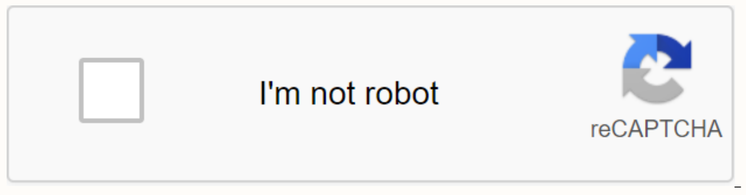

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Posterior fossa cancer

Volume 47, Number 1, February 2020, Pages 46-53Magnetic ResonanceView Abstract Speech Loss (Mutism): Some children completely lose their ability to speak. Other children can say a few words or say very short phrases. This loss of speech usually occurs 1-2 days after surgery. For most children, speech returns over the next few weeks or months, but there may be some permanent damage to speech. Since this is a key feature of the condition, posterior phossu syndrome is also known as cerebellar mutism. Speech problems due to muscle weakness or poor muscle control (disarthria): Many children with posterior phossa syndrome have speech problems because they have trouble controlling the muscles of the mouth, tongue, palate and vocal cords. Speech may be difficult to understand due to slow speech, slurred speech, problems with making sounds or problems with loudness, tone or height. Speech problems due to damage to brain pathways that control movements necessary for speech (apraxy): Some children have trouble pronouncing what they want to say properly. They may have trouble coordinating mouth movements for speech or consistently saying targeted sounds or words. They may also have difficulty moving their mouths voluntarily. For example, children may not be able to open their mouths or smile at command. However, they can yawn like a reflex or laugh while laughing. Swallowing problems (dysphagia): Children may not be able to control the muscles used to swallow. This may require changing diet, using specialized equipment or strategies, or even feeding tubes until problems improve. Learn more about speech pathology Lack of voluntary movements (apraxy): Initially, most children will find it difficult to move when asked (voluntary movements). However, they can display unintended or automatic movements, such as yawning or grimacing. This can make hands and feet weaker than they are. Problems with muscle coordination become apparent only after the apraxy improves and voluntary movements return. Motion control problems (ataxy): Various problems in movement, balance and coordination of muscles are seen in posterior phossu syndrome. Children may have problems with large movements, as well as fine motor skills. Reduced hand eye coordination, problems handling small objects and unstable walking become apparent as the child improves. Some degree of these problems will continue in most children with posterior fossa syndrome. During the early stages of posterior phossa syndrome, bowel and bladder control is impaired in most children, although these functions usually improve in time. Weakness on one side of the body (hemiparasis): Some children may have weakness on one or both sides of the body. Change in muscle tone (hypotonia or hypertonia): Muscle tone refers to the balance of muscle tension when the muscle is idle. Hypotonia, or low muscle tone, can result in floppy muscles and inability to control or upright seating. Hypertonia, or muscle tone, causes the muscles to be too tight. Involuntary movements: Some children may develop forced movements. This may include tremors, sudden muscle or limb twitches or involuntary eye movements. Cranial nerve problems (cranial nerve cronies): Cranial nerves VI and VII are often involved in posterior fossa syndrome. The sixth cranial nerve controls eye movements. Problems with this nerve can cause double vision and a crossed eye. The seventh cranial nerve is the nerve of the face. Damage to this nerve can cause the face to drool. Children may drool or have trouble making facial expressions. Learn more about physical therapy Learn more about work therapy Children with posterior phossa syndrome often have emotional lability. They can show answers, such as laughter or crying, that are unexpected or do not coincide with the situation. Children may have mood swings or find them difficult to calm down. Sometimes children may appear withdrawn or show few answers. Irritability, depression, anxiety and carelessness are also common. Sleep problems may also occur, including a change in sleep patterns or schedule. Some children with posterior phossa syndrome have changes in the way they respond to sensations such as touch, light, sounds or movement. Maybe they're bothered by things in the environment that haven't caused a reaction before. These changes can limit a child's ability or desire to participate in a game, daily activities or rehabilitation. Learn more about psychology Children with posterior phossa syndrome often show a decrease in cognitive function, including problems with focus, attention span, processing speed and memory. They can perform tasks more slowly and have trouble organizing and planning. Children may be less able to solve problems and communicate their ideas. The decrease in cognitive function is likely to last to some extent. However, it can be difficult to know whether the cause is posterior fossa syndrome or if symptoms are due to cognitive late effects related to tumor or treatment. Learn more about cognitive late effects While survival rates continue to improve and in many cases can be considered favorable (Gottardo and Gajjar, 2006), the vast majority of