very much bothered people and ostracised me and my mum, because, in a sense that people wouldn't want to be near you, they didn't want to really want their kids to be near you. It was like I was diseased and contagious. For some reason, people thought seizures were contagious".
Zara	12	33	26	4	Visual impairment, Hearing impairment, Seizures, Hemiplegia, Learning Difficulties	"I need help with a lot of physical tasks. I was very unsupported at school. I have a support worker 4-6 hours a day who helps me get around and who helps with independent living. I cannot work due to my physical and visual impairments".	"They just treat you as if you are a sack of potatoes. Even potatoes bruises if you treat them badly. I've got epilepsy. It is a mixture of partial and absence seizures. Then I've got hearing impaired, so I've only got 10% of my right ear and 70% on my left. Then I've got visual impaired because my visual field. I can't see anything from the sides of me, only in front".
Isabel	97	95	96	3	Unilateral Blindness, Multiple Endocrinopathies, Infertility due to prior tumour +/- treatment, Headaches and Migraines.	"I had very frequent migraines after my brain surgery, but recently these have settled and can be months apart. I am blind in one eye but have normal vision in my other eye".	"That's one thing I've always said to people that I do not let my diagnosis define me, nor do I define my diagnosis. It's a part of me, I'm not a part of it. It never stopped me, and it never will stop me doing what I want to do in life at the end of the day".
Ollie	91	83	86	1	No ongoing objective physical or functional disabilities	"I am a site engineer".	"I've got a master's degree in civil and structural engineering, and I'm currently working on a railway project up in Liverpool, building a new station".
Emma	59	55	57	6	Visual impairment, multiple endocrinopathies, cognitive impairment with memory difficulties, fatigue.	"I have cognitive processing difficulties. I am partially sighted and have poor peripheral visual fields, I would say I am ¾ blind. I feel that I should have been given an EHCP. I cannot drive due to my vision. I feel like I don't have many friends and have never had a romantic relationship. At work I need help with display screen equipment and get tired when concentrating or reading".	"My eyesight is a constant reminder of the tumour because if I can't see something, or I bumped into something, or my eye starts hurting, it's a constant reminder that I had a brain tumour. My memory is not very good, but then I've had tests and stuff that would say otherwise. I always think these tests that you have, these cognitive tests aren't very good at true experience of what you actually have".
Mike	100	55	71	8	Hemiplegia, Visual Impairment, Hearing Impairment, Severe Learning Difficulties, ASD, Insomnia, multiple endocrinopathies.	"At school not everybody understood me, and I felt empathy and compassion was lacking. I feel isolated by my disabilities. Great lack of support and understanding from teachers who did not appear to understand an acquired brain injury. I find relationships very difficult".	"One of the disabilities that was caused by the tumor was impaired sight. Up until I had radiotherapy, my right eye was completely blind because of the pressure on my optic nerves by the tumor. The hearing was affected by chemotherapy, and for about 20 years or so now, I've been wearing hearing aids in both ears. My right side is not as strong as my left".
Median Score	86	73	76	3			
Mean Score	77	69	72	3			
Score Range	12 - 100	33 - 100	26 - 100	0 - 8			

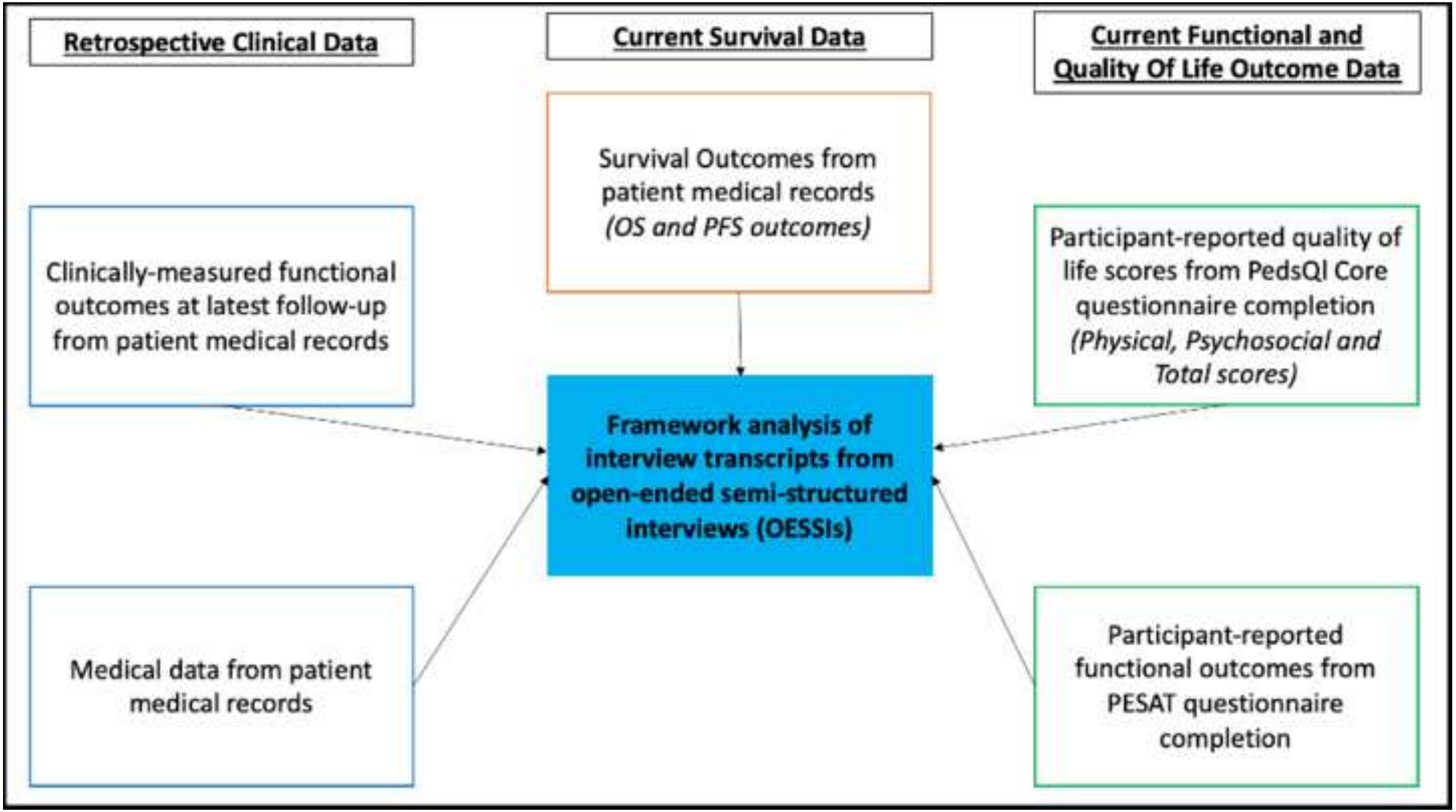

Figure 2