survivors experience significant damage after treatment (Ness, etc., 2008). The decline in overall intellectual abilities and problems in academic achievement after treatment plagues this group of children and provokes their families (Mabbott al., 2005, Mulhern, al., 2005). In addition, a large number eventually require some form of special educational service (Dennis et al., 1996, Mitby et al., 2003). While considered broad-spectrum abilities, monitoring intellect and academic achievement remains important. Deficits in these areas can produce limitations on education, employment goals, and independent living as a patient ages in adulthood (Maddrey al., 2005, Moore, 2005, Mostow, al., 1991). For further understanding of the etiology of these changes, further examined the underlying specific cognitive abilities. It is believed that contributing to the decline of intellect and academic achievement is slowed information processing speed, reduced memory capacity and declining ability to maintain attention (Maddrey et al., 2005, Mulhern and Palmer, 2003, Nagel et al., 2006, Palmer et al., 2007, Reeves et al., 2007, Schatz et et et et., 2000). Not all patients experience the same kind of challenge. The nature and severity of the deficit differs among patients with patient and treatment factors attributed to possible outcomes. These factors help identify who is at higher risk and must be taken into account when examining late effects after treatment for pediatric posterior tumor fossa. Among the healthy, general intellect, measured by the total quotient score (IQ), it is expected to remain stable over time. However, the decline in patients' IQ as treatment time increases is one of the most commonly documented outcomes among those with back fossa tumors (Mulhern, al., 1992, Mulhern, al., 1998, Lynx, and Al., 2001). Studies of the individuals show that older age at the time of treatment acts as a protective variable in relation to the severity of the fall (Mulhern al., 1992). More recent longitudinal studies show that the pattern of decline varies over time depending on the patient's age at the time of treatment (Palmer, al., 2003, Lynx, al., 2001). The intellectual capacity of 50 patients was prospectively monitored over a period of 7 years, resulting in an analysis of 188 psychological assessments (Palmer al., 2003). For patients who were older at the time of treatment (M = 11.05 years) the model predicts that the basic intellect will remain unchanged until approximately 2 years after diagnosis when a slight decline begins. In approximately 4 years after diagnosis, this rate of decline increases significantly. The younger patient however (M = 5.86 years) experiences an immediate decline that does not plateau until a few years after treatment. It has also been shown that the decline in intellect is due to a failure to learn and acquire new information at the expected rate, rather than the loss of previously acquired information (Palmer, Al., 2001). Intelligence within a healthy population is strongly supported by normal age-related memory development and processing speed (Fry and Hale, 2000). This association was also proven among cancer survivors where it was reported that those with poorer working memory and slower processing speeds showed lower intellect (Schatz, al., 2000). Instead of seeing the expected age-related development of verbal memory ability, those with back phossa tumors show declines over time (Copeland ir., 1999, Mulhern, al., 2001) with difficulty in retrieving and recognizing verbal information (Nagel, al., 2006). Age-related challenges are also reflected in academic fields of reading, spelling and mathematics among those for posterior fossa tumors. Older age at diagnosis was associated with better reading and higher grades of school scores of surviving parents (Mabbott et al., 2005), while younger age at diagnosis was predictive of poorer reading ability among survivors (Mabbott et al., 2005, Mulhern et al., 2005). The extent of tumour removal was considered in determining the classification of patients' risks and assigning risk-based treatment options for patients with back fossa tumours (Gajjar, al., 2006). Since residual tumor leads to the determination of high-risk disease and the need for higher doses of radiation treatment, complete surgical resection of the tumor is desired whenever possible. The impact of surgery may include damage to proximal structures such as the cerebellum and is associated with an eventual cognitive outcome. The effect of surgical resection on cognitive outcome was studied by monitoring 24 patients with back fossa tumors treated with surgery only (Steinlin, al., 2003). Although it was found that percent of operative patients exhibited normal verbal, performance and general intelligence, more than half showed significant performance deficits for attention, memory, processing speed and visual-constructive ability. Damage to the cerebelity vermis area was associated with a more severe performance deficit. The authors concluded that the results highlight the importance of considering the role of the cerebelity in cognitive development and how surgery can interrupt this development. A recent review presented evidence within the literature suggesting a link between cerebelility abnormalities and cognitive processes among children and adolescents (Steinlin, 2007). In addition to studies of patients with pediatric back phossu tumors, studies involving children with various conditions were included, including Dandy Walker Syndrome, Fragile X Syndrome, Down syndrome, Williams syndrome, dyslexia, attention deficit disorder, brain trauma and leukemia. However, the accompanying review highlights the need to consider discrepancies in methodology, such as motor components of measures and consternations of conditions such as increased intracranial pressure, when interpreting results supporting

the role of the cerebeln in cognition (Frank, al., 2007). The call was made for multiple controlled lesion studies that eliminate confusing variables to determine what specific functions support the cerebellum, how and to what extent (Frank al., 2007). A thorough study of cognitive function among a group of children and adolescents who survived with cerebelar astrocyte (Vaquero, al., 2008) was recently completed. Among the measured outcomes were planning ability, conceptual capacity, semantic verbal fluency, memory, selective attention, inhibition of responses and visual-spatial organization. The group of astrocytomas, treated only with surgery, showed deficits in short-term memory, semantic verbal fluency and selectivity The level of damage was higher for those patients with the tumor, and therefore surgery, which included the cerebelity vermis area. The authors conclude that the operation clearly generated an impact on executive function and that perhaps these areas of function are further compromised by additional treatments such as radiation and chemotherapy. Of the modalities used in the treatment of posterior phossa tumors, the most studied is the impact of receiving radiation. An early review of the study of the neuropsychological status of patients showed that radiation had a negative effect on intellectual development (Mulhern al., 1992). Those receiving radiation therapy had IQ levels 12-14 points lower than those who did not receive radiation. Six years later, the influence of two levels of radiation dose exposure (36 Gy vs. 23.4 Gy) was studied in combination with patients' ages: younger versus older, divided in middle age at diagnosis = 8.85 years (Mulhern, al., 1998). Four groups of long-term survivors were formed for analysis purposes: Young/36 Gy, Young/23.4 Gy, Older/36 Gy, Older 23.4 Gy. Tests of global intellect, nonverbal intellect, reading, mathematics and attention were completed by all patients. Showing that the neuropsychological outcome was age-dependent, the outcomes of the all-measure groups were ordered from lowest to highest as follows: Young/36 Gy < Young/23.4 Gy < Older/36 Gy < Older 23.4 Gy.An interaction between patient age and radiation dose exposure was shown to be significant in a large longitudinal study in 111 patients who were prospectively followed over a 7-year period (Mulhern, al., 2005). Three areas of academic achievement were studied, including decoding reading, spelling and mathematics. Those treated as high risk, therefore receiving higher doses of radiation, and those who were younger, experienced greater declines over time in intellect and academic ability (Mulhern, al., 2005). Relationships between two levels of cranial radiation (25 Gy and 35 Gy) and several cognitive outcomes among a group of adolescents who survived the standard risk of medulloblastoma (Kieffer-Renaux, al., 2000) were investigated. Those receiving the standard dose of radiation (35 GY) showed a significantly lower verbal IQ than those who received a reduced dose (25 Gy). Similar relationships were found for verbal fluency and understanding of written words. Although both groups showed reduced processing speed and impaired verbal memory, those who received higher standard radiation doses had greater impairments. Cognitive outcome was also found to differ significantly in groups when comparing patients who received different types of treatment for posterior phossa tumors. Those who underwent surgery and radiation to the skull were compared to those who were alone in surgery and with those who did not have tumors that were not CNS (Mabbott, al., 2008). There are no significant differences between labour groups and constant attention was found, at which each group performed within the normal range. However, there was a significant difference between the information processing speed groups. Those who received radiation as part of treatment showed a significantly slower rate of information processing than those who received surgery alone or were treated for non-cnS tumors. For those diagnosed with posterior phossa tumours such as medulloblastoma or PNET, treatment with surgery, radiation and adjuvant chemotherapy is a well-known approach that produces favorable outcomes (Gajjar et al., 2006, Gottardo and Gajjar, 2006, Packer et al., 1999, Thomas et al., 2000). However, this is not always an approach for patients diagnosed with posterior phossa tumours under the age of three or for those within European protocols. Studies exist in this group of patients where treatment involves surgery and chemotherapy, thereby delaying the need for radiation therapy. Unfortunately, assessing cognitive outcomes within these studies is uncommon. One exception is a review of 43 patients who had <3 years when they were diagnosed with classical or desmoplastic medulloblastoma and treated with surgery followed by three cycles of chemotherapy (Rutkowski, al., 2005). Fourteen of these patients completed neuropsychological evaluation on average 4.8 years after diagnosis. The general intelligence and visual-motor integration of this group of patients was significantly lower than healthy controls of the same age. Patients receiving chemotherapy were compared to an earlier group of patients who also received radiation after surgery. The chemotherapy group showed higher general intelligence. A recent study published follow-up data for 108 patients enrolled in a European study who received only cranial spine radiation or chemotherapy prior to cranial spine radiation as a treatment for standard medulloblastoma risk. Patients were diagnosed between the ages of 3 and 15 and contacted for follow-up for an average of 7.2 years after diagnosis (Bull, al., 2007). Depending on the age of the participants, they were asked to complete or have their parent complete various questionnaires on survival quality, including health status, behaviour and quality of life. Those who received chemotherapy with radiation treatment reported significantly worse health, greater physical limitations and an increased need for therapeutic services. Although it provides a thought that provokes a view of the additive effect of chemotherapy, caution has been observed in interpreting these results (Packer, 2008). Patients were not always randomised to patients with treatment. In specific cases, doctors and parents were able to choose which group of studies their patient was assigned to. When looking at the results among only those randomised (n=50), no significant differences in quality of life measures were visible. In addition, no assessment of cognitive functions has been completed. However, those who received chemotherapy plus radiation reported an increased need for educational support compared to those receiving radiation therapy only. The synthesis of the study identifies a particular risk and challenge for adolescents and young adults who have survived. Depending on the history of cancer and the treatment of the survivor, cognitive risks and the need for support will vary. Examining the use of special educational services among a large group of cancer survivors in pediatrics (n=11,425), those treated for malignagonal diseases of the central nervous system (n=1637) showed the highest rates of need (Mitby, etc., 2003). Analyzed by age at diagnosis, more than 70% of those diagnosed between 0 and 5 years old reported requiring special educational services, over 55% for those diagnosed between 6 and 10 years old, over 32% for those diagnosed between the ages of 11 and 15, and over 23% for those diagnosed between the ages of 16 and 20. The length of services required also increased for those diagnosed at an earlier age and who received higher levels of radiation dose (Mitby, al., 2003). For a patient who was older at the time of treatment, cognitive difficulties cannot seem particularly visible to caregivers until a few years after treatment, a time when many will attend high school. The high school curriculum brings increasing academic requirements. Coupled with a decline in learning ability at a rate comparable to healthy peers, academic performance can decline sharply. Intervention in the form of specific educational services, individual educational plans and teacher education on the challenges survivors face may be necessary to ensure academic success. For a patient who was younger at the time of treatment, challenges at school can be immediately visible upon returning to regular classroom activities in elementary years and these challenges can continue to adversely affect academic achievement throughout their high school years and beyond. By the time a patient reaches adolescence, special services or individual educational plans may already have been needed and should be reassessed and transferred to a high school environment. These supports may be even more critical for those treated as a high-risk patient, receiving higher doses of radiation than their standard risk partners. Academic failure is described as secondary to changes in more fundamental processing, memory and attention rate abilities (Mulhern and Palmer, 2003), significant processes by which new learning occurs (Dennis, al., 1998). However, the difficulties with these core abilities can be subtle in their presentation. For adolescent cancer survivors, these early but relatively subtle behavioral changes can be interpreted by teachers as fatigue, lack of motivation, carelessness or even disinterest and should not be dismissed. Instead of such behaviour hyperactivity or impulsivity, people who have gotten over cancer are often described as having a sluggish cognitive pace similar to what is known as a predominantly careless subtype of ADHD (Reeves, al., 2007). The neurocognitive functions of otherwise healthy children diagnosed with ADHD showed that those diagnosed with a predominantly careless sub-pressure showed a slower processing rate than children without ADHD (Solanto, al., 2007). Among a similar group of children, the processing speed deficit concerned people with reading difficulties (Shanahan, etc., 2006). Cognitive function difficulties are also associated with behavioral and social outcomes among adolescents who survived. The term executive functioning is used to describe several related cognitive functions such as selective and enduring attention span, working memory and organization (Mulhern and Palmer, 2003, Polderman, al., 2007). A study by a large group of pediatric cancer survivors (N=7147) found that adolescents and young adults survivors with restrictions on executive function were less likely to finish high school, be employed, have household incomes of more than $20,000, be married or report living as if they were married. It was these conditions that were also associated with reports of poor emotional health, which in turn were also associated with reports of poor health-related quality of life (Ness et al., 2008). Adolescents who survived CNS tumors were also identified as at risk for symptoms of depression, anxiety and reduced social competence (Mabbott et al., 2005, Schultz et al., 2007) making already clear time in adolescents' social lives even more challenging. Jasno je da adolescenti i mlade odrasle osobe koje su preživjele tumore dječje stražnje fosse doživljavaju brojne izazove u širokom rasponu funkcionalnih područja (Bull et al., 2007, Maddrey et al., 2005, Ness et al., 2008, Schultz i sur., 2007). Illness and treatment have been found to affect neurocognitive functions, academic performance, emotional and social behavior well into adulthood. Without regular and rigorous follow-ups, early changes, which can be subtle in nature but tolerable with early diagnosis and treatment, can go undetected (Oeffinger and Robison, 2007). Several models of survival care have been proposed in the literature (Children's Oncology Group, 2006, Oeffinger and McCabe, 2006). Expanding on the last model put forward by Oeffinger and McCabe (2006), the current model attempts to describe in more detail the roles of psychology experts as they relate to the care of survivors of posterior phossa tumours within the cancer treatment centre environment (Figure 1). To the point of diagnosis of a patient's tumor is usually supervised by a primary care physician in their home community. After the diagnosis of posterior phossu tumor, the oncologist assumes the role of the main caregiver, communicating the patient's progress with PCP as the treatment progresses (vertical arrows; Figure 1). in the environment of the cancer center, the oncologist leads several specialists who are battling a multidisciplinary care team, including, but certainly not limited to, clinical psychologists and school psychologists, each with a free but special focus that contributes to the patient's overall treatment and well-being (shaded boxes; Figure 1). This team meets regularly to share information for development and action in accordance with the team's recommendations. Outside the cancer center, this type of communication, important for continuity of patient care, may be less formal and dependent on individual start-up care providers. Recommendations and guidelines for monitoring children's cancer survivors have been developed (Children's Oncology Group, 2006, Landier, etc., 2004, Skinner, etc., 2005). These guidelines clearly state that future evaluation must be completed on the basis of known or suspicious risk. Clinical psychology fulfills this important need with its expertise in evaluating cognitive functions. In the proposed model (Figure 1), clinical psychology first conducts a psychological evaluation as soon as the patient is physically and cognitively able to do so. In many cases, this early assessment serves as a benchmark for comparing future results. It is therefore important that the assessment battery is risk-based; assessment of areas of ability known to be susceptible to decline after treatment. The assessment should include an assessment of broad spectrum capabilities, such as general intelligence and areas of academic performance, as well as core cognitive skills, including minimum information processing speed, attention and memory processes. With favorable survival rates, the patient can be evaluated by clinical psychology in adulthood. Therefore, assessment instruments that are suitable for a wide age range, without compromising quality. This eliminates problems with changing test versions as the patient ages and improves the accuracy of longitudinal monitoring. Continued and regular prospective evaluation after the end of therapy is also crucial for the overall quality of survival. While patient questionnaires and surveys have provided important insight into the survival experience, it is also important to test and examine directly. Instead of relying solely on patient self-reporting on performance, research has shown that cognitive function also needs to be objectively evaluated. In a study of pediatric cancer survivors 10 years after treatment, self-reported reports on quality of life and self-perception of cognitive abilities were compared with actual test results (Maddrey al., 2005). Interestingly, both survivors and caregivers overestimated the neurocognitive abilities of the survivor. Actual test scores were significantly lower on measures of overall cognitive ability, attention, memory and problem solving. However, the perceived academic function did not differ significantly from the results obtained, with self-reporting results and testing indicating a low-average capability. This is most likely due to the fact that survivors and their carers receive feedback on academic function in the form of reporting cards, grades or assignment marks, improving the accuracy of their self-reporting. Therefore, in the proposed model, patients return to see clinical psychology for regular assessment of cognitive functions. The results are repeatedly shared with the team and recommendations, areas of concern and descriptions of the benefits communicate. Depending on patients' needs, environment and team, clinical psychology may also include providing family-based services in the form of crisis intervention, support groups, individual therapy, and referrals to psychiatric service. In the proposed model, experts within school psychology offer expertise that combines a range of fields to offer valuable service to the cancer center, the patient's community school, as well as family. Ideally, this person or persons would be established within the cancer centre and become specialised in working with those being treated for children's cancer. However, this is not always possible and often clinical psychologists fulfill the roles of cognitive evaluators and those described below as school psychology. School psychology supports the transformation of clinical evaluation into action within the patient's community school system. Using their understanding of psychological assessment, as well as processes, laws and patient rights to get the support they need, school psychology can bring an increased level of understanding, insight and achievement that otherwise cannot be achieved after a patient leaves a treatment center to return to their own communities. Shortly after diagnosis, school psychology makes contact with the family to obtain information about the patient's education history, setup, curriculum and all pre-existing academic problems. As a link between the patient's family, school and cancer treatment team, school psychology is the primary contact for issues related to cognitive function and academic performance. During the active treatment phase, if the patient is medically fit, school psychology will help the family start home education services through their local school system. Initially fulfilling an important support role (dotted line; Figure 1), school psychology takes on a more prominent role when the patient is not receiving treatment (hard line; Figure 1). People who have gotten over childhood cancer make up a growing but still small percentage of the total population. Therefore, many professionals, including teachers and other education professionals, may be unaware of the risks survivors face. In the proposed model, school psychology becomes an advocate for patients regarding education and academic issues. School psychology has a critical impact by discussing the written summary of the specific diagnosis of the patient, the dates of treatment, the type of treatment received, description of the risks of treatment associated with the evidence faced by the survivor. These interviews can take place with both family and patient education providers. By informing those involved, school psychology improves the ability to identify risks, facilitates proactive health care, and prospectively monitors the patient. By integrating information obtained from multiple sources, including teacher, family, and direct evaluation results with clinical psychology, school psychology also initiates individualized educational plans or 504 plans as needed (in the United States under IDEIA 2004 and the Rehabilitation Act of 1973). By documenting, quantifying and discussing the health of a cancer survivor in pediatrics with their teachers, school psychology plays a key role in improving a patient's academic success and completing our understanding of the long-term effects as the patient ages. Communication between school psychology and the patient's home community school regularly resumes (vertical arrows, Figure 1). Continuous reassessment of the accommodation and security of support services, including necessary interventions that can benefit the academic progress of the survivor, is essential. While some researchers have begun to learn from methods used to intervene with other populations with similar deficits, much still needs to be achieved. Interventions that are useful for children with lack of attention, difficulty reading and damage to working memory offer direction. Intervention programs may include pharmacotherapy, cognitive therapy, experimental interventions designed against specific deficits, or the use of already commercially available programs (Palmer, al., 2007). Using access to accommodation, the intervention can also take the form of improving the teaching environment of a survivor at home or at school. Interventions can be carried out by those within school psychology, clinical psychology or other specialties. Attention deficit hyperactivity disorder (ADHD) is the most commonly diagnosed behavioral disorder in childhood (National Institutes of Health, 1998) with stimulant medications such as methylphenidate (MPH) widely prescribed as a pharmacological treatment. Survivors of malignant back fossa tumours show attention deficits similar to those of children diagnosed with ADHD by a careless subtitle. Therefore, it is believed that MPH treatment can be beneficial for cognitive rehabilitation among survivors (Butler and Mulhern, 2005). In 2001, a study was published that compared the immediate cognitive function of 15 pediatric cancer survivors randomized to receive MPH on 17 children randomized to placebo (Thompson, al., 2001). Patients who received MPH showed significantly greater improvements in the ongoing attention task. Expanding on this study, the same group then conducted 3 weeks of double-blind cross-over studies with 83 paediatric survivors (Mulhern ir., 2004). Both parents and teachers rated the child to have better attention skills while the child was receiving MPH. In 2007, a follow-up study was published on the acute effectiveness of MPH among 122 cancer survivors in pediatrics using several neurocognitive measures (Conklin, al., 2007). There is evidence to suggest benefits for selective attention task, but other tasks showed no significant improvements after MPH. The Literature Scientific Review stated that while preliminary support for the efficacy and safety of stimulants is promising, more research is needed on the long-term effects of stimulants among cancer survivors (Daly and Brown, 2007). Although pharmacological intervention offers one alternative, there is a large proportion of caregivers who want a non-pharmacological approach. A mph study with cancer survivors in pediatrics identified 192 eligible participants (Conklin ir., 2007). However, parents of more than 34% (n=66) of eligible people refused to participate citing concerns about putting their child on a stimulant among the primary reasons for rejection. Researchers must respond by developing and testing non-pharmacological interventions, such as cognitive behavioral methods, aimed at reducing the late effects associated with treatment. One such effort was made with the development of a cognitive remediation program that combines methods that use three disciplines: brain injury rehabilitation, special education and clinical psychology (Butler, 1998, Butler and Copeland, 2002). The programme consisted of approximately 50 hours of teaching over a period of 6 months. Those who received the remediation program showed significant improvement in attention, short-term memory and sentence memory tests, while those who did not receive the program showed no significant improvements over the same time period. No group has shown progress in mathematical achievement. The authors recognize that the program has been time consuming and expensive to provide, but feel that the potential benefits outsmad these expenditures and continue to explore methods for intervention. Since cancer survivors in pediatrics have been found to experience a particular decline in reading ability, interventions developed specifically for those diagnosed with reading disabilities require research. Reading difficulties are most often the most studied of academic deficits with research showing an unrelenting persistence of difficulties unless an intervention is obtained (Shaywitz, al., 2008). Children don't just grow out of reading difficulties. While children with and without reading difficulties will improve in their ability over time, the gap between the two groups remains (Shaywitz ir., 2008). It is believed that weakness in phonological consciousness, the ability to recognize and manipulate phonemes within the tongue, is the basis of many difficulty of reading. Programmes focusing on phonological The phonics and meaning of the text showed a significant improvement in basic reading skills, even among the weakest readers (see Fletcher ir., 2007 for review). One such intervention highlighting phonological awareness also showed functional changes in the fMRI study among children diagnosed with dyslexia when patterns of activity within reading-related brain regions increased to levels comparable to control subjects that were not impaired (Temple, al., 2003). As phonological awareness improves, the idea is that reading words becomes more automatic by requiring less attention to the act of reading. Therefore, more focus can be given to the meaning of the text. However, the direct transfer of improved phonological awareness to gains in reading fluency and understanding is not always automatic (National Reading Panel, 2000). Studies with adolescents have shown that reading rates are perhaps the most useful clinical marker for differentiating poor than average readers. Using unmanageable reading tests may not identify those in need of support, where tests that emphasize reading speed would provide improved sensitivity (Shaywitz, al., 2008). At the high school level, reading fluency becomes more important given the large amounts of written information the curriculum requires. Relying on contextual clues to gain meaning will not prove to be an effective strategy. Students with phonological weakness will be put off in their struggle with individual words so that understanding the entire passage becomes very difficult. Using books on tape could help with their ability to acquire the necessary information, reduce reading demand, and improve understanding. Testing can also be done with a teacher asking questions according to it, and allowing the survivor to provide answers in the same format. Gains in oral reading fluency were also seen using the Parent Teaching Intervention Program (Gortmaker, al., 2007). The ability of working memory is crucial for learning and deficits can lead to eventual failure in the classroom (Gathercole and Alloway, 2006). High school and high school often require students to take notes from lectures. This skill can be particularly problematic for a survivor with a working memory deficit because they may not be able to keep the information in memory long enough to organize and accurately record. This also applies to material that will need to be copied from the board or presented on PowerPoint slides. To improve the retention of material, teachers could provide outlines of content that will be covered during lectures or provide copies of slides for students to take home. Partner student can provide notes or lectures can be recorded. Mathematical problems that have sequential steps, such as long divisions, algebras and chemistry equations can also pose major difficulty. Written instructions based on short and simple steps can be used simple recommendation during class while I'm working on my own assignments. The number of equations or the volume of work could also be reduced. Tasks or tests that require a survivor to write an essay, paragraph or short answer may also seem complicated because problems with executive function would impair the ability to organize information, with a time-lapse situation increasing already high demand. It is necessary for the success of the survivors to be given extended time for tasks and tests. Multiple choice formats can be used for tests instead of requiring a survivor to write their answers. For creative writing tasks, instructions may need to be streamlined to smaller manageable steps, such as creating a theme, listing 3 main points, viewing content, and compressing them. This helps the survivor feel less overwhelmed by the task and provides a focus on their efforts. Survivors who have deficits in processing speed require additional accommodation. Their homework could easily take 2-3× longer than other students need. Together with the motivation to do well, they can spend all their evening and weekend time working on domestic or class projects. These students may become discouraged by this constant high amount of work to maintain a certain grade or grade point average. At some point they will become frustrated and overwhelmed by the amount of work and loose enthusiasm. Using a computer to process text instead of writing manually can be especially useful in timely completing tasks and tests and giving only every other question, as homework can help reduce volume. Curriculum requirements need to be reduced and communication between carers and teachers remains regular and open. Through emails and conferences, parents and teachers were able to monitor classroom performance as well as homework loads and adjust requirements accordingly. A wait-to-failure approach is not considered desirable in the proposed risk-based governance model. Proactive, long-term care, based on known risks of cognitive decline, is key to patient success and quality of survival. Active testing and implementation of prophyromatic intervention, focusing on the prevention of negative outcomes, is key to improving the lives of survivors of posterior phossu tumors. Interventions could be initiated during or immediately after treatment with the aim of strengthening skills and abilities known to be susceptible to rejection after treatment (Moore, 2005). Unfortunately, the development of empirically confirmed interventions for people who have gotten over cancer has not been widely implemented and prophylactic intervention has not yet been confirmed. The population of adolescent and young adults who have survived tumors of children's posterior phossu is already growing. A large number of survivors experience cognitive difficulties that lead to academic failure, behavioral challenges and social difficulties. These survivors need effective interventions to strengthen their weaknesses and highlight their strengths. The proposed model should be considered dynamic and ongoing work. Modifications are needed for those providing follow-up care in non-cancer treatment settings. As interventions are tested and better data become available, the proposed model can be improved and edited to include in particular the timing of the intervention. Additional team members, with specific roles described, can also improve the proposed model. A multidisciplinary team approach, each of which brings expertise and insight from a specialized field, is key to the patient's success and their optimal quality of survival. This research is supported by U.S. Lebanese Syrian Affiliated Charities (ALSAC) and support for the P30CA21765 Cancer Center (CORE). Bull KS, Spoudeas HA, Yadegarfar G, Kennedy CR. 